

The London School of Economics and Political Science

Burden of Posttraumatic Stress Disorder (PTSD) – health, social, and economic impacts of exposure to the London bombings

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DECLARATION

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I can confirm that Chapters 4-7 are based on the data collected in a previous study I undertook at Department of Health, Clinical and Educational Psychology, UCL. Most of the data I use in the thesis is collected by myself during the evaluation of the NHS mental health response after the 2005 London bombings study. I can confirm I have been solely responsible, under the guidance from my supervisors, for the design of the thesis, data analysis, interpretation of the findings and write-up of the thesis.

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Abbreviations

AA	Alcoholics Anonymous
A&E	Accident and Emergency
ASD	Acute Stress Disorder
ASHE	Annual Survey of Hours and Earnings
BDI	Beck Depression Inventory
BNF	British National Formulary
CAB	Citizens Advice Bureau
CBA	Cost benefit analysis
CBT	Cognitive behavioural therapy
CEA	Cost-effectiveness analysis
CEAC	Cost-effectiveness acceptability curves
CLT	Central Limit Theorem
CUA	Cost utility analysis
CMA	Cost minimization
CSRI	Client Service Receipt Inventory
DALY	Disability-adjusted-life-year gains
DH	Department of Health
DSM	Diagnostic and Statistical Manual of Mental Disorders
ELCMHT	East London and City Mental Health Trust
EMDR	Eye Movement Desensitisation Reprocessing
EQ5D	EuroQol 5D
FSS	Functional somatic syndrome
GAD	Generalised anxiety disorder
GLM	Generalised Linear Model
GP	General practitioner
HERC	Health Economics Research Centre
IAPT	Improving Access to Psychological Therapies
ICD	International Classification of Diseases

ICER	Incremental cost effectiveness ratio
LB	London Bombings
LDC	London Development Centre
MAR	Missing at random
MCAR	Missing completely at random
MDD	Major depressive disorder
MI	Multiple Imputation
MNAR	Missing not at random
MRCN	Medical Research Council
NCCMH	National Collaborating Centre for Mental Health
NHSRC	National Health Services Reference Costs
NHS	National Health Services
NI	Northern Ireland
NICE	National Institute for Clinical Excellence
OLS	Ordinary least square
PDS	Posttraumatic stress scale
PSSRU	Personal Social Services Research Unit
PTSD	Posttraumatic Stress Disorder
QoL	Quality of Life
QUALY	Quality-adjusted-life-year gains
RCT	Randomised controlled trial
SES	Socio-economic status
SLAM	South London and Maudsley
SSRI	Selective Serotonin Reuptake Inhibitors
ST	The screen and treat Programme
TFCBT	Trauma Focused Cognitive Behavioural Therapy
TSC	Traumatic Stress Clinic
TSQ	Trauma Screening Questionnaire
UCHSC	Unit Costs of Health and Social Care

Abstract

Background: Posttraumatic Stress Disorder (PTSD) is a common disorder that causes a significant health, social and economic burden for the individuals who suffer from it and consequently, for society as a whole. However, little is known about the consequences of PTSD, and in particular there is a lack of empirical data in relation to its economic impact on individuals and health systems, or on the treatments that might be provided.

Aims: The aim of this research is to assess the health, social, and economic impacts of PTSD by focusing on the individuals exposed to the London bombings by: a) reviewing the current evidence and measures of the health, social and economic impact of PTSD; b) assessing the impact of the London bombings in terms of service use and the impact on health, social, and economic activity of those affected; c) conducting an economic evaluation of the 'screen and treat' programme implemented as a mental health response after the London bombings; and d) assessing the broader implications and feasibility of screening for PTSD in primary care.

Method: Semi-structured interviews with 230 participants, screen and treat programme users and potential users conducted as a part of the evaluation of the NHS mental health response to the London bombings, analysis of the dataset on the outcomes collected as a part of the programme, and semi-structured interviews on the benefits of and barriers to implementing screening for PTSD in the primary care sector.

Analysis: A range of quantitative and qualitative methods are conducted including: estimation of the costs associated with exposure to the London bombings, analysis of cost and outcome variation between individuals exposed to the bombings, economic evaluation of the screen and treat programme distinguishing three comparator groups, and directed qualitative content analysis of fourteen interviews on the benefits of and barriers to screening for PTSD in primary care.

Results: The higher prevalence of London bombing-related problems for individuals who were not treated, even as long as two and a half years after the

bombings, confirms the benefits of long-term screening after exposure to traumatic events. Participants who used the screen and treat programme reported significantly higher average direct and total costs. The treated group reported up to three times higher total costs in comparison to individuals who were screened and assessed only, with work-related costs making the highest contribution to the total cost, followed by the programme itself, and then other health care costs. Similar service use patterns were found between the treated, and the screened and assessed only groups. The main cost drivers identified in the analysis for the full sample of individuals exposed to the London bombings were being of female gender, being in a non-white British ethnicity group, experiencing injury, old age, and feeling one might be killed and/or injured. The treated group consisted of individuals who were more severely affected by the London bombings when compared to the group who were screened and assessed only.

Conclusions: The effects of trauma exposure and PTSD have a wide-ranging and long-term health-related and economic impact on exposed individuals. The findings suggest that the screen and treat programme was successful in identifying participants with greater mental health needs and providing them with treatment. Providing the best evidence-based treatment early in the form of the 'screen and treat' approach does not seem to be cost-effective. However, without having a proper waiting list comparison group the questions on effectiveness and cost-effectiveness of the ST programme are difficult to answer with certainty. This study has pointed out vulnerable groups such as minority ethnic groups and women who are likely to experience worse outcomes and generate higher direct and indirect costs. There is a need for timely, rigorously-implemented economic evaluations of mental health interventions for PTSD. There is a role for non-RCT study designs in economic evaluations of PTSD interventions. There is also a need for economic evaluation of screening for PTSD intervention in primary care.

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Chapter 1 Introduction

1.1 The impact of PTSD: importance and relevance of the subject

Terrorist attacks are increasingly frequent global phenomena with wide-reaching behavioural, health and economic consequences. The intent to harm and cause as much disruption as possible is the key feature of terrorist attacks and is associated with a particularly high risk of psychopathology (Norris et al., 2002). Posttraumatic stress disorder (PTSD) is often cited in literature as one of the most common consequences of exposure to terrorism and indeed one of the best documented (Neria et al., 2008; DiMaggio & Galea, 2007; Boscarino, 2002).

PTSD is a common mental health disorder that is associated with significant health, social and economic burdens for individuals, their families and society as a whole. PTSD is associated with high levels of social, occupational and physical disability (McFarlane, 2010; Coughlin, 2011; Vieweg, 2007; Kessler, 2000), considerable economic cost (Marciniak et al., 2004), high levels of health service utilization (Marshall et al., 2014; Elhai, North and Frueh, 2005; Erbes et al., 2007), poor social and family relationships, absenteeism from work (Fineberg et al., 2013), lower income, and lower educational and occupational success (Kessler, 2000; Iversen et al., 2008).

Traumatic events are quite common among the general population, with population lifetime cumulative exposure to any traumatic event ranging from 20% to 87% (Kessler et al., 2000), but fortunately not everyone exposed will go on to develop PTSD (Breslau, 1998; Ferry et al., 2008). Lifetime prevalence rates of PTSD range from 3.5-6.3 for men and 7.9-13.8 for women (Breslau, 2009; Helzer et al., 1987; Kessler et al., 1995). The UK 2007 Adult Psychiatric Morbidity Survey reported a conditional probability of 8.9% that those who experienced trauma will screen positive for PTSD and reported a best estimate whole population PTSD point prevalence of 3% (APMS, 2007).

Conditional PTSD prevalence of those directly affected in terrorist attacks has been estimated to range between 12% and 40% (Whaley & Brewin,

2007; Gidron, 2002; DiMaggio & Galea, 2006). In comparison, reported PTSD prevalence rates among rescue workers range between 10% and 20%, while for the general population reported prevalence rates range between 5% and 10% (Neria et al., 2007). Whalley & Brewin (2007) reported that 30-40% of individuals directly affected by terrorist attacks continue to experience significant problems two years later. Neria and colleagues (2008) confirmed this finding in a systematic literature review looking at PTSD following disasters.

Upon exposure to traumatic event(s), most individuals will present symptoms of distress and anxiety that will decline naturally after a few weeks (Rubin et al., 2005; Rubin et al., 2007; Whalley & Brewin, 2007). Depending on several factors discussed in the next section, a number of individuals will fail to recover and will require treatment (APA, 2013). In addition, a number of individuals might exhibit sub-threshold PTSD or there could be a delay in presentation of symptoms ranging from a couple of months to years, defined as delayed expression in DSM-5 (APA, 2013).

The new fifth edition of DSM (APA, 2013) has introduced changes to both the diagnostic criteria and the classification of the disorder. Firstly, it has removed PTSD from the anxiety disorders group and re-classified it under trauma and stressor-related disorders. In regard to diagnostic criteria, DSM-5 has taken a step away from the traditional view of PTSD as “primarily a fear-based anxiety disorder” (Bryant & Wessely, 2013, p. 202). Instead, DSM-5 presented a four factorial model supported by the majority of confirmatory factor analysis studies (Duhamel et al., 2004; McWilliams et al., 2005; Palmieri et al., 2005). The DSM-5 diagnostic criteria for PTSD include the following:

- exposure to trauma involving actual or threatened death, serious injury or sexual violence by direct experience, witnessing or learning about an event that occurred to a close family or a friend, or through repeated exposure to aversive details of a traumatic event (Criterion A).
- intrusion (Criterion B).

- avoidance (Criterion C).
- negative alterations in cognitions and mood (Criterion D).
- alterations in arousal and reactivity with the traumatic event (Criterion E).

The risk of developing PTSD is higher for individuals with a personal and/or family psychiatric history, reported childhood abuse, low social support and life stress both pre- and post-trauma, or an emotional response to the traumatic event such as guilt, helplessness and shame (Brewin, 2000; Ozer, 2003; DeLisi, 2003).

The nature and severity of the traumatic event, being of female gender, being of a young age at time of exposure have also been frequently reported as risk factors for PTSD (Breslau, 2002; Breslau et al., 1999; Brewin et al., 2000; Ozer, 2003).

The latest edition of DSM presents risk factors associated with PTSD as pre-traumatic, peri-traumatic, and post-traumatic as presented in Table 2.1 (APA, 2013).

Table 2.1 PTSD predictive factors from DSM 5 (APA, 2013)

Pre-traumatic risk factors
<ul style="list-style-type: none"> • Previous psychiatric disorder • Gender (female greater than male) • Personality (external locus of control greater than internal locus of control) • Lower socioeconomic status • Lack of education • Race (minority status) • Previous trauma • Family psychiatric history

Peri-traumatic risk factors

- Trauma severity
- Perceived life threat
- Peri-traumatic emotions
- Peri-traumatic dissociation

Post-traumatic risk factors

- Perceived lack of social support
 - Subsequent life stress
-

Bonnano et al (2010) suggested that the outcome of the disaster is shaped by a particular combination of risk and resilience factors, rather than by a particular predictor. This view of PTSD is in line with the latest understanding that interaction of genes and environmental factors – a combination of multiple neurobiological mechanisms alongside their interactions with social, biological, contextual and psychological factors that “increase risk or support recovery” (Breslau, 2009, p. 205) – are responsible for PTSD.

For individuals involved in a terrorist attack, the risk is highest among those closest to the incident, those exposed to grotesque death, and those with the most severe injuries (Whaley & Brewin, 2007). Members of minority groups, as well as people experiencing multiple stressors such as employment and property loss have a higher risk of developing PTSD and a higher number of symptoms (Galea et al., 2008). In the study of stress levels experienced after the London bombings of the London-based population, non-white and Muslim Londoners reported substantially greater levels of stress in comparison to the other respondents (Rubin et al., 2005). Groups that are particularly at risk from PTSD are refugees and asylum seekers due to their exposure to a wide range of traumatic events, with reported PTSD prevalence ranging from 4% to 86% depending on the study population (Hollifield et al., 2002).

Among all anxiety disorders, PTSD is considered to generate the highest cost to individuals, their family and wider society (Marciniak et al., 2004). A recent study looking at the economic impact of PTSD in Northern Ireland (NI) estimated the total cost of PTSD in 2008 to be £172.8 million, including direct and indirect costs (Ferry et al., 2008). The authors concluded that this was a conservative estimate, as they did not include the economic impact of premature mortality or short-term sickness. Kessler (2000) estimated that PTSD is associated with \$3 billion of lost productivity per year in the US.

Although there is a general consensus that PTSD has a significant impact, supporting evidence is limited and mostly originates from a heterogeneous methodological background, which affects comparability and generalisability.

Evidence-based treatment, as recommended by NICE guidelines, consists of up to 12 sessions of cognitive behavioural therapy (CBT) or eye movement desensitisation reprocessing (EMDR) starting after one month for severe cases, or watchful waiting and treatment three months after trauma for mild or moderate cases (Bisson et al., 2010; Ehlers et al., 2003, NICE, 2005). The latest Cochrane review on psychological therapies for chronic posttraumatic stress disorder confirmed the main recommendations of the NICE guidelines (Bisson et al., 2013). Therefore, early detection and treatment of PTSD are important in order to avoid it becoming a chronic condition with potentially profound consequences. For this reason, the 'screen and treat' approach has been proposed in recent years. This approach focuses on identifying and screening all individuals exposed to a traumatic event in order to refer them, if needed, for evidence-based treatment. However, the screen and treat approach had not been implemented or evaluated following a major disaster in the UK until the 2005 London bombings.

1.2 The London bombings and the screen and treat programme

The 2005 London bombings (LB) happened on July 7 at 8.50 a.m., at the peak of the morning commute, on train routes that included transport hubs to and out of London Edgware Road, Kings Cross, and Aldgate underground stations and a

bus in Tavistock Square. This was the largest mass casualty in the UK since the World War II, with 52 deaths and 775 other injured individuals. Another terrorist attack in London on 21 July involved unsuccessful bomb attempts and the shooting of an innocent passenger in the days following the bombings. Due to the timings and location of the bombings, they affected on average a young, working population on their morning commute to work and possibly also visitors to London.

The mental health response programme to the LB - known as the screen and treat programme (ST) - started within two months of the bombings in September 2005 at three London locations. The ST programme's steering group established that around 4000 individuals were affected in the incident, of which around one third would need psychological treatment according to the existing literature (Brewin et al, 2009). The number of affected individuals was calculated on the basis of the underground train carriages and bus capacity, and the number of members of the emergency services involved. Due to the lack of capacity within existing services to meet that need, the Department of Health (DH) committed to fund the screen and treat programme guided by the programme's steering group recommendations. With the rationale that existing services would be overburdened by screening and not have the resources for outreach, a dedicated screening team was set up within the London Traumatic Stress Clinic (TSC). This novel approach to trauma response was grounded in research findings indicating the low effectiveness of the commonly used 'first aid' psychological interventions after traumatic events such as debriefing (NICE 2005), alongside lessons learned from other mental health responses after traumatic events such as the King's Cross fire (Rosser et al., 1991; Turner et al., 1989), and the 1998 Omagh bombing (Gillespie et al., 2002). This decision was also based on evidence that only a number of the exposed individuals would need treatment, as the majority were likely to recover naturally within a couple of weeks of the traumatic event (Rubin et al., 2005; Whalley & Brewin, 2007). Secondly, PTSD can have a profound adverse impact on the health and social functioning of those individuals affected, as well as their families, and can

become chronic, lasting up to several decades after the event if left undiagnosed and untreated (Yule, 2001).

The aim of the ST programme was to systematically follow-up as many survivors and affected individuals as possible, provide them with information about posttraumatic responses and immediate sources of help, screen them at regular intervals using validated instruments to detect individuals whose symptoms have failed to remit naturally, and deliver appropriate therapy to that subset of people.

The programme consisted of a psychiatrist, two psychological assistants and an administrator, and ran for two years, until September 2007.

1.3 The main contribution of the thesis

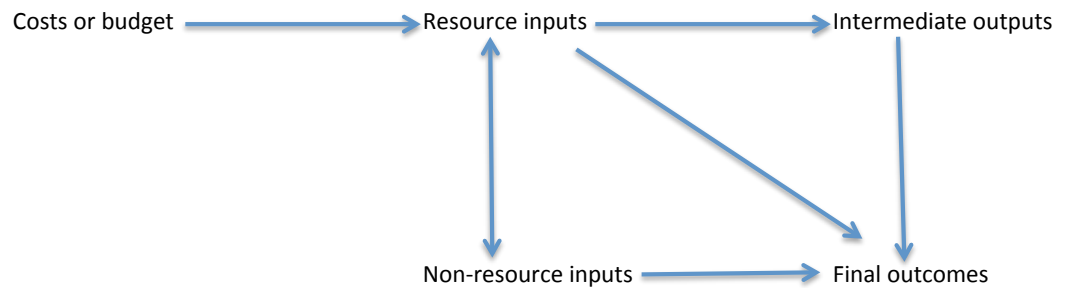
Given the evidence on prevalence of PTSD and its economic, health and social effects, there are great incentives on both micro and macro policy levels to complement existing policies with the data coming from the implementation of evidence-based practice in a real world context.

This thesis takes an interdisciplinary approach and integrates the perspectives of clinical psychology, health economics and social policy in describing the effects of exposure to the LB. Such interdisciplinary approach is well suited for describing the effects of PTSD. It demonstrates how the effects of PTSD are not one-dimensional and how they affect different aspects of individuals' lives and society as a whole. Each perspective offers a different outlook and answers a different set of questions, thus providing a rounded view of PTSD and its effects. The clinical psychology perspective defines and describes PTSD, its symptoms, prevalence rates, defines risk factors and treatment, and describes the health and social effects of PTSD. The health economics perspective offers an insight into the economic effects of the LB and PTSD, measures direct and indirect costs associated with the LB and expenditure associated with setting-up and running a mental health response, and highlights methodological challenges in evaluating mental health interventions in the observational study context. Social policy provides a wider context for understanding and implementing the results of the study. It helps in

answering questions such as what lessons from the ST programme can be implemented in future mental health responses, and whether the screen and treat approach be applied in a wider context such as primary care and the IAPT programme.

The production of welfare approach (POW), developed primarily as an evaluative technique (Knapp, 1984), offers a useful framework for exploring the burden of PTSD. The production of welfare approach draws on economic concepts and terminology, and applies them to social care or health contexts. It provides a framework for identifying and exploring the interrelationships between costs, both resource and non-resource inputs, and their effect on intermediate (service) outputs and final outcomes. This study will apply the framework of the 'production of welfare approach' in examining the evidence behind the burden of PTSD on individuals exposed to trauma and society as a whole. The POW framework postulates a causal relationship between the changes in levels of inputs and levels of outputs mediated by the role of other factors (Davies, 1985, p.3). Identification and measurement of 'other factors' is of great importance as they are likely the cause of variation in the model (Fernandez, 2005). Furthermore, information on mediating factors presented in the model as 'non-resource inputs' will allow us to 'control' for them when examining the relationship between costs and outcomes using the cost function. Similarly, utilisation functions will serve as another tool in the analysis, enabling me to examine the relationship between non-resource inputs and intermediate outcomes such as the BDI, PDS and EQ5D scores at the end of the treatment. Figure 1.1 (Davies & Knapp, 1981; Kendall & Knapp, 2000) depicts the key elements of the POW framework applied to the provision of treatment for PTSD within the ST programme.

Figure 1.1 The production of welfare from Kendall & Knapp, 2000



- Costs expressed in the form of opportunity costs, represent the total amount of resources used.
- Resource inputs used for providing treatment and health services, such as buildings, programme's staff, and capital.
- Non-resource inputs refer to the characteristics of service users (gender, age, ethnicity, health status, mental health history, informal care support), providers, service environment, type of trauma, prevalence of the disorder and its aetiology such as comorbidity rates, characteristics of the traumatic event. Non-resource inputs are "likely to explain the majority of variations in outcomes" (Fernandez, 2005, p. 35).
- Intermediate outputs include the number of direct and indirect hours of therapist work and number of sessions provided.
- Final outcomes represent the impact of the treatment on the individuals and their families and society as a whole, for example, as measured in terms of improved quality of life, averted productivity loss, reduced comorbidity and increased welfare.

As illustrated by the POW approach, in exploring the burden of PTSD in the context of terrorism there are a number of important factors that should be considered: PTSD prevalence/incidence rates, the range of services used by people with PTSD, the cost of treatment including training of the clinicians, the prevalence of comorbid conditions, the effects on individuals and families such as the cost of informal care, deterioration of QoL, lost employment and education opportunities, cost of suicide, burden of homelessness, and the costs

associated with productivity loss including unemployment, reduced hours of work, presenteeism and absenteeism.

Data collected as a part of the ST programme and its consequent evaluation provide an opportunity to explore the health, social and economic effects of a terrorist attack and specifically the effects of PTSD on the individuals involved. These data include information on the socio-demographic characteristics of participants, type of exposure to traumatic events, the type and frequency of the services used by individuals as a consequence of their exposure to the LB, and data on treatment outcomes, thus providing an insight into mental health recovery pathways for individuals exposed to such stressors. Furthermore, this dataset and the use of econometric tools enables an economic evaluation of the ST programme in the form of a cost-effectiveness analysis, as well as a piloting of the evaluation methodology in the context of an observational study.

The research presented in this thesis aims to contribute to the existing evidence in a following way:

- Describe the health, economic and social effects of the London bombings and PTSD.
- Explore how the costs and services used relate to the characteristics of the participants and exposure factors.
- Determine the cost of being diagnosed with PTSD.
- Investigate which factors are associated with being diagnosed with PTSD and how PTSD diagnosis affects services used.
- Compare costs and outcomes of the ST programme and conduct an economic evaluation of the ST programme.
- Explore the benefits and barriers of introducing screening for PTSD in primary care.

1.4 Research question

The aim of this research is to assess the health, social, and economic impact of PTSD by focusing on individuals exposed to the London bombings.

In order to achieve this aim, the following objectives were chosen:

- To review and assess the current evidence and measures of health, social and economic impact of PTSD.
- To assess the impact of the London bombings in terms of service use and the impact on health, social, and economic activity of those affected.
- To conduct an economic evaluation of the screen and treat programme implemented as a mental health response after the London bombings.
- To assess the broader implications and feasibility of screening for PTSD in primary care.

According to the POW framework, I expect to find that participants' characteristics, treatment timing and trauma context will affect the service use. I expect that participants with PTSD will have significantly larger costs in all cost categories when compared to participants with no PTSD. Furthermore, I expect a positive correlation between costs and the timing of the treatment start, all things being equal. Finally, my hypothesis is that it is cost-effective to treat individuals early (within the first year after the LB exposure) as the provision of early best evidence-based treatment prevents the onset of chronic PTSD and associated costs.

1.5 Thesis outline

The next chapter (Chapter 2) will start with identification of existing literature and its gaps, and review the current evidence on the health, social and economic impact of PTSD. After the Literature Review in Chapter 3, I will present my study methods, including the aim and objectives of the thesis, and an overview of the evaluation study within which this economic analysis was carried out,

including sample structure, choice of instruments used and choice of statistical analysis. Chapter 4 will focus on describing and exploring the costs of exposure to the LB from several perspectives. I will assess the impact of the LB in terms of service use and the effects on the health, social, and economic activity of those affected, and present the costs and outcomes associated with exposure to the LB. This chapter will explore how to quantify the effects of the LB in the form of a costing study.

Following that, in Chapter 5 I will explore costs and their relationship to participants' characteristics, exposure factors and service types. I will also investigate the factors associated with being diagnosed with PTSD and the related costs.

As the next step in the analysis I will use the data from Chapter 4 to conduct an economic evaluation of the ST programme by comparing costs and outcomes for three distinct participant groups. Each analysis will display a different level of complexity due to the availability of the data and offer a different perspective on the effectiveness of the ST programme. Due to the difference in the type of available data for each comparator group, I have divided the work on economic evaluation of the ST programme into two separate chapters.

Chapter 6 will present two partial economic evaluations of the ST programme and compare participants who used the ST programme to those who did not use it. Following on from this, Chapter 7 will introduce the third available comparator group and compare participants who have received treatment within the first ten months after the LB with participants who were treated later in the programme, and will present a cost-effectiveness analysis of the ST programme.

In Chapter 8 I will explore the benefits of, and barriers to screening for PTSD in a broader context. This chapter will take forward the idea of screening for PTSD in a primary care context as a valid method of disorder detection, and the prevention of chronic PTSD and its role as a possible pathway into treatment. I will present results and discuss policy implications from a

qualitative study looking into the feasibility of screening for PTSD within primary care services, particularly in the context of the recently introduced Improving Access to Psychological Therapies (IAPT) programme.

My final chapter will summarise the empirical findings, set out the limitations and strengths of the study, and then discuss the research, policy and practice implications of the work.

Existing evidence on the economic burden and cost-effectiveness of PTSD treatment is quite limited, which means there is little to inform policy or provision in response to this serious and potentially costly disorder. While no single research project can provide the answers to all outstanding questions, the findings presented in this thesis add to the evidence base on the health, social and economic impact of PTSD as experienced by those individuals involved in the London bombings of 2005, and on the cost-effectiveness of the ST programme.

Chapter 2 The burden of PTSD

2.1 Introduction

According to available evidence, PTSD is associated with high levels of social, occupational and physical disability (McFarlane, 2010; Coughlin, 2011; Vieweg, 2007; Kessler, 2000), considerable economic cost (Marciniak et al., 2004), high levels of health service utilisation (Marshall et al., 2014; Elhai, North and Frueh, 2005; Erbes et al., 2007), poor social and family relationships, absenteeism from work (Fineberg et al., 2013), lower income, and lower educational and occupational success (Kessler, 2000; Iversen et al., 2008).

However, to understand the true impact of PTSD, it is important to start by reviewing and understanding where the evidence on PTSD effects comes from and what it implies. This chapter aims to outline the current knowledge about the burden of PTSD by examining the health, social and economic effect of PTSD on individuals and society by reviewing the available literature. Due to scarcity of available literature, particularly on the economic effects of PTSD, the review will not focus exclusively on disasters and terrorist attacks, but will include a wide array of traumatic events. Although the dataset used in this research is based on individuals affected by the LB, there is no evidence on the difference in the disorder's aetiology, symptoms, or treatment for different traumatic events.

The review of the literature will cover two broad areas:

- a. the health, social and economic impact of PTSD,
- b. the evidence behind screening for PTSD in the primary care.

2.2 Search strategy

In agreement with my supervisors, I conducted a rapid review of the literature, rather than a standard systematic literature review. The rapid review of the literature used systematic review methods to search the available literature, and critically assess what is already known on the subject of the health, social

and economic impact of PTSD, and then to identify the gaps in the literature, but did not include mapping of the evidence.

In the evidence search, I decided to adopt a broad search strategy without very strict inclusion criteria for two reasons. Firstly, the economic evaluation approach has been introduced relatively recently as a tool in the mental health arena. Consequently, there are relatively few economic evaluations conducted in the mental health domain, and certainly very few in the PTSD niche. Secondly, there are few studies attempting to measure the economic and social effects of PTSD, and the evidence base describing its effects is still developing. I wanted to identify published and unpublished studies on the economic, health and social effect of PTSD by thoroughly searching electronic databases, books, grey literature, unpublished materials obtained directly from authors, hand-searching recent issues of relevant journals such as Journal of Traumatic Stress, BMJ, JAMA, Journal of Clinical Psychology and reference lists of identified studies and reviews. I followed the guidelines suggested by the NHS Centre for Reviews and Dissemination (2001) in developing the search strategy.

I started by identifying the keywords for the literature search for each area of the review. I used the keywords alone and in the following combinations: "PTSD" AND "anxiety disorder", "prevention", "detection", "screening", "QoL", "health effects", "social effects", "comorbidities", "health care costs", "health service use", "treatment costs", "societal cost", "opportunity costs", "voluntary sector services costs", "cost-effectiveness", "economic evaluation", "economic burden", "economic effect".

I used the following data sources in reviewing the literature: electronic databases such as Medline, Cochrane library, PsychINFO, DARE abstracts, Pilots, Health-Evidence Canada, the NHS economic evidence database, and Google Scholar. I focused on systematic reviews, review of the reviews and meta-analyses in the first step to identify key studies in the area. Following on from there, I focused on primary studies to ensure I covered all the relevant recently-published studies. I initially identified relevant papers by screening their titles

and abstracts and only obtained full papers for papers meeting inclusion criteria.

The review included systematic reviews and meta-analyses of randomised controlled trials, randomised controlled trials themselves, non-randomised intervention studies, observational studies, longitudinal, cross-sectional and case studies, and expert opinion if applicable. The review included studies published after 1980, the year of formal recognition of PTSD by American Psychiatric Association's Diagnostic and Statistical Manual of Mental Disorders (DSM).

The review included both civilian and non-civilian populations. The scope of traumatic stressors was not limited to exposure to terrorism. I excluded non-English articles, and studies on children, adolescent and elderly populations.

This review of current literature on PTSD includes a variety of studies differing in their target populations, methodology, sampling methods and causes of PTSD. This potentially has implications for the comparability and generalisability of the findings, which will be further discussed.

2.3 The health, social and economic effect of PTSD – the state of the evidence

PTSD is a prevalent disorder characterised by high comorbidity and well-documented effects on physical health and the social domains. As change in each domain affects other domains, it is important to present the disorder within this multidimensional context in order to assess its full impact. If left undiagnosed and untreated, PTSD can become chronic and last for decades (Yule, 2001). Consequently the economic effects of PTSD on individuals and society as a whole can be significant. Trauma exposure and PTSD increase costs to individuals, the health system and society as a whole (Walker et al., 2003). In 2010, anxiety disorders were in the top five most costly brain disorders in the UK, with estimated costs of £11.687 million. Approximately 50% of the costs were attributable to indirect costs, and 25% to direct healthcare costs (Fineberg et al., 2013). The latest NICE guideline has reported that social and welfare

costs of claims for incapacitation and severe disablement from severe stress and PTSD amounted to £103 million in 2003/4 (NICE, 2005). As the burden of PTSD ranges widely, it is important to include all associated direct and indirect costs in assessing its impact on individuals, the health system and society as a whole (Knapp, 2003). In contrast to the large evidence base on the effectiveness of the treatment for PTSD, the review of the literature has confirmed scarcity of studies assessing wider economic consequences and exact costs of both treated and untreated PTSD.

High comorbidity is a distinctive characteristic of PTSD, although the nature of the relationship between PTSD, exposure to traumatic events and comorbid disorders is still unclear (Ferry, 2008). People suffering from PTSD are more likely to develop other anxiety, mood, and substance misuse disorders than non-PTSD respondents (Kessler, 2000; Brewin et al., 1996; Vermetten & Lanius, 2012; APA, 2013). Studies report that around 80% of PTSD sufferers have more than one diagnosis (McFarlane, 1989), and point to pre-existing PTSD as a risk factor for the subsequent onset of drug use disorder (Breslau et al., 2003; Reed et al., 2007) and major depression (Breslau et al., 2000). 30-40% of individuals with PTSD are reported to have substance use disorder (Brady et al., 2004).

The extensive health effects of the PTSD have been widely reported and include a long list of conditions such as asthma (Spitzer, 2009), cardiovascular disease (Breslau et al., 2003), coronary arterial disease, hyperlipidaemia, obesity, hypertension, and coronary heart disease (McFarlane, 2010; Coughlin, 2011; Vieweg, 2007), anaemia, arthritis, asthma, back pain, diabetes, eczema, kidney and lung disease, and ulcers (Weisberg et al., 2002).

Review of the literature identified two systematic reviews and one meta-analysis study investigating the relationship between PTSD and physical health. One review explored the physical health consequences of PTSD and reported on significantly greater general health symptoms, general medical conditions, and poorer HR-QOL for PTSD (Pacella, Hruska and Delahanty, 2012). A meta-analysis of functional somatic syndrome (FSS) and psychological trauma

revealed individuals who reported exposure to trauma were 2.7 times more likely to have FSS regardless of type of trauma or type of condition. A systematic review on the link between PTSD and physical comorbidities identified evidence on association between PTSD and arthritis (Quereshi et al., 2009). PTSD is often reported as having more pronounced and longer-lasting detrimental effects on health and quality of life (QoL) in comparison to other anxiety disorders. Patients with PTSD reported poorer physical health and more medical conditions when compared to healthy controls or controls with other mental health conditions such as depression or other anxiety conditions (Zayfert et al., 2002; Frayne et al., 2004).

However, measuring and interpreting these effects is not straightforward. An underlying characteristic of the available evidence is that it comes from cross-sectional and low quality studies (Afari et al., 2014) and this causes difficulties in establishing causality and determining whether reported conditions are a consequence of exposure to a particular traumatic event, a pre-existing condition, or a personal predisposition. Measuring health effects demands careful examination of and access to the information on the pre-trauma health status of the individuals in the form of GP or hospital records, which can be time and resource consuming. In the large number of cases available, evidence on the relationship between PTSD and physical health is characterised by great heterogeneity among study populations ranging from the general population, to veteran and military samples or special populations such as victims of disasters (Ullman & Siegel, 1996). In addition, there is a great diversity among methods employed which further limits generalisability and comparability of findings.

The finding that PTSD sufferers use more health services when compared to controls with similar sociodemographic characteristics has been replicated in studies on general, military and veteran populations (Marshall et al., 2014; Elhai, North and Frueh, 2005; Marciniak et al., 2005; Erbes et al., 2007). Interestingly, these patients seek help mainly for physical health issues (Marciniak, 2004) meaning frequent physical health problems are therefore identified as an important marker of undiagnosed PTSD and are an important

indicator for PTSD screening in primary care. Review of the literature covering health service use associated with exposure to traumatic events and PTSD diagnosis has identified only one critical review by Elhai, North and Frueh (2005) that explored health service use predictors among trauma survivors. Their findings highlighted female gender, previous trauma history and PTSD diagnosis as predictors of increased mental health service use, while PTSD was a significant predictor of medical service use. In an earlier study looking at health care costs in women, Walker et al (2003) observed that PTSD was associated with total and component care costs and suggested that detection and treatment of PTSD in primary care would be a potentially cost-effective way in reducing PTSD prevalence rates. Tagay et al (2005) reported that patients with PTSD had significantly higher rates of medical consultations, psychotropic medication and psychotherapy when compared to patients without PTSD. The total medical spending of a sub-sample of individuals with PTSD was five times higher than for individuals with other anxiety and adjustment disorders, when controlling for age and sex (Berndt et al., 2000). Similarly a US study looking at cost and resource use connected with PTSD diagnosis for a sample of Medicare or private insurance users found that users with PTSD had significantly higher mental health resource use and service costs in comparison to matched control insurance users with major depressive disorder (Ivanova et al., 2011).

Answering questions on the relationship between trauma exposure and PTSD with health services use is crucial for health providers, planners and funders, as it provides valuable information for immediate aftermath response as well as long-term service provision and funding. Evidence is needed on demand, type and cost of services used by the population exposed to a traumatic event, both for the immediate aftermath of the event and from the long-term perspective.

Another valuable question for policy makers is whether reduction in PTSD symptoms would result in reduction in health care service use. An observational study on veterans' service utilisation reported that treatment completion resulted in a 32% reduction in service use in comparison to pre-treatment service use, which consequently resulted in a 39% reduction in direct

costs (Meyers et al., 2013). Future studies should examine this relationship carefully by using a well-designed experimental study that will control for other predictors and mediating factors of service use.

An important and often overlooked cost in the context of PTSD (and other mental health disorders) is the burden of the disorder on family and caregivers. A study exploring the caregiver burden in partners of veterans with PTSD reported a greater burden in this group when compared to caregivers of veterans without PTSD, after controlling for a set of variables including PTSD symptom severity, hostility, major depression, and health complaints and caregiver sociodemographic factors (Calhoun et al., 2002). A study by Manguno-Mire et al. (2007, p. 147) reported that “severe levels of overall psychological distress, depression, and suicidal ideation” were prevalent among female partners of veterans with PTSD. Although there is a strong indication of the adverse impact of PTSD on families looking after individuals with PTSD (Kalra et al., 2008), few studies have explored the caregiver burden in anxiety disorders and even fewer have looked specifically at the relationship between PTSD and the caregiver burden. One of the conclusions of this finding is the fact that is still “difficult to put an economic value on informal care” (Knapp, 2003, p. 477).

A link between increased suicide risk and PTSD has been suggested by several studies. Studies have warned that PTSD sufferers have a high rate of suicide attempts, reported as up to 19% (Nutt, 2000), and that they are six times more likely to attempt suicide than demographically matched controls (Kessler, 2000). A Danish population-based study on the link between PTSD and completed suicide reported an odds ratio of 9.8 linking suicide with PTSD, and 5.3 after controlling for psychiatric and demographic confounders; it concluded that a diagnosis of PTSD is a risk factor for completed suicide (Gradus, 2010). A number of disaster studies have reported what appear to be elevated rates of both suicide and suicidal ideation (Quin et al., 2003; Vehid et al., 2006; Bonnano et al., 2010). However, one needs to be careful in conclusions about causality between exposure to disaster and suicide, as the findings are conflicting. For example, no increase in suicide was detected after

the September 11th terrorist attack in New York City (Mezuk et al., 2009; Bonnano et al., 2010). The role of pre-existing risk factors needs to be carefully examined when assessing the relationship between trauma exposure and suicide (Warheit et al., 1996; Bonnano et al., 2010). Assessing the suicide-related costs of premature mortality related to PTSD is not an easy task and that is a likely reason for the scarcity of this type of data in relation to PTSD and other mental health disorders in general. If one were to get an accurate picture of the economic impact of suicide on society, direct costs (e.g., police, funeral services, healthcare use), lost productivity and intangible costs of pain, grief and premature loss of life would need to be assessed, which is methodologically very challenging.

Negative effects of PTSD that pose a burden to individuals and society include a strong association between PTSD and low educational attainment (Iversen et al., 2008), higher odds of school failure, elevated odds of teenage pregnancies and a high impact on family and marriage (Kessler, 2000). Risky behaviour such as reckless driving and risky sexual behaviour has been recognised relatively recently as PTSD (Miller et al., 2014). Evidence on the health, social and economic effects on the aforementioned factors are yet to be established. Quantifying the effects of these factors poses a significant challenge, as it is difficult to isolate and measure them, establish a causal relationship with PTSD and allocate economic value. Nevertheless, it is important to recognise and acknowledge the role of these factors in assessing the burden of PTSD.

PTSD also has considerable effects on employment. Work loss and impaired functioning are greater with co-morbid disorders than with pure disorders, and PTSD is associated with 3.6 days of work impairment per month for affected individuals (Kessler, 1995). When considering the effects of PTSD on the workforce, the following factors should be taken into account: work loss, cutback and impairment, and forgone work opportunities and benefits claims (Kessler, 2000; CEP, 2006). Individuals with PTSD exhibited 200% higher absenteeism rates in comparison to a non-mental health disorder group in another study (Berndt et al., 2000). A study looking at work productivity for a

sample of individuals exposed to the 9/11 event in New York reported that PTSD was associated with lower quality workdays even after controlling for baseline status (Boscarino et al., 2006).

Furthermore, it has been estimated that about 40% of all disabilities and about 40% of all incapacity benefit claims are due to mental illness (CEP, 2006). People with depression, anxiety or severe mental illness are more likely to be unemployed or economically inactive than the healthy population (SCMH, 2006), and it has been reported that less than 25% of people with a mental illness have a job (CEP, 2006; SCMH, 2003).

Early detection and provision of best-evidence treatment is of the utmost importance in reducing costs of PTSD, not only for individuals with the disorder but to society as a whole. This is supported by the findings from studies looking at the effects of PTSD symptom reduction on employment gains. In a study of Vietnam veterans with severe and very severe PTSD, Smith, Schnurr & Rosenbeck (2005) concluded that modest reductions in symptoms can lead to employment gain even if symptoms still persist. This conclusion is consistent with findings from an older study from Berndt et al. (2000) looking at health-care use and work productivity among employees with mental health disorders. After considering the relationship between PTSD and service use, it is important to explore whether the reduction in PTSD symptoms is associated with a reduction in health care service use.

Available evidence on the PTSD burden is characterised by great heterogeneity and covers a wide continuum of populations ranging from the general population, veteran and military samples or special populations such as victims of disasters (Ullman & Siegel, 1996). In addition, there is a great diversity among methods employed, which further limits generalisability and comparability of findings. An underlying characteristic of the available evidence is that it comes from cross-sectional and low quality studies that vary greatly in the methodology used (Afari et al., 2014). Each study provides a snapshot of some of the aspects of the disorder. These findings could be potentially influenced by the wide scope of the literature search. However, what is clear is

that there is a paucity of studies taking a holistic approach to measuring the burden of PTSD, looking at the health, social and economic effect of the disorder, utilising reliable measures, and comparing costs and outcomes of the intervention in question.

Over the past two decades, the economic burden of mental health disorders has increasingly been recognised by policy makers, providers and funders. There has been a shift from a predominant health perspective of the disorders into the economic and social domains, which has been fuelled by the increased interest and application of health economics principles and methods in the mental health area. Slowly, this shift has been reflected in the type of research questions and commissioned and conducted studies, which have increasingly adopted an economic perspective. Evidence-based decision-making demands economic evaluations and examination of “cost impacts and differences in the context of outcome differences” (McCrone, 2003, p. 10).

At this moment, the evidence base on the cost-effectiveness of mental health response after the terrorist events is still developing. Although the social and economic impacts of PTSD have been increasingly recognised and documented, high-quality evidence in the form of cost-effectiveness or cost-benefit analyses, alongside systematic reviews and meta-analysis on these impacts on individuals, is still scarce. My own updated review of the literature on the social and (in particular) economic impacts of PTSD did not yield many new studies since my own preliminary search (for my Major Review) in 2007. In total, I have identified only three studies examining some aspects of the costs and outcomes of PTSD. A cost of illness study, conducted by NICE to feed into guidelines, estimated that the total annual cost of implementing the recommendations on best evidence-based treatment for PTSD would be £33.4 million (NICE, 2005). In a 5-year proposed plan this cost would be reduced by savings if pharmacotherapy was replaced by psychotherapy, NICE stated that the recurrent annual net cost of fully implemented recommendations in England would amount to as much as £26 million at 2005 prices. Although this is a conservative estimate, as the model did not take into account costs averted by timely provision of the treatment, nevertheless this study provides an insight

into costs the health system is facing associated with provision of treatment for PTSD. However, for making an informed decision on funding PTSD treatment data on treatment outcomes along data on costs averted is needed. More helpful information for policy-makers is presented in a cost-effectiveness study looking into the timing of the provision of therapy, commissioned by the National Collaborating Centre for Mental Health (NCCMH), concluded that the CBT and EMDR treatment at 12 weeks is a cost-effective option in comparison to treatment at 2 weeks post-trauma, operating under the assumption that remission is worth more than £2420 (NICE, 2005). The third available study looked into the evaluation of implementation of the best evidence-based practice as recommended by the NICE guidelines, delivered by the Improving Access to Psychological Therapies (IAPT) services. The study compared an IAPT site to two matched comparator sites. Individuals at the IAPT site received treatment via a stepped-care approach, as recommended by the NICE guidelines on treatment of PTSD in primary and secondary care, while the comparator sites offered treatment as usual consisting of GP services, primary care counselling and referral to secondary care services. Although the authors of the study concluded that IAPT services were “probably cost effective within NICE guidelines threshold of £20,000-30,000” they remarked on uncertainty regarding the cost and outcome differences (Mukuria et al., 2013, p. 226).

Economic data on the direct and indirect costs of PTSD, or on its treatment, are limited, with data from general mental health or depression studies usually being used as proxies. Although there have been a number of studies that have focused on anxiety disorders in general or on depression, which are common comorbid conditions to PTSD (McCrone et al., 2008; Layard et al., 2008; Thomas & Morris, 2003; NICE, 2005), there is still a scarcity of studies looking at the wider economic consequences of PTSD, on data on the exact economic burden of PTSD and on the cost-effectiveness of its treatment (McCrone et al., 2003). For example, a systematic review by Lewis, Pearce and Bisson (2012) on efficacy, cost-effectiveness and acceptability of self-help interventions for anxiety disorder including PTSD, did not find a single study that included an economic evaluation.

2.4 To screen or not to screen for PTSD - benefits of early detection and screening

There is now considerable evidence that mass early intervention for trauma survivors (using critical incident stress debriefing or related techniques) is unlikely to reduce later psychopathology and is an inefficient use of resources (McNally et al., 2003; Roberts et al., 2010). The majority of survivors will not require mental health treatment. However, a minority is likely to develop chronic conditions and to have significant work and social impairments unless appropriately treated.

The NICE (2005) PTSD Guidelines recommend the routine use of a brief screening instrument for PTSD at one month post-disaster. Screening should involve all individuals exposed to the traumatic event and continue up to a year after the event at regular intervals. The purpose of screening is to identify all individuals at risk and refer them for evidence-based treatment if needed. In light of the evidence presented in the NICE guidelines, experiencing a number of PTSD symptoms within the first month after the traumatic event is part of the natural recovery pathway.

Early detection and treatment for PTSD will reduce the impact of PTSD on individuals, their family and society in terms of suffering as well as costs to the health and social care systems. However, many PTSD cases go unnoticed by both individuals and general practitioners. A US study has reported that around 10% of affected individuals received help in the year after PTSD onset, after which there is an average delay of 12 years before receiving any kind of help (Wang et al., 2005). These are lower treatment rates than for other common mental health disorders. One UK community survey (Bebbington and al., 1997) found that about 10% of an inner-city population had a need for psychiatric treatment in the past year, with only 50% of these needs being met. Unmet needs were particularly high for anxiety disorders. Evidence assessed highlights the lack of recognition of the nature, seriousness, and chronicity of PTSD, both among sufferers themselves (Kessler, 2000) and among UK general practitioners (Munro et al., 2003; Duxbury, 2006). A survey reporting

awareness of NICE guidelines and PTSD in practice patients has concluded that there is a poor rate of case-recognition in both primary and secondary care.

Furthermore, the estimated prevalence of PTSD cases in both GP practices and CMHTs were much lower than prevalence expected from epidemiological studies (Ehlers, 2006). According to the PTSD prevalence data, GP practices with a catchment area of 5,000 people should expect 75 – 150 cases annually. The GP's lack of knowledge (Munro et al., 2003; Duxbury, 2006; Zimmerman, 1999) is a possible explanation as studies report only 2% of GPs recognise PTSD (Taubman, 2001) and GPs often do not ask about traumatic experiences (Duxbury, 2006). The results of a GP survey reveal a lack of information about NICE guideline recommendations for PTSD. As a result, the majority of patients with PTSD did not receive or were not referred to recommended psychological treatment. Instead, patients were most often prescribed medication, most frequently selective serotonin reuptake inhibitors (SSRIs; Ehlers, 2006), which is exactly the opposite of what is recommended by NICE guidelines.

Another explanation for poor treatment rates could be that PTSD sufferers are not aware of the cause of their symptoms; the avoidance symptoms associated with PTSD, thinking the problem will get better by itself, wanting to solve the problem by him/herself (Kessler, 2000), long treatment waiting lists, costs and availability of treatment (CEP, 2006; SCMH, 2006).

The literature highlights the need for increased awareness and greater recognition of PTSD, especially in primary care. There is a need for increased availability of psychological treatment, as studies report 30% of people seen at GP surgeries have mental health problems (CEP, 2006). Two-thirds to three-quarters of people identified in epidemiological surveys who meet criteria for mental disorder are not receiving treatment (Andrews et al., 2000). The 2007 general population Adult Psychiatric Morbidity Survey reported that only one quarter of the individuals who screened positive for PTSD were receiving treatment for a mental or emotional problems (National Centre for Social Research, 2007).

Due to the high prevalence of the disorder and its significant impact on individuals, their families, the health system and society as a whole, the prospect of screening for PTSD has been suggested by numerous authors with the purpose of early detection and to prevent the onset of chronic PTSD in various contexts from emergency department to post-disaster mental health response (Liebschutz et al., 2007; Kimerling et al., 2006; Ouimette et al., 2007; Van Dam et al., 2013; Lang & Stein, 2005; Foa et al., 2008; Breslau et al., 2003; Silove et al., 2009; Ivanova et al., 2011). Kessler et al. (2009) argued that screening at the workplace and treatment of anxiety disorders might have a positive return on investment by increasing workplace performance and reducing healthcare costs associated with the disorder and comorbid disorders, and might be cost-effective from the societal perspective in reducing its effects in health and social functioning. Another benefit of screening lies in the opportunity to detect subsyndromal PTSD (Duffy et al., 2009).

As with other health problems such as cervical cancer or depression, screening for PTSD at general practice level could be a way forward to ensuring identification and access to treatment for individuals exposed to traumatic events by employing valid, reliable and brief measures. This would ensure that individuals exposed to traumatic events are identified, informed about PTSD and the help available, screened for symptoms at regular intervals with reliable and valid measures and referred for treatment, if and when necessary. This way the GP could serve as a triage point by minimising unnecessary referrals for treatment. Furthermore, screening for PTSD at general practice level could complement the work of the Improving Access to Psychological Therapies (IAPT) programme, which aims to provide evidence-based treatment for depression and anxiety disorders.

The introduction of screening for PTSD demands a careful consideration of numerous factors such as:

a. Who should be screened? Should screening be aimed only at high-risk populations, such as refugees and asylum seekers, or at individuals suffering from high-risk conditions often comorbid with PTSD, such as alcoholism or domestic violence, or the general population?

- b. Should screening focus on the identification of people with new PTSD (predictive screening) or only on identifying already-existing cases?
- c. In which context (setting) should people be screened?
- d. Which instruments should be used for screening?
- e. Once screening has taken place, what is the best way to ensure that individuals are referred for and provided with appropriate treatment?

When assessing the implications and feasibility of screening for PTSD, the criteria devised by National Screening Committee provide valuable guidelines. A summary of the guidelines is presented in Table 7.1 and they cover the criteria around the condition, available instruments, treatment, and characteristics of the screening programme.

Table 2.1 National Screening Committee Criteria (NSCC)

The Condition

1. The condition should be an important health problem.
2. The epidemiology and natural history of the condition, including development from latent to declared disease, should be adequately understood and there should be a detectable risk factor, disease marker, latent period or early symptomatic stage.
3. All the cost-effective primary prevention interventions should have been implemented as far as practicable.
4. If the carriers of a mutation are identified as a result of screening the natural history of people with this status should be understood, including the psychological implications.

The Test

5. There should be a simple, safe, precise and validated screening test.
6. The distribution of test values in the target population should be known and a suitable cut-off level defined and agreed.
7. The test should be acceptable to the population.

8. There should be an agreed policy on the further diagnostic investigation of individuals with a positive test result and on the choices available to those individuals.
9. If the test is for mutations the criteria used to select the subset of mutations to be covered by screening, if all possible mutations are not being tested, should be clearly set out.

The Treatment

10. There should be an effective treatment or intervention for patients identified through early detection, with evidence of early treatment leading to better outcomes than late treatment.
11. There should be agreed evidence based policies covering which individuals should be offered treatment and the appropriate treatment to be offered.
12. Clinical management of the condition and patient outcomes should be optimised in all programme.

The Screening Programme

13. There should be evidence from high quality Randomised Controlled Trials that the screening programme is effective in reducing mortality or morbidity.
14. There should be evidence that the complete screening programme (test, diagnostic procedures, treatment/ intervention) is clinically, socially and ethically acceptable to health professionals and the public.
15. The benefit from the screening programme should outweigh the physical and psychological harm (caused by the test, diagnostic procedures and treatment).
16. The opportunity cost of the screening programme (including testing, diagnosis and treatment, administration, training and quality assurance) should be economically balanced in relation to expenditure on medical care as a whole (ie. value for money).

With regard to PTSD, the available supporting evidence demanded by the NSCC is even scarcer than in the case of depression. As outlined earlier in the chapter, there is ample evidence on the burden of the condition itself and arguments as to why it constitutes an important health problem. However, as discussed earlier, the evidence on the cost-effectiveness of primary care preventive interventions is scarce.

With regard to the screening instruments, a good number of available tests with good psychometric properties are available. However, in the UK there are no validated translations of the screening instruments to the other languages frequently spoken by refugees and asylum-seeking groups. Furthermore, a review of the evidence on routine screening for PTSD in the refugee and asylum-seeker population concluded that there is not enough evidence of the benefits of the screening programme outweighing the potential harm (Rousseau et al, 2011). The study concluded that there is a limited number of screening instruments that have been validated for this particular group. Moreover, the psychometric properties of the available screeners, along with their cut-off scores, are on the whole established only for a specific group of respondents, which limits its application and accuracy (Hollifield et al, 2002).

With regard to the treatment of PTSD, NICE guidelines (2005) have identified trauma-focused CBT along with EMDR as effective. Furthermore, there is evidence that the early detection of the disorder, along with timely and effective treatment three to six months after trauma exposure, prevents the development of chronic PTSD and its consequent burden. The NICE guidelines (2005) are also clear on who should be offered treatment and on the treatment protocols.

There is a big gap in the existing knowledge about the implementation of screening for PTSD at the general practice level. This literature review has identified only two studies with evidence of the benefits of predictive screening for PTSD in the UK or internationally, in addition to evidence presented in the 2005 NICE guidelines. However there seems to be a consensus around screening high-risk groups rather than the general population.

The latest NICE guidelines on PTSD (NICE, 2005, p. 101) suggest there is “no sound evidence to support a national or large population screening programme for PTSD”. Instead, following available evidence, NICE advocates screening only of high-risk groups (NICE, 2005). More recently, NICE has supported screening for PTSD after a major disaster, as well as the screening of refugees and asylum seekers (NICE, 2012).

A recent example of predictive screening after a major disaster was the NHS Mental Health Response after the London bombings study, also known as the 'screen and treat' programme. An independent evaluation of the programme concluded that screening was an effective way of identifying individuals with mental health problems following exposure to this traumatic event (Brewin et al., 2008).

The second identified study on predictive screening for PTSD by Bisson et al (2010) looked at the benefits of predictive screening for victims of violent crime in an emergency unit using the Trauma Screening Questionnaire (TSQ; Brewin et al., 2002). Given the reported prevalence of PTSD following violent crime, the authors expected that for every two people who screened positive on the TSQ two weeks post-exposure, one would develop symptoms of PTSD one month after exposure. Unfortunately, there was a low response rate, with only 17% of those who used emergency services being screened. Of these, 338 (57%) screened positive, but only 26 (7.7%) were formally assessed and nine individuals (2.7%) received therapy for PTSD. The main reason for rejecting the assessment following a positive screen was unwillingness to discuss trauma and a lack of concern about the screening results. The authors concluded that the screening was not as valuable as expected, due to the low response rate and relatively high costs of screening. However this study has a very high ecological validity and offers valuable insights into the practicalities of setting up screening, alongside the outcomes of such programmes.

A review of the evidence on routine screening for PTSD in the refugee and asylum-seeker population concluded there is not enough evidence of the benefits of the screening programme outweighing the potential harm (Rousseau et al., 2011).

Predictive screening for acute stress disorder (ASD) or a broad range of biological and cognitive factors has been suggested as a way forward in identifying future PTSD cases. Two separate studies, one by Bryant (2003) and one by Creamer (2004), concluded that ASD does not offer sufficient predictive power to diagnose later chronic PTSD. Instead, Bryant et al (2011) concluded

that a more accurate predictor of PTSD could be found in a broad range of biological and cognitive factors.

Biological markers, such as an elevated resting heart rate, elevated respiration and lower cortisol rate in the days after trauma exposure, have been explored in numerous studies as PTSD predictors (Bryant, 2006; Bryant et al., 2008; Yehuda, 2001). However, studies to date investigating biological and cognitive factors have not yielded unequivocal results and there is still uncertainty behind the reliability of those measures as predictors of PTSD.

Evidence on effective screening programmes, especially in the context of primary care, is scarce and even when available is presented in the form of observation studies, rather than RCTs. Furthermore, many questions on the role, acceptability and appropriate design of the screening as a pathway into treatment in the context of primary care are still open and demand careful consideration and more supporting evidence. Finally, a review of existing literature on PTSD screening has not identified a single economic evaluation.

In conclusion, there is no straightforward answer to what seems a simple question. However, the identification of the relevant questions nevertheless provides a useful template for future studies. Numerous factors behind the decision to introduce a screening policy are discussed in Chapter 8.

2.5 Summary

In this chapter, my aim was to demonstrate how the health, social and economic effects of PTSD are interconnected and that, in order to account for the full extent of the impact of the disorder, one needs to include effects and costs in all three domains. The POW approach helps us in identifying all the relevant factors and the patterns of their interrelationships in evaluating the effects of PTSD. This is a resource- and time-consuming endeavour with numerous methodological and practical difficulties, including availability of service use data, reliance on self-reporting in service use, difficulties in measuring productivity loss and presenteeism data in particular, and difficulties

in capturing, measuring and costing effects of trauma exposure and PTSD on the social domain.

Evidence is scarce on the demand, type and cost of services used by the population exposed to a traumatic event, both for the immediate aftermath of the event and from the long-term perspective. Information on the type, frequency and costs of service use associated with PTSD is needed alongside information on the cost-effectiveness of available mental health interventions.

In order to prevent chronic PTSD and its associated burden, the literature suggests screening for PTSD as a way of identifying people in need of treatment, and as a pathway into treatment. However evidence on screening for PTSD, in particular in the primary care context, is scarce and many questions on the role, acceptability and appropriate design of screening remain to be answered.

The presented findings support the relevance of the key questions this study aims to explore. There is a need for high-quality evidence of the social and economic effects of PTSD, the costs and effects of implementing best evidence-based treatment protocols, and information on costs and benefits of early screening for PTSD alongside the practicalities of setting-up such practice. In particular, there is a demand for evidence coming from comprehensive economic evaluation studies that comply with study design, data collection and analysis protocol recommendations. On the other hand, there is a need for recognition and integration of innovative non-experimental study designs into economic evaluation in order to reflect the real-world setting and widen the framework of the analysis to areas and questions not easily evaluated by experimental design.

This study attempts to offer a comprehensive view of the effects of PTSD on individuals, their families and society as a whole. Moreover, the study aims to explore what it means for individuals to be involved in a terrorist attack, what are their needs in the intermediate aftermath and longer-run after exposure to trauma, how to structure and deliver an evidence-based mental health response in an efficient and cost-effective manner, and how to prevent

chronic PTSD in the general population by setting-up screening protocols in the general practice context as a pathway into treatment. Each of these questions contributes a piece of evidence and offers a different perspective on the array of effects PTSD has on individuals and society as a whole. In my opinion, such a multidimensional and comprehensive approach is justified by the complexity of the subject and demands for a diverse and heterogeneous methodological approach, which is presented in the next chapter.

Chapter 3 Methods

3.1 Introduction

This study is based on an evaluation of the NHS mental health response introduced shortly after the 7 July 2005 London bombings. The NHS mental health response was delivered in the form of a screen and treat programme (ST). This chapter aims to set the context for the study by providing a general overview of both the ST programme and its subsequent evaluation.

I will start by setting out my study aim and objectives, and follow with an overview of the NHS mental health response, the ST programme, and a brief description of the evaluation study.

In order to address the questions outlined in my study objectives I will employ a number of different methods. I will begin by outlining possible ways to address the questions and explain my choice of methods. For each study objective, and in separate sub-sections, I will describe the sampling procedure, the choice of instruments, data collection protocol and the analysis plan.

3.2 Aim and objectives

The aim of this research is to assess the health, social, and economic impacts of PTSD by focusing on individuals exposed to the London bombings.

In order to achieve this aim, the following objectives were chosen:

- To review and assess the current evidence and measures of health, social and economic impact of PTSD. (Chapter 2)
- To assess the impact of the London bombings in terms of service use and the impact on health, social, and economic activity of those affected. (Chapters 4 and 5)
- To conduct an economic evaluation of the screen and treat programme implemented as a mental health response after the London bombings. (Chapters 6 and 7)

- To assess the broader implications and feasibility of screening for PTSD in primary care. (Chapter 8)

3.3 The study context – the screen and treat programme

3.3.2 Structure and outcome measures

The screen and treat programme ran for two years, between September 2005 and September 2007, at three locations in London. All the screening, assessment and treatment data was collected by clinicians and the screening team, and archived in the form of an ACCESS database.

The role of the Screening team was to coordinate outreach and screening, to contact and screen all individuals exposed, and to refer those who screened positive for detailed assessment or treatment, if needed. The screening team was responsible for collecting contact details of the exposed individuals from the Metropolitan police, A&E departments at London hospitals and other statutory and non-statutory organisations involved in the various forms of response and support after the LB.

All identified individuals exposed to the London bombings were contacted by letter or telephone and sent a questionnaire on the nature of their involvement with the bombings, as well as information on gender, age, GP details and any children living with them. In addition, the questionnaire contained a set of screening questions in order to detect any symptoms of psychopathology. Following up the initial questionnaires at one, three, six and nine month intervals, additional screening questionnaires were sent to the individuals. The questionnaires included the Trauma Screening Questionnaire (TSQ; Brewin et al., 2002), a brief screening measure for posttraumatic stress disorder. The questionnaire has a yes-no response scale and contains ten questions on whether there has been a presence of PTSD symptoms at least twice in the last week. Previous research has demonstrated that this instrument has excellent performance relative to other instruments and that endorsement of 6 or more symptoms yields high levels of sensitivity and specificity (Brewin, 2010; Walters et al., 2007).

The TSQ was supplemented by additional screening questions: two on depression (Kroenke et al., 2003), one on travel phobia and three more general questions on elevated levels of distress including questions on increased drinking or smoking.

All individuals were given feedback upon the receipt of the screener and were provided with any additional information they needed. In the event that respondents replied positively to at least six questions on the TSQ, or to any of the additional screening questions, they were considered to screen positive and were invited for a detailed clinical assessment at one of the clinics. Individuals who screened negative were informed that they were recovering well and were screened again in three months to monitor their progress and detect potential delayed-onset PTSD. The screening questionnaire is given in Appendix A.

The detailed clinical assessments and the treatment were delivered at one of the three clinics within London that took part in the project; the Traumatic Stress Clinic (TSC), Camden & Islington Mental Health and Social Care Trust; the Centre for Anxiety Disorders and Trauma, South London and Maudsley NHS Trust (SLAM); and the Institute for Psychotrauma, East London and City Mental Health Trust (ELCMHT).

The purpose of the longer clinical assessment was to identify individuals in need of treatment exclusively due to their exposure to the LB. Individuals with pre-existing mental health conditions were referred to their respective clinicians. Secondly, the assessment aimed to determine an individual's suitability for trauma-focused cognitive therapy by employing the criteria set by DSM-IV and ICD-10 disorder due to exposure to LB, which has not been resolved on its own.

Assessment included the following instruments:

- Structured Clinical Interview for DSM-IV (SCID) (First et al., 1997)
- CAGE alcohol abuse screening instrument (Mayfield et al., 1974)
- SF-12 Health Survey (Ware et al., 1996)

- Short McGill Pain Questionnaire (Melzack, 1987) where appropriate, and
- Inventory of Complicated Grief – Revised (Prigerson & Jacobs, 2001).

Individuals with persistent and distressing conditions were referred for treatment even if not meeting criteria set by DSM-IV and ICD-10. Assessed individuals who were not referred for treatment were followed up at 3-month intervals at three, six and nine months, in order to monitor their progress and detect delayed-onset PTSD that occurs in about 15% of the exposed civilian population (Andrews et al., 2007).

Psychological treatment was delivered in three psychological trauma centres in London: the TSC, Camden and Islington Mental Health and Social Care Trust; the Centre for Anxiety Disorders and Trauma, SLAM; and the ELCHMT.

The location of the ST programme affected access to the programme: many individuals based outside London avoided using transportation services because of the nature and location of the traumatic event and had to rely on services available in their local area. However, all non-London residents who were unable to travel to London, and who contacted the ST programme and needed treatment were referred by the programme to their local treatment centres.

The main aim of the ST programme was the early identification and treatment of PTSD. However, in practice the ST programme only started receiving larger numbers of referrals from September 2005 (although the first referrals were made in July 2005) due to delays in obtaining the contact details from police and hospitals caused by the Data Protection Act (1998).

The treatment provided, as recommended by the most recent NICE guidelines (NICE, 2005), was trauma-focussed cognitive-behaviour therapy (TFCBT) and eye movement desensitisation and reprocessing (EMDR). The level of treatment provided was recorded by clinicians on a monthly basis in two separate data collection systems; as the total number of hours of direct and indirect time spent (data needed for the DH), and in a clinic's own system that

monitored each client's progress and included data on the start and end dates of treatment, the type of treatment, the total number of sessions attended and missed, as well as depression and PTSD assessments at the start and end of treatment. At the end of the screen and treat funding, patients still receiving treatment were referred to the usual NHS psychological services.

The progress of the treatment and the level of the symptoms were monitored by administering the Posttraumatic Diagnostic Scale (PDS; Foa et al., 1997) and the Beck Depression Inventory (BDI; Beck et al., 1961) at the start and the end of the treatment for each patient. The initial goal was to administer both questionnaires at each treatment session. However, this protocol was not followed strictly due to a variety of practical reasons such as time constraints or a patient's unwillingness to go through the same questionnaire each session. Therefore, in order to address problems introduced by the missing BDI and PDS data I have only used scores from the start and end of the treatment. In the case where the start and/or end of treatment scores were missing I have used the available score from the next available treatment session. The ST programme sent screening materials to 910 adults (and a further 7 children whose details are not reported here). The ST programme received contact details of 910 individuals exposed to the LB from Metropolitan police, hospital lists, organisations involved in the mental health response, or through self referral. Out of 910 individuals who were sent screeners and information on PTSD, only 596 individuals returned a screener.

Figure 3.1 Referrals to the screening team diagram

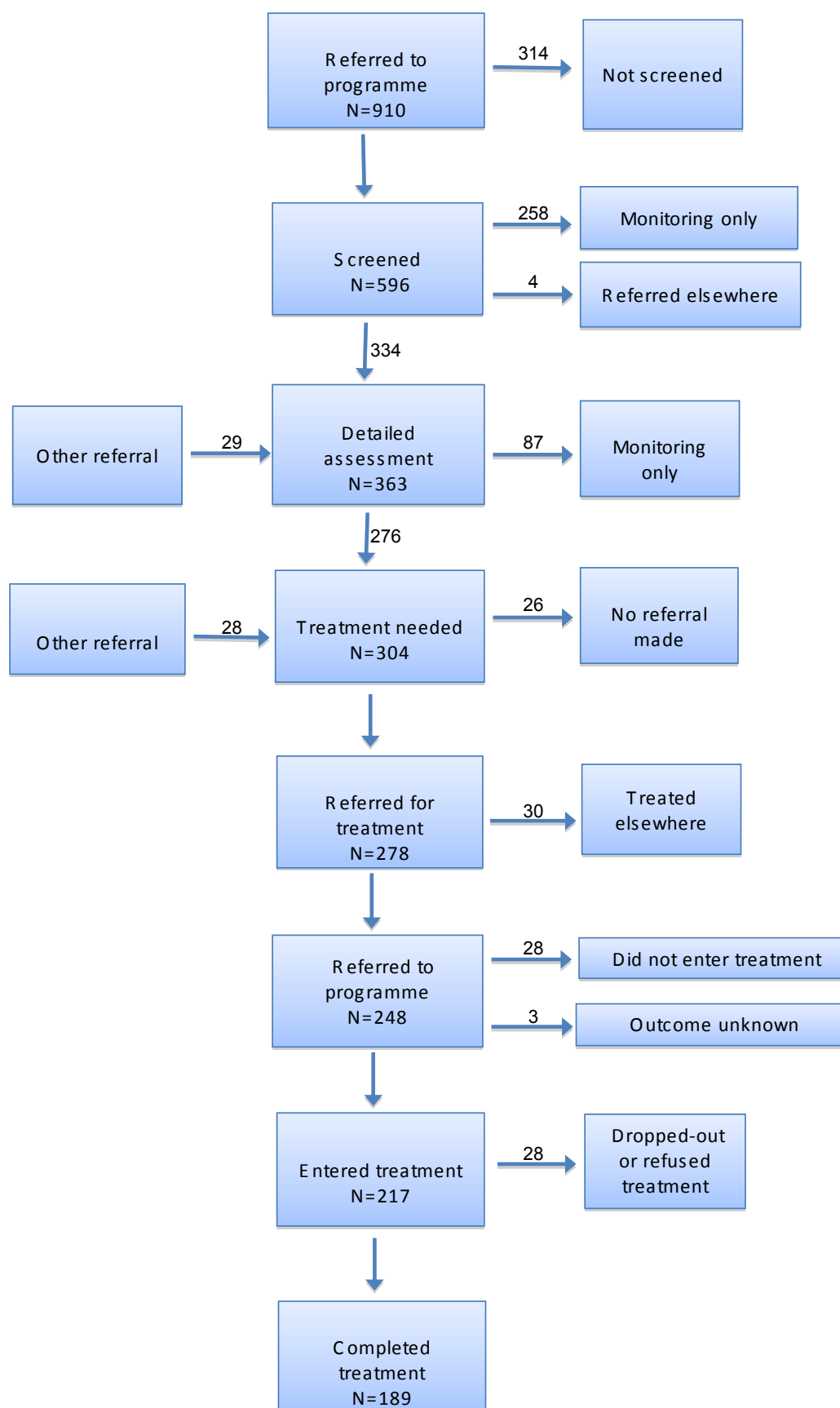


Figure 3.1 shows that of the 910 adults, 65.5% returned at least one screening questionnaire and, of these, 56.7% screened positive at some stage. A majority of those receiving a more detailed clinical assessment (76%) were judged to require psychological treatment and most were referred, 248 within the programme and 30 outside the programme. Of those treated within the programme, 189 completed a course of therapy. Thus, just under one third of those who were originally screened entered and completed treatment. Individuals who required monitoring only continued to be screened in three month intervals until they were discharged from the programme or referred to assessment and/or treatment within the programme or elsewhere.

3.4 Evaluation of the ST programme

The DH commissioned and funded both the ST programme and its evaluation, which was structured and delivered by UCL's Department of Health, Clinical and Educational Psychology. The evaluation looked into the acceptability of the ST programme, satisfaction and service use, and the nature of the health, social, and economic impact of exposure to the London bombings.

The evaluation aimed to contact a sub-sample of ST programme users alongside a sample of the individuals who were exposed to the London bombings but did not use the services offered by the programme either out of choice or lack of knowledge. In addition, the evaluation aimed to interview the main stakeholders who contributed to the set-up, running and funding of the programme. In total, the evaluation study planned to interview around 200 individuals who were exposed to the LB.

3.4.1 Evaluation timeframe

Evaluation of the NHS response after the London bombings project ran from June 2006 until November 2008. During that period, two research psychologists (ZH and this researcher) from UCL's Department for Clinical, Educational and Health Psychology collected data on the treatment follow-up, and the social and economic impact of the London bombings. At the outset of the evaluation it was agreed that all collected data on service use, and the social

and economic effects of the LB will constitute a core part of this thesis. Although data were collected as a part of the evaluation study, I was solely responsible for data cleaning, entry and analysis. Furthermore, I have contributed to the design of the modified version of the CSRI questionnaire used in the evaluation study.

3.4.2 Evaluation data collection protocol

An NHS Research Ethics Committee granted ethical clearance prior to the start of the evaluation. Participants were initially contacted via letter, which briefly outlined the aim of the study and invited them to take part. Participants had two weeks to opt out of the study by sending back the form in a pre-paid envelope enclosed with the letter. After two weeks, if no opt-out response was received, participants were contacted in order to arrange a telephone, face-to-face or postal interview depending on the participant's preference, and at a convenient time and place. All the participants received study information sheets containing study details and the evaluation's team contact details. All participants also signed the consent form and were informed that they could opt out of the research at any time, and that opting out would not influence their future care. All data collected as a part of the screening, assessment and treatment were stored by the ST team in both paper and electronic form. All collected data was checked for inconsistencies and re-entered into ACCESS and SPSS electronic databases.

61% of the interviews were conducted via telephone, while 32% were conducted face-to-face and took place either at the evaluation team's office or at a convenient location of the participant's choosing (office, home, coffee shop). The rest of the questionnaires were returned by post (6%) or email (1%). Interviews, both face-to-face or telephone, took on average 30 minutes.

3.4.3 Evaluation sub-sample

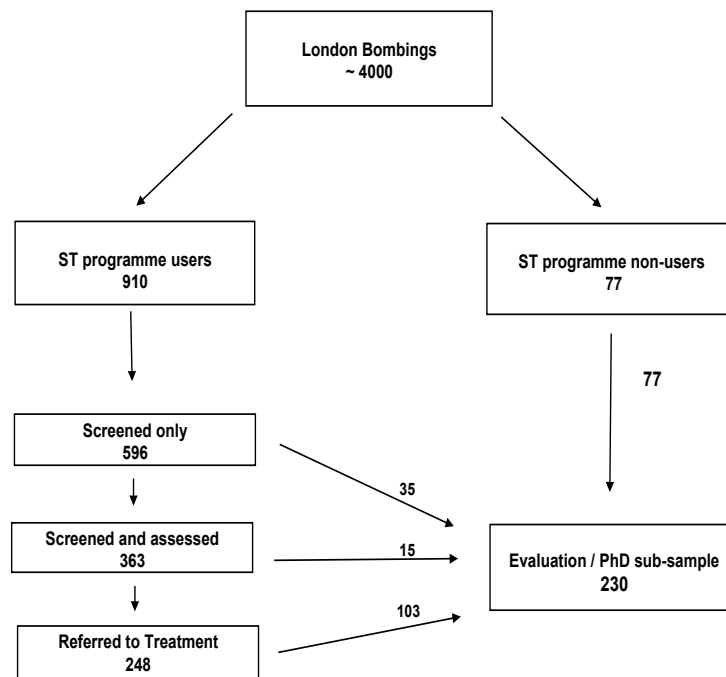
In order to have an accurate representation of the sample recorded on the screening team database, the evaluation sampled participants from all segments of the ST programme (screened, assessed, and treated participants) alongside a group of participants who declined to take part in the ST programme. In total,

the evaluation interviewed 230 users, potential users and non-users of the ST programme. *Users* are defined as the individuals who used any part of the ST programme. Individuals who never used the programme out of personal choice are referred to as *non-users*, while *potential users* are the individuals who were not aware of the existence of the programme. The study recruited individuals from the ST programme database.

In order to recruit the programme's potential and non-users, the research team sent out letters to individuals on Metropolitan Police witness and wounded lists who were not already included in the ST programme's database. A number of individuals contacted the evaluation team directly, having heard about it by word of mouth. The evaluation study received a list of 623 individuals from the Metropolitan police that had not been shared with the ST programme. 77 individuals from that list were interviewed during the evaluation as a part of a category of participants who did not use the ST programme. Again it is difficult to assess how representative that sub-sample was, as the evaluation did not have any socio-demographic data on the group of 623 individuals to begin with. Moreover, for the same reasons it is not possible to assess how representative 623 individuals were of all the individuals who were exposed to the bombings and did not use the ST programme. The analysis of this particular dataset is a reminder of how research in this area is fraught with methodological and practical difficulties. However, at the same time it offers high ecological validity and insight into applied clinical interventions in a real world setting.

The evaluation also attempted to contact the users of standard NHS Direct services. This service was set up within hours of the London bombings, aimed at identifying individuals involved in the LB and directing them to appropriate services within the NHS.

Figure 3.2 Study sample break down



As Figure 3.2 demonstrates, a total of 230 interviews were conducted as a part of the evaluation, 103 with individuals who were referred to treatment within the London bombings programme, 35 with individuals who were screened only, 15 with individuals who were screened and assessed only, and 77 with individuals who did not use programme. The sizes of the evaluation follow-up sub-samples were not determined by the power calculations and therefore the evaluation sample cannot be regarded as representative, only indicative of the ST programme users and individuals exposed to the LB. The sample size was determined by the possibility of identifying and contacting individuals, depending on their availability and willingness to engage in the study after a considerable time had elapsed since the event (from 17 up to 38 months after the LB).

The sample size for each participant category was determined in the study proposal and approved by the study funder prior to the start of the evaluation. The aimed sample sizes were 50 for participants who did not use

the programme, 70 individuals who have received treatment under the ST programme, and 40 for participants who were screened and assessed only. However, during the course of the study, and in agreement with the main investigator, we have continued with the data collection even after reaching the sample size quotas. The ST programme released the contact details of the participants to the evaluation team once individuals were discharged from the ST programme, while most of the participants in the programme non-user category come from the large Metropolitan police list which was originally not shared with the ST programme for unknown reasons.

The sampling structure and response rate is presented in Table 3.1. The eligible participant category in Table 3.1 represents all the individuals whose details were available to the evaluation, while the contactable number of participants represents all individuals whose actual contact details were available to the evaluation. The response rate, presented in Table 3.1, was just over 60% for programme users and 12% for non-users.

The evaluation interviews were conducted on average 731 days after the London bombings, ranging from 422 to 1181 days. I will present the results in later chapters, but it can be noted here that different methods of data collection did not produce higher or lower costs. The difference between face to face interviews and indirectly conducted interviews was tested using the Mann-Whitney test ($U=5456.00$, $Z=-0.496$, $P=0.62$)

I wanted to explore what a suitable sample size would be, based on a conventional power calculation. For this purpose I have used a specific online power calculation tool developed by Soper (2013) to estimate the minimal sample size for a multiple regression model with three to six predictors. A suitable sample based on medium effect size for three predictors model would be 76, for a four predictors model a minimum of 84, for five predictors model a minimum sample would be 91, and finally for six predictors model the sample would need to be at least 97 (Soper, 2013). However, one must be cautious in interpreting the quoted power calculations as the sample size required in order

to find significant effects will depend on the variability of the dependent variable and of the covariates.

The sampling structure and response rates for each sub-sample are presented in Table 3.1.

Table 3.1 Sampling structure

	Eligible N	Contactable N	Interviews conducted	Effective response rate (%)
Screened and/or assessed only	124	76	50	65.8
Treated	189	161	103	64.0
Did not use the programme (second Met police list)	623	611	77	12.6
Total	935	848	230	27.3

The majority of the participants were involved in the 7 July events at the King's Cross, Edgware Road, Aldgate and Russell Square locations. Three-quarters of them had personally witnessed the effects of one of the bombings and around one third of the participants reported they had been injured. Half of the participants reported that they had seen someone who was injured or killed. Participants who did not witness personally the effects of the bombings were bereaved or had a family member or a close friend involved in the LB. The sub-sample of the ST programme users and individuals followed up by the evaluation study is in many ways different from the usual users of NHS mental health services due to the nature of their exposure to the traumatic event. They were predominantly from white British or 'white other' ethnic categories, aged in their early forties, mostly caught up in the early morning London commute on their way to work; although this finding is limited by the fact that around half of the ST programme users and around 15 per cent of evaluation sub-sample did not report their ethnicity. A small percentage of the 230 people followed up in the evaluation reported previous mental or physical health problems, 11.3% reported psychiatric comorbidity while 3% reported physical comorbidity.

Although the evaluation sub-sample cannot be directly compared to the ST programme user sample, for descriptive purposes it is interesting to note that the evaluation study participants' age, gender, profession and ethnicity distribution closely resemble the ST programme users' distribution (Table 3.2). However, it needs to be pointed out that the evaluation sample had a larger percentage of white British participants. Around half of the participants in the evaluation sub-sample were white British and female, on average 41 years of age.

Table 3.2 Demographic characteristics - study sub-samples

	ST Programme N=596	Evaluation N=230
	N (%)	N (%)
Age M (range, SD)	41.67 (19.16-92.04, 12.20)	41.76 (21.65-82.58, 11.48)
Gender male	270 (45.3)	114 (49.6)
Ethnicity		
Asian Indian	13 (1.4)	8 (3.5)
Asian Pakistani	1 (0.2)	1 (0.4)
Black African	7 (1.2)	4 (1.7)
Black Caribbean	11 (1.8)	3 (1.3)
Black Other	1 (0.2)	1 (0.4)
Chinese	3 (0.5)	2 (0.9)
White-British	193 (32.4)	134 (58.3)
White-Irish	11 (1.8)	6 (2.6)
White-Other	36 (6.0)	18 (7.8)
Other	33 (5.6)	15 (6.5)
Not stated	287 (48.2)	35 (15.2)

As Table 3.3 shows, around 40% of participants were contacted via details on the Metropolitan Police witness lists followed by referrals from NHS hospitals, organisations affiliated with the response to the London bombings and self-referrals (data from the ST programme records). It is interesting to point out that there was a low GP referral rate, even though the programme disseminated information on available services to London-based GP practices on several occasions.

Table 3.3 Source of referrals to ST programme

Referral Source	N	%
Metropolitan Police Witness List 1	23	10.00
NHS Hospitals*	14	6.09
7th July Assistance Centre	12	5.22
Health Protection Agency	4	1.74
Self-referral	17	7.39
NHS Direct	11	4.78
GP referral	8	3.48
London Mayor's Fund	3	1.30
Red Cross	12	5.22
British Transport Police Occupational Health Dept.	9	3.91
Friend/Relative	4	1.74
Other NHS**	2	0.87
Metropolitan Police Occupational Health Dept.	4	1.74
Other***	37	16.08
Metropolitan Police Witness List 2	70	30.43
Total	230	100

*NHS Hospitals: Accident & Emergency lists and individual referrals from Whittington, Royal Free, Royal London Hospital, UCH, King's College Hospital, North Middlesex Hospital

**Other NHS: London mental health trusts and ambulance services

***Other: Victim Support, Welfare Unit City of London, family liaison officers, Kings Cross United, Criminal Injuries Compensation Authority

In total, 97 participants received treatment, of which 60% were male with an average age of 41 years (24-68). Participants received on average 12.5 sessions (range 0-64, s.d. 11.6 sessions) and missed 1.6 sessions (range 0-22, s.d. 2.7 sessions).

Table 3.4 shows PTSD was the predominant primary diagnosis; 67 participants were diagnosed with PTSD DSM-IV (29%) and 10 with PTSD ICD-10 (4.3). Participants with PTSD DSM-IV diagnosis also satisfied the ICD-10 criteria for PTSD. Other reported diagnoses were travel phobia (2.6%), adjustment disorder (2.6%), complicated grief (2.2%) and depression (0.9%).

In total, 82 participants completed treatment and around 70% received trauma-focused CBT alone or in combination with EMDR (Table 3.5). They attended on average 13.6 sessions (range 1-64, s.d. 11.71).

Table 3.4 Primary diagnosis for evaluation sub-sample

Primary diagnosis	N	%
PTSD DSM-IV	67	29.1
PTSD ICD-10	10	4.3
Depression	2	0.9
Travel Phobia	6	2.6
Adjustment Disorder	6	2.6
Generalised anxiety disorder	1	0.4
Complicated Grief	5	2.2
Other	1	0.4
None	130	56.5
Missing	2	0.9
Total	230	100.0

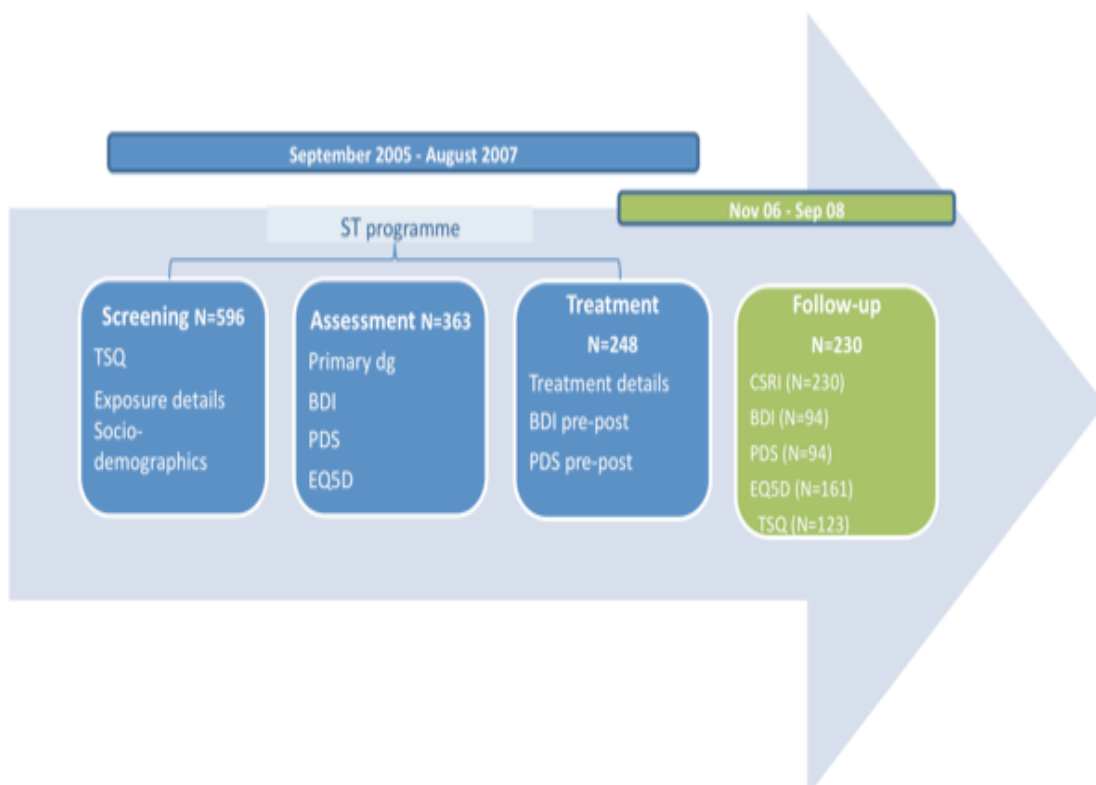
Table 3.5 Type of treatment applied

Type of intervention	N	%
Trauma focused CBT	53	64.6
EMDR	6	7.3
Both	17	20.7
None	4	4.9
Missing	2	2.4
Total	82	100

3.4.4 Evaluation measures

Evaluation was not built into the ST programme from the outset. As Figure 3.3 shows, it was only introduced to the programme from November 2007, during the last nine months of the programme. The aim was to follow-up a convenience sample of all the groups within the programme (depending on which aspect of the programme they used). The timing and the set-up affected the data collection methods significantly as they only allowed for one point of data collection for both costs and outcomes of the programme, and relied on the participants' recollection of the services they used for often long periods of time after the LB event. Consequently the timing of the evaluation limited the scope and generalisability of the evaluation study. Access to the independent sources of the information such as GP records, which would increase the quality and ensure collected data did not rely solely on the participants' recollection of the services used, was not planned within the scope of the study. Furthermore, the evaluation study did not have access to data on pre-LB functioning of the participants.

Figure 3.3 The ST programme and evaluation timeline and outcome measures



In total, the evaluation interviewed 230 participants. Each sub-group of the participants was followed up with the specific measures already used in the ST programme for that particular group. To be precise, participants who did not take part in the ST programme and those who were screened only as a part of the programme were followed up with the screening measure (TSQ); individuals who were assessed and individuals who received treatment were followed up with the BDI and PDS. Data on service use and quality of life measure were collected for all evaluation participants. Table 3.6 presents indicators of interest to this study.

Table 3.6 Indicators collected during screening, assessment, treatment and evaluation

Screening related information:
<ul style="list-style-type: none"> • source and timing of referral • socio-demographic information: age, gender, ethnicity, occupation • total number of screeners received • total score per screener
Assessment and treatment information:
<ul style="list-style-type: none"> • mental health history • physical health concerns • primary diagnosis • medication use • total number of sessions • therapy type • treatment centre and clinician • treatment outcomes: treatment start and end score for BDI PDS and QoL
Evaluation follow-up:
<ul style="list-style-type: none"> • whole sub-sample: <ul style="list-style-type: none"> - source and timing of referral - socio-demographic information: age, gender,

ethnicity, occupation

- exposure information: nature of involvement, day and location
- QoL
- Client Service Receipt Inventory

- participants who did not use the ST programme or who were only screened and assessed: TSQ
 - participants who received treatment: PDS and BDI
-

The TSQ questionnaire was used with individuals who were screened only, potential users and people who did not use the ST programme. The Beck Depression Index score (BDI) and the Posttraumatic Stress Scale (PDS) was used for individuals who were assessed only and for those who finished treatment. A modified version of the Client Service Receipt Inventory (CSRI) (Beecham & Knapp, 1992) was administered to all programme users to measure service use associated with the impact of the bombings, and subsequently to measure the costs.

The CSRI was complemented with two additional questions on impact on employment, one question on effects on physical health and one question on effects on social life. The copy of the questionnaire is presented in Appendix B. The CSRI is a widely employed research tool developed for use in mental health evaluations nationally and internationally (McCrone, 2007). Initially developed for evaluating community care, it has since been used in a variety of settings from evaluations of new drugs and specialist work schemes to children's mental health and social care (Beecham & Knapp, 2001).

The original version of the CSRI covers the following domains: client detail and information, followed by accommodation and living situation, information on employment, earnings and other personal information, and finally information on the receiving of service (Beecham & Knapp, 2001). The CSRI was slightly modified in collaboration with a health economist from the Institute of Psychiatry, King's College London (IoP) to reflect the particular needs of this evaluation. The modified CSRI collected a mix of quantitative and

qualitative data on the health, social and economic impact of the LB and was piloted to ensure questions were worded and ordered appropriately.

The CSRI enquired about the nature of the involvement in the LB, followed by questions on how the person was feeling now, using questions on feedback and changes in their outlook on the world as a result of involvement in the LB. The next section of the questionnaire covered the use of special services set up for people affected by the bombings. This was followed by questions about experiences with the use of the ST programme, including details on the type and length of treatment, as well as satisfaction with it. The next section asked about all statutory and non-statutory health-related services that respondents had used due to the exposure to the LB, including reason, number of hospitalisations and duration of contact. In addition, details were recorded on medication use due to exposure to LB (type and frequency). These questions were followed by a set of questions on the impact of the bombings on work and leisure, employment status and occupation; participants were asked to report the number of sick leave days, hours reduced or weeks of unemployment due to the LB.

The CSRI enquired about statutory benefits that participants were receiving due to their involvement in the LB. Finally an open-ended question was introduced on the effects of the LB on work and leisure activities.

The CSRI relied on participants' recollection of LB-related service use, between 17 and 37 months after the LB event. Health-related quality of life was assessed with two measures, SF-12 (Ware et al., 1996) and EuroQol EQ5D (EuroQol group, 1990), administered to all programme users. The EQ5D was initially employed due to its wide use and short, user-friendly format. This is a standardised instrument for health outcomes and is frequently employed in health economic evaluation. It assesses five domains of health: mobility, self-care, usual activities, pain/discomfort and anxiety/depression.

After a couple of months of application the evaluation team had concerns that the EQ5D was not reflecting the actual state of respondents' well-being. Researchers found that the EQ5D was often unrepresentative of the problems

that participants reflected on in completing the other instruments or that they expressed verbally during the interviews. One of the criticisms made of the EQ5D is poor sensitivity in detecting improvements in low-morbidity conditions (Brazier et al., 2002). Therefore the evaluation team decided to introduce SF-12 Version 1 due to its wider scope and good psychometric properties (Brooks, 1996). SF-12 Version 1 contains 12 questions that cover participant assessment of both their physical (PCS-12) and mental health (MCS-12) domains. The physical health domain covers physical functioning, role-functioning, bodily pain, and general health. The mental health domain covers vitality, social functioning, role-emotional and mental health.

Another advantage of the SF-12 measure is the norm-based scoring, which enables comparisons between different populations, conditions and other generic health measures (Brooks, 1996). However, introducing another QoL measure after the evaluation had started created problems later on in the data analysis due to the issue of comparability of the two measures, consequently reducing the sample size in some analyses.

Fortunately, it was possible to address this problem and compare the two measures with the help of the transformation algorithm developed by Gray, Rivero and Clarke at the Health Economics Research Centre (HERC), University of Oxford (2006). The algorithm translates raw SF-12 values into estimated EQ5D responses and utilities (Gray et al., 2006) by using regression analysis.

3.5. Methods to calculate and explore the costs of being involved in the London bombings (Objective 2)

In addressing Objective 2 the focus is on identification, measurement, and exploration of all costs associated with exposure to the LB. I have divided this work into two chapters. Chapter 4 looks at theory and practice in cost calculation and offers descriptive findings. Chapter 5 examines the relationship between costs and their potential determinants, and factors associated with the diagnosis of PTSD. Although the societal perspective has the advantage as it covers all the costs, it was not possible to adopt this, as I did not capture all

costs such as costs to the families. Instead I took a perspective of the health and social care system by analysing all the costs associated with setting-up and running of the ST programme. In addition, I attempted to measure all the costs associated with private and voluntary sector services. The extent to which I was successful in measuring those costs depends on the methods used. Due to the nature of the study I relied heavily on recollections of service use even after a considerable time had since elapsed, which could result in under- or over-estimation of costs. Nor did I use any independent source of data such as hospital or GP records to rectify the individual accounts as there was no scope for this in the study.

3.5.1 Methods for costing LB associated service use

Identifying and allocating robust and reliable costs is often not a straightforward task. In order to describe the costs associated with exposure to the LB I have used two data sources: one on costs associated with the set-up and running of the ST programme, and a separate dataset on all services used by individuals due to their exposure to the LB, collected during the evaluation of the ST programme.

Data on costs associated with the set-up and running of the ST programme were collected during the programme by a programme manager based at the London Development Centre (LDC). At the end of the first year of the programme, the collection of the programme cost data was passed on to the evaluation team direct.

Screening costs included staff costs, general non-pay costs (8% of staffing costs), clinical/management support costs (12%) and premises overheads (20%). Treatment costs consisted of staff costs, general non-pay costs (8% of staffing costs), treatment-specific non-pay costs, clinical/management support costs (12%), and premises overheads (20%). Other included costs were patient travel reimbursement. Start-up costs consisted of hardware purchase, advertising, furniture and fittings.

All treatment costs were collected using the top-down approach by dividing total cost by the total number of provided sessions (including did-not-attend sessions).

Data on the ST programme outcomes, including information collected during screening and assessment were collected by the ST programme administrator.

Treatment outcome data, including records on treatment type, start and end dates, treatment outcome type and number of therapy sessions in the form of direct and indirect half-hour units, were collected by the therapists on a monthly basis. Data was stored in the form of an Excel document and passed on to the evaluation team who pooled all the data and stored it in the SPSS database.

The next step was to list all the services used alongside their appropriate units of measurement and to allocate costs. I used two published sources of costs – Personal Social Services Research Unit's (PSSRU) Unit Costs of Health and Social Care and NHS Reference Costs - as they presented unit costs based on UK national figures and “are taken as a good approximation of long-run marginal opportunity costs” (Knapp et al., 2008). For costs not presented in those two publications I used data from sources such as annual reports, published studies and in a few cases, market prices. For the purpose of the analysis I re-categorised services into the following groups: medication, hospitalisation, statutory sector services, private sector services and voluntary sector services. In addition, I listed all occupation and earnings-associated costs in a separate category.

The costing method and prices per unit for each service category are outlined below. All the costs collected by the CSRI were measured from an individual perspective and allocated to services in a bottom-up approach. All costs are standardised to 2007/2008 prices and presented in pounds sterling at 2007/08 prices.

3.5.2 Methods for exploring cost and outcome variations

Understanding factors behind differences in costs is important for service planners, funders and implementers. Differences in costs can sometimes be attributed to systematic factors such as participant characteristics and needs, type of service provision, as well as non-systematic factors otherwise known as random or stochastic factors (Knapp et al., 1995, p. 12). The cause of the latter is usually random fluctuations in data recording, participants' responses or measurement errors.

a. Cost function

A useful tool in exploring cost variation is the cost function. This technique allows us to explore cost fluctuations and describe relationships between costs, as dependent variable, and one or more explanatory variables such as service outcomes, while controlling for participants' and service characteristics. This statistical technique is useful in the context of a naturalistic observational study such as this one, where randomisation is not practically or ethically possible, as it "allow[s] multiple marginal effects to be examined in order to remove influences of stochastic factors" (Knapp, 1995, p. 14). However, this is only possible for the variations for which there are data, otherwise those influences will be included in the stochastic or unexplained variation (Knapp, 1998).

The approach gives insight into cost drivers, and in addition it enables us to hold other factors constant and thus compare different dependent variables under the same circumstances. This task is often complicated by the fact that service use costs are usually not normally distributed, usually because a large number of participants have zero cost and/or a small number of individuals have very high costs (Knapp et al., 2002; Manning & Mullahy, 2001). Consequently, this results in a long-tailed and skewed cost distribution (either positively or negatively) and affects data analysis and interpretation as it asks for a departure from standard methods, and perhaps the use of non-parametric methods.

b. Approaches in analysing data which is not normally distributed

The literature points to several approaches to data analysis under these conditions (Kilian et al., 2002). The first is to use bootstrapping methods that ‘augment’ the study sample by drawing a large number of small samples from the original sample with replacement and providing estimates of the true distribution. The ordinary least square (OLS) method can then be applied (Byford et al., 2001). Bootstrapping is useful for checking the robustness of the confidence intervals and p-values (Byford et al., 2001) and for providing “robust inferences not dependent on the distribution assumptions” (Dunn et al., 2003, p. 400; Barber & Thompson, 2000, p. 3232) providing the sample is large enough. OLS has an advantage as it analyses data in its original units of measurement and provides information on the percentage of variance explained by included predictors (Kilian et al., 2002). However, OLS is not the best model to fit data that is not distributed normally or in case of heteroscedasticity of the residuals (non-constant variance between observed and modelled costs) (Dunn et al., 2003, Kilian et al., 2002).

The second option suggested by Kilian (2002) is to transform costs using logarithms (Knapp et al., 2002; Knapp et al., 1998) or by taking the square root. Both methods reduce skewing in the data and stabilise the variance so that “the variability of the observed costs will not increase with their mean” (Dunn et al., 2003, p. 400) and use OLS regression approaches. The difficulty with this approach lies in interpretation of the transformed costs as the regression coefficients are expressed in the unit of transformation rather than costs, and require retransformation to the original scale. Another potential issue with this approach is with participants with zero costs, where the recommended remedy is to add a small constant before transforming the data (Dunn et al., 2003). Retransformation of the costs back to their original measured value within OLS introduces a bias and consequently the predicted transformed costs will be underestimated unless a bias-reduction method such as ‘smearing’ is applied (Dunn et al., 2003; Duan, 1983).

The third recommended option is to use a generalised linear model (GLM). GLM builds on the linear regression model used by OLS, but allows for non-normal error distributions and for other than identity links between

random and stochastic model components (Jackman, 2004). GLM uses the same regression function form as OLS:

$$Y_i = \alpha + \sum \beta_i x_i$$

called “linear predictor” (Dunn et al, 2003, p. 401) which includes a stochastic and systematic component and a link between them (Jackman, 2004). To recapitulate briefly, the linear regression model assumes a normal distribution of dependent variable with a constant variance, and a linear combination of covariates and coefficients (Jackman, 2004). However, unlike OLS which uses ‘raw’ observed data, GLM uses a link function to connect the dependent variable with covariates (Clark & Thayer, 2004). The ability to fit data to a broad family of distributions of the error term ranging from normal to gamma and exponential distribution, and use of various link functions depending on the distribution family (Clark & Thayer, 2004) make this approach attractive in the context of analysing service use costs. GLM assumes that the relationship between cost and predictor is multiplicative and the final prediction outcomes do not need retransformation (Dunn et al., 2003) and uses a maximum likelihood method to fit the data instead of ordinary least squares (Dunn et al., 2003).

The key to achieving robust results with this approach lies in the choice of the appropriate family of distributions that fit the data well, and to decide which link function to apply (Manning & Mullahy, 2001). The Park Test is a useful tool in making those decisions as the test estimates λ , the true variance function (Manning & Mullahy, 2001), and suggests whether the chosen family of distribution fits the data well. For example, for $\lambda=0$ variance function is Gaussian, $\lambda=1$ variance function is Poisson, $\lambda=2$ function is Gamma, and $\lambda=3$ function is inverse Gaussian (Manning & Mullahy, 2001). These authors advise caution in model application as GLM can produce biased estimates and loss of model precision when using an inappropriate error distribution or link function or if the “error term is heavy tailed on the log scale” (Manning & Mullahy, 2001, p. 263).

As cost data often follow a gamma distribution, the use of GLM using log link and gamma distribution is recommended in exploring variations in costs (Dunn et al., 2003).

3.6 Methods to conduct economic evaluation of the ST programme (Objective 3)

3.6.1 Types of economic evaluation

Costs and outcomes of an intervention represent valuable information. However, when presented on their own, they provide only a limited perspective to service providers, commissioners and funders in their task to “identify the most efficient way in achieving policy objectives” (Sefton et al., 2003, p. 43). Economic evaluation offers a set of useful tools and techniques and enables one to answer an array of questions by exploring the relationship between the costs and outcomes (outputs) of an intervention within a context of comparison with alternative intervention(s) (Byford et al., 2003). Drummond et al. (2005) define economic evaluation as “comparative analysis of alternative courses of action in terms of both their costs and consequences”(p. 65).

Economic evaluation in mental health is a relatively young field which took off in terms of its application only in the late 1980s (Knapp, 1999; Blumenschein & Johannesson, 1996). As a consequence, many different approaches have been reported under the umbrella of economic evaluation, which is evident from the analysis of earlier publications in the field. However, over time, economic evaluation has become more widely accepted and applied, and as a result its boundaries have become clearer.

Drummond et al (2005) distinguish three types of full economic evaluation: cost-effectiveness (CEA), cost-benefit (CBA) and cost-utility (CUA) analysis. Although the literature on economic evaluation includes cost minimisation (CMA) in this category, Briggs and O’Brien (2001) argue that CMA “cannot be considered as a unique study design due to uncertainty around cost and outcome estimates”(p. 182). The factor that differentiates between the different types of economic evaluation is the type of the outcome data they are comparing. The nature of the outcome data, alongside its target audience

(health care users, providers or funders) determines the type of questions economic evaluation is trying to answer and consequently its comprehensiveness. CEA can be “performed on any alternatives that have a common effect” (Drummond et al, 2005, p. 54). CEA compares costs of two or more interventions with their effects, traditionally by calculating an incremental cost-effectiveness ratio (ICER) that divides the difference in costs of two interventions by the difference in their effects: $ICER = \frac{\text{Cost treatment group} - \text{Cost control group}}{\text{Effect treatment group} - \text{Effect control group}}$ (Petrou & Gray, 2011).

The net benefit approach supplements information provided by the ICER and puts the comparison of cost and effectiveness within the context of willingness to pay for a unit of improvement (Hoch et al., 2006). The net-benefit regression framework introduces cost-effectiveness acceptability curves (CEAC), which combine information on the probability of an intervention being cost-effective for a defined unit of outcome improvement (Knapp, 2007; Fenwick et al, 2006; Hoch, 2002) and address the uncertainty around estimation of both costs and outcomes (Hoch et al., 2006). A CEAC offers a comprehensive yet visually clear presentation of uncertainty around cost-effectiveness estimates. Furthermore, it provides valuable information, particularly for decision-makers, on the probability that an intervention is cost-effective in comparison to the alternative (Fenwick et al., 2006).

Alongside CEA, cost-consequences analysis has been developed to address and capture *multiple* outcomes and their costs, and this feature makes it particularly suitable for evaluation of complex interventions (Byford et al., 2003). However, one of the limitations of this cost-consequences approach lies in its inability to compare interventions by their cost-effectiveness and the final decision is left to policy/decision-makers to select from the presentation of all available scenarios. Nevertheless, as Byford et al. (2003) suggest, such an approach is well suited for applied policymaking.

Cost-utility analysis (CUA) introduces concepts of utility and personal preferences to economic evaluation (Drummond et al., 2005). Some of the

authors in the field argue that this is a sub-type of CEA (Hoch & Smith, 2006). In CUA, costs of alternative interventions are compared to the measures of the value of a programme's effects expressed often as quality-adjusted life-year gains (QALY) or disability-adjusted life-year gains (DALY). For example, a QALY measure combines information on the length of time in that state with the perceived utility value for that health state expressed between values 0 and 1, where 0 signifies death and 1 full health (Drummond et al., 2005; Phillips, 2005). In contrast to CEA, which uses programme-specific (or disease-specific) outcomes, CUA involves generic measures of outcomes (Drummond et al., 2005) such as EQ-5D (EuroQoL Group, 1990), SF-12 (Ware et al., 1996), Health-Utilities Index (Furlong et al., 2001), and enables cross-disciplinary (cross-disease) comparisons of interventions with different health benefits (McCabe, 2009).

CUA provides a broader perspective and is therefore well suited for policy and decision-makers as it "facilitates transparency of resource allocation process" (McCabe, 2009, p. 2). Decision-making based on CUA relies on the value or specific preference individuals or society place on the different health states (McCabe, 2009), individuals' characteristics and experiences such as health condition type (chronic or acute), length of symptoms, age, and sensitivity of instrument used to measure utilities behind health states in question (McCabe, 2009; Brazier et al., 2007; McCabe et al., 2008). This illustrates that although CUA is indeed a useful tool, it has its limitations which need to be addressed and accounted for when interpreting the evaluation findings and translating them into policy recommendations.

Cost-benefit analysis (CBA) measures both outcomes and costs of intervention in monetary units (Michan et al., 2007). It is built on the principles of welfare economics (Drummond et al., 2005) and addresses the question as to "whether a certain intervention is worth doing while taking into account social opportunity costs of all resources consumed" (Drummond et al., 2005, p. 24).

Knapp (2007) concludes that “in general, the broader the research question, the more demanding are the data needs, and consequently CBA is tougher than CUA which is harder to conduct than CEA” (p. 485).

Another factor that determines the type of analysis - in addition to the type of outcome and cost data collected - is the evaluation perspective (Byford & Raftery, 1998). Economic evaluation can address different perspectives in their design, data collection and analysis from service users, providers, and funders to the most comprehensive societal perspective (MRC, 2010). A societal perspective encompasses the essence of welfare economics (Byford et al., 2003) and addresses the notion of opportunity cost, cost viewed as ‘opportunity forgone’ (Knapp, 2007), as a core principle behind resource allocation in the context of scarcity (Gold et al., 1996).

3.6.2 The role of experimental and non-experimental design in economic evaluation

Randomised controlled trials (RCT) are considered the methodological gold standard and are often used as “a vehicle for economic evaluation” (Petrou & Gray, 2011a, p.1760). Although the preferred design for economic evaluation (Byford et al., 2003) RCTs are not always possible due to ethical, practical or methodological concerns. In the case of the ST programme, although it could be argued that an RCT study design would have been stronger methodologically, it was not considered ethically acceptable from clinical, policy-making and political perspectives and was therefore abandoned for the observational study design.

Depending on the research question and the context of the study, RCTs are not always necessarily a good methodological choice. Non-experimental designs such as observational studies and decision modelling present alternative approaches often used for economic evaluation. Although a non-experimental study design cannot control for unobserved systematic variable factors by random allocation of participants in treatment and control groups, and by blinding researchers and clinicians about treatment allocation, it provides an opportunity to evaluate real-life situations that are not observable

in an RCT context. In the example of mental health response after the LB, this approach was the only available ‘vehicle’ for economic evaluation.

Non-experimental design is particularly useful in evaluating natural experiments, which allow researchers to investigate and evaluate events, policies or interventions that could not be evaluated within the remit of other methodological designs for ethical, practical or methodological reasons. Natural experimental studies “explore, evaluate and aim to make causal inferences about impacts of events, interventions or policies which are not undertaken for the purpose or/and under control of research” (MRC, 2010, p. 5).

A useful ‘externality’ from evaluations based on the non-experimental studies lies in the development and application of diverse and creative methodological approaches to evaluate effects and outcomes. This approach aids in avoiding “evaluative bias” due to evaluating only specific types of interventions such as RCTs (MRC, 2010).

However, non-experimental designs inherently suffer from problems with validity, namely validity of non-randomised evidence and potential selection bias (Deeks et al., 2003). Moreover, as a consequence of the non-randomisation, they often result in overestimation (Deeks et al., 2003; Sefton et al., 2010) or underestimation of treatment effects and increased variability of the results (Deeks, 2003). Observational study designs offer an opportunity to evaluate an intervention under ‘real life’ circumstances, and this is reflected in high ecological validity. However, at the same time there are often challenges with non-randomization, lack of statistical power and sample size calculations.

Use of a non-experimental design calls for the use of appropriate statistical methods in order to deliver unbiased results and to control for all confounding factors and selection bias (Kreif et al., 2012). It is important to understand and examine the potential sources of variation in exposure (Meyer, 1995) and control for potential confounders (MRC, 2010). The literature offers different statistical approaches such as multivariate regression and propensity score matching (Rubin, 1997) in addressing confounding factors and achieving robust estimates.

Regression analysis is useful in testing whether difference in the outcomes is caused by difference in the exposure rather than confounding factors. However, it relies on the assumption that all the relevant factors have been captured and measured with valid instruments (MRC, 2010). Sensitivity analysis is recommended to explore the uncertainty in the estimations (Briggs & Gray, 2009).

3.6.3 Best practice in economic evaluation

Literature recommendations on best practice and elements of economic evaluation have resulted in a number of published guidelines. MRC (2010) highlights the importance of published guidelines on recommended practices for the conduct of observational studies in ensuring uniformity when reporting evaluation results and enabling quick and easy assessment of the quality of the conducted study. Guidelines differ in their comprehensiveness and approach; however, in general they all agree on the following:

- A need for integrating economic evaluation from the design stage of the study (Husereau et al., 2013; Drummond et al., 2005);
- Importance of transparent reporting (MRC, 2010) – a description of the rationale behind the choice of the design and methods, transparency about possible sources of the bias and how the authors have addressed this, comparison of the results with results of similar interventions taking into account study context;
- Clear definition of target population, explicit sampling criteria, and valid and reliable measures of exposure and outcomes (MRC, 2010);
- Use of sensitive and robust instruments for collecting costs and outcome data;
- Exploring the heterogeneity of the sample/trial population (Petrou & Gray, 2011):
- Employing both qualitative and quantitative methods in establishing why and how programmes work (Byford et al., 2003);

The consolidated health economic evaluation reporting standards (CHEERS) guidelines (2013) provide a thorough checklist that covers all important

questions and elements of the economic evaluation for each stage of the analysis. I have included the whole list in Figure 3.5.

Figure 3.5 CHEERS checklist – items to include when reporting economic evaluations of health interventions

Item No	Section/item	Recommendation
Title and abstract		
1	Title	
2	Abstract	
Introduction		
3	Background and objectives	
Methods		
4	Target population and subgroups	
5	Setting and location	
6	Study perspective	
7	Comparators	
8	Time horizon	
9	Discount rate	
10	Choice of health outcomes	
11a	Measurement of effectiveness	
11b	Synthesis-based estimates:	
12	Measurement and valuation of preference based outcomes	
13	Estimating resources and costs	
	13a Single study-based economic evaluation	
	13b Model-based economic evaluation:	
14	Currency, price date, and conversion	
15	Choice of model	
16	Assumptions	
17	Analytical methods	
Results		
18	Study parameters	

19 Incremental costs and outcomes

20a Characterising uncertainty

20b Model-based economic evaluation:

21 Characterising heterogeneity

Discussion

22 Study findings, limitations, generalisability, and current knowledge

Other

23 Source of funding

24 Conflicts of interest

For consistency, the CHEERS statement checklist format is based on the format of the CONSORT statement checklist.

I would like to finish this section by noting that there is no flawless economic evaluation (Drummond et al., 2005). Each study has methodological challenges of some kind and the main point is to reflect those issues in the analysis and presentation of the findings with the aim to “lead to a better decision making (rather than) embody some ultimate truth” (Drummond et al., 2005, p. 13). This should not be used as an excuse for poorly planned and executed evaluations; it is solely a reminder that evaluation results should be interpreted with caution and within the remit of the study design.

3.6.4 How to evaluate the ST programme?

After a brief overview and discussion of literature recommendations on economic evaluation, this section will address its application in the case of mental health response to the LB.

One of the aims of the evaluation study was to conduct an economic evaluation of the ST programme. In the process I encountered several challenges. The evaluation was retrospective in its nature, as it was only introduced in the second year of the ST programme in July 2006 and ran until February 2009. The evaluation was delivered in a form of an observational study that followed up 153 programme users and contacted another 77 individuals who did not use the ST programme, regarding services they have used due to exposure to LB and impacts on their social life and health.

Therefore, due to the timing of the evaluation and its retrospective nature, data on health, economic and social impacts of the LB were collected only on one occasion, between 17 and 38 months after the LB, and therefore relied solely on individuals' recollections. Another big challenge for the economic evaluation was the absence of a comparison group. Lastly, due to the nature of the intervention, each participant had a different time point for entry into the ST programme and evaluation study.

Evaluation of the ST programme provides a good illustration of how often in the real world context implementation of the recommendations on the set-up and delivery of economic evaluations is either not possible or practical. For example, even though it is recommended that the evaluation is embedded at the formative stage of the programme, this is often not possible for practical reasons. In the case of the LB, the ST programme stakeholder group (around 20 professionals representing various aspects and sides of the emergency and mental health response, from police, Transport for London, DH to clinicians and trauma specialists) had a priority to devise an acceptable plan from clinical, practical and financial perspectives, and evaluation was not a priority. This affected the collection of some of the outcome and service use measures, which could only be collected retrospectively at this point, and limited the scope of the evaluation considerably. However, these factors could be seen as challenges rather than limitations as they bring interesting and valuable insights into complex interventions, and help to answer questions on whether they are worth doing and in which way.

The key question of the ST evaluation is whether the effect of the intervention can be evaluated with available data. Average treatment effect compares average treatment outcomes of the treated and comparator groups. However, the crucial task is to control for the heterogeneity in the sample, particularly for those factors that influence participant selection into treatment versus control groups. In the observational study paradigm some of those factors will be observable (and measured by the study). However, some of the factors are likely to be unobserved either due to the study design or the quality of the collected data.

Comparison group choice was a central issue for the economic evaluation of the ST programme. In an ideal methodological world I would have a carefully-chosen comparison group, which would match the treatment group on all relevant characteristics apart from exposure to the intervention in question. Allocation to the groups would be random, and both participants and evaluators would be kept blind to allocation to groups. However, such a scenario in the case of the ST programme has two problems – the first one is that it cannot be practically implemented for the reasons discussed earlier, and the second lies in the low ecological validity of such methodological design which questions the appropriateness of its use in the context of the mental health response to the LB. In such cases of absence of a comparison group as defined by experimental study design, Sefton et al (2001) suggest using the term ‘comparator group’ to distinguish between the two. I will employ that suggested terminology in this chapter from now on.

At an earlier stage of my research (at the time of my Major Review in 2007), I identified several comparator groups and suggested back-up alternatives should I need to deviate from my initial plan. This has proven to be a good strategy, as I soon had to abandon my initial and most comprehensive choice due to the absence of funding to support a study looking into the referral pathway, service use, costs and treatment timing for individuals seeking treatment for PTSD. The first comparator group choice included individuals on the waiting list for the NHS evidence-based treatment in the form of trauma-focused CBT or EMDR for PTSD at London’s Traumatic Stress Clinic (TSC).

On the basis that there are no differences between the late and early treated participants other than the treatment timing, participants who received treatment later than 8 months after the exposure to the LB would make an alternative comparison group. The assumption behind the choice of this particular timing cut-off is that individuals waited on average 8 months before receiving treatment under the standard NHS practices (in 2010) for treatment for PTSD. This waiting time was confirmed in one of the interviews I conducted (with interviewee CL2), as described later in my qualitative study. However, the 8 month cut-off when applied to the evaluation sub-sample resulted in

unbalanced sizes of the early and later treatment sub-groups. In contrast, the cut-off point of 300 days before and after the LB ensured a more balanced sample size and, in my opinion, 10 months' cut-off time within the context of the two-year programme should not affect the analysis significantly. However, results of the analysis need to be interpreted with caution as the cut-off timing decision was taken prior to the data analysis.

Another potential and available option was to explore differences between the ST programme users and individuals who did not use the ST. Although this option is not a good comparator group, it enables a closer look at reasons behind the programme use, alongside needs and costs. A third option is to investigate differences between individuals who were screened and assessed only and those who proceeded from the screen/assessment phase to the treatment. Again, this option provides for an interesting cost-outcome analysis and offers an insight into how effective the ST programme was in identifying individuals with treatment needs. Furthermore, it provides follow-up information on the mental health needs of individuals who were categorised by the ST programme as not needing treatment in comparison to those who were referred for treatment. The list of comparator groups used in the study is presented in Table 3.7.

Table 3.7 Evaluation comparator groups

a. Early treatment vs. Later treatment
b. ST users vs. ST non-users
c. ST treated users vs. ST screened and assessed only users

3.6.5 CEA protocol

In order to minimise and adjust for observable biases potentially introduced by the observational study design – such as non-random selection of participants and measurement error – and to enhance robustness of the analysis, I used a regression framework to predict both costs and effects while controlling for common measured factors. However, due to the study design there is significant uncertainty around unobservable and non-measured

effects that can influence the results of the analysis and potentially lead to omitted variable bias and unobserved regression coefficients. While a randomised design is likely to achieve “orthogonality of measured covariates and unobservables” (Jones, 2007, p. 5), in observational study designs one strategy to address unobservables in the context of the large samples with well observed characteristics could be to “assume a non-systematic influence on the treatment effect” (Jones, 2007, p. 5). Another approach could be to use factors that predict treatment but have no effect on outcomes to mimic random assignment to treatment (Jones, 2007, p. 7). My strategy was to use multivariate regression to adjust both costs and outcomes for the same group of covariates based on theoretical and statistical criteria.

As discussed in Section 3.5.2, for all cost models I used GLM, as the literature highlighted its advantage in predicting average values of non-normally distributed values in comparison to transformed OLS models (Glick et al., 2007).

I will start the analysis with descriptive analyses of participants’ sociodemographic characteristics, exposure and clinical characteristics. For costs and outcome categories for each participant group I will present unadjusted mean values before presenting models and adjusted estimates. Differences between participants’ characteristics, unadjusted costs and outcomes are tested using Pearson’s chi-squared test, parametric (t-test for independent samples), and non-parametric test for independent samples (Mann-Whitney).

For descriptive analysis purposes, I will present the following cost categories:

- a. costs associated with the *ST programme*
- b. *direct cost*, which aggregates statutory-provided health care services, hospitalisation, medication, voluntary and private sector provided services, and
- c. *total costs*, which aggregates the *ST programme*, direct costs and work-related costs due to sick leave, unemployment and reduced work hours.

The next step will be to present the model evaluation. First, I will explore potential interaction terms based on factors that have been identified by my Literature Review to affect either costs or outcomes, such as being diagnosed with PTSD, the number of previous traumatic events, female gender and premorbid conditions.

In the second step I will assess the model fit. For the GLM model I will use the Park test to check the appropriateness of the family distribution, and re-run the model with alternative families to check for a suitable fit. Next I will run a link test to assess the linearity of the response. This step will be followed by a check of the distribution of the residuals in order to observe any pattern in their distribution as a sign of heteroscedasticity, which occurs when variance of the error term is not constant (William, 2012). This can be due to measurement errors, model misspecification, or sub-population differences within the sample (William, 2012).

After identifying the best model fit I will proceed with estimating the final model. I will calculate average mean predicted costs and effects for both treatment and comparator groups, and subtract them to obtain the differences in group means. Both costs and effects (outcome) models will follow the same protocol detailed below.

Both cost and outcome analyses have been conducted using SPSS 12 and STATA 11 statistical packages.

3.6.6 Uncertainty analysis

The next step in CEA is to present, describe and explore uncertainties around cost-effectiveness analysis. The difference in mean predicted costs (incremental predicted costs) divided by the difference in mean predicted effects (incremental predicted effects) is known as the incremental cost effectiveness ratio (ICER) and describes the additional cost of achieving an incremental improvement in outcome from (say) early treatment compared to later treatment. However by calculating ICER in this manner, one does not have any information on uncertainty around the cost-effectiveness estimate.

There are a number of methods to estimate confidence intervals around mean ICER values such as confidence box, confidence ellipses and use of Fieller's theorem, and non-parametric bootstrapping, each with its own merits and limitations (Gray et al., 2010). Among available methods, non-parametric bootstrapping is the most frequently used approach. Non-parametric bootstrapping starts with a sample from the population of interest and re-draws a number of sub-samples from it with replacements in order to estimate the distribution around the statistic of interest (Gray et al., 2010). This logic is applied in the case of the ICER in order to calculate a confidence interval around the mean ICER.

However, in the case of small samples and skewed variables of interest, bootstrapping is not an ideal way to estimate population means (O'Hagan & Stevens, 2003). Gray et al (2010) suggest that increasing the number of bootstrapped replication "only improves estimate of the sampling distribution, however it does not make point estimate more precise"(p. 23). Another problem is associated with interpretation of negative ICERs, which will be identical for both more costly/less effective or more effective/less costly alternative interventions. Furthermore, the ICER does not address the question of willingness to pay for a unit of improvement and hence provides limited information.

As discussed previously, cost effectiveness acceptability curves are a widely-used supplement to the ICER (Fenwick & Byford, 2005; Wilian et al., 2003; Fenwick et al., 2001; Fenwick et al., 2004) as they present uncertainty around cost-effectiveness means without all the statistical challenges of calculating a confidence interval (CI) around the ICER (Briggs & Fenn, 1998). The literature on CEACs discusses several methods of CEAC construction. The first method uses a joint distribution of bootstrapped incremental costs and incremental effects by plotting the proportion of cost-effective pairs for the value society or that the policy funder is willing to pay per unit of improvement (Fenwick & Byford, 2005). A second option discussed by Nixon et al (2005a) applies non-parametric methods for establishing cost-effectiveness by use of the central limit theorem (CLT). As those authors argue, the CLT can be

successfully used with skewed distributions in prediction of a robust estimate of the population mean, however only in the case of large enough samples. Results from a later study by these same authors showed that with moderate to large data samples (>50), even with highly skewed data both non-parametric bootstrapping and CLT performed equally well and accurately estimated standard errors (Nixon et al., 2010).

After considering my options for the analysis I decided to present a table of ICERs calculated from predicted cost and outcomes without bootstrapping. This will serve as an illustration of predicted differences in costs and outcomes between the groups, and all possible difficulties in interpreting ICERs. I decided to use the approach advocated by Nixon et al (2010) based on the CLT method¹. CLT starts with the premise that “whatever shape of the population distributions of the costs and effects, the distributions of the sample means will converge to normal population as sample size increases”(Nixon et al, 2010, p. 317). CLT assumes independence of the two comparison groups and calculates the covariance between the estimates of the population mean cost and effect difference based on the sum of the covariance between the cost and effects data in each arm divided by the respective sample sizes (Nixon et al., 2010). Nixon et al (2010) use incremental net monetary benefit (INB) of one treatment compared to another to represent the results of CEA.

INB is defined as:

$$INB(K) = K\mu_{\delta e} - \mu_{\delta c}$$

Where K represents the decision-maker’s willingness to pay for one unit gain in health outcome, while $\mu_{\delta e}$ and $\mu_{\delta c}$ represent mean parameters and are estimated by sample cost and effect means. New treatment is cost-effective if and only if $INB(K) > 0$. As the value of K is unknown the plot is estimated for various values of K (Nixon et al., 2005a, p.1220).

In order to obtain CEACs I have entered predicted costs and effects into the CLT EXCELL model provided by Nixon et al. (2005b).

¹ CLT model in EXCEL spreadsheet can be downloaded from <http://www.mrc-bsu.cam.ac.uk/Software/download.html>

When using the CLT to estimate CEACs, Nixon et al (2005a) suggest adjusting for baseline covariates in the case of non-randomised studies. Furthermore, they discuss several methods from the recent literature: from net-benefit approach applied to linear regression models to estimate individual-net benefit (Hoch et al., 2002), or by seemingly unrelated regression equations (Willam et al., 2004) to the method presented by Nixon and Thompson (2005) that considers the joint distribution of costs and effects in the context of different distributions.

As described earlier, in this particular study I have adjusted all costs and effects models for the following covariates: age; gender; ethnicity, if person was injured (Q1); if person thought they will be injured or killed (Q2); if person saw someone who was injured or killed (Q3); psychiatric comorbid conditions; treatment type; follow-up timing (days since the LB) and total number of treatment sessions. The choice of covariates was guided by theoretical underpinning on the effects of the socio-economic variables, exposure details, pre-existing psychiatric comorbidity, effect of the treatment type, timing and length on both outcomes and costs, and finally on the available data.

3.7 Methods to conduct qualitative study on implications and feasibility of screening for PTSD within primary care (Objective 4)

In order to examine the benefits and practicalities of introducing screening for PTSD in general practice, a collaborative study between UCL and LSE, in partnership with a London-based GP practice and the Traumatic Stress Clinic in London, was proposed in 2008. This study was intended to build on the findings of evaluation of the ST programme.

The study aimed to explore screening for PTSD in two ways. First, it was the intention to interview people with PTSD who had succeeded in accessing treatment, in order to learn how they were referred, what obstacles they faced, and how long the process took. Second, it was intended to test the process of identifying people with PTSD by carrying out screening in three general

practices using validated screening instruments. This could have served as a pilot for a wider screening programme.

Regrettably, after two unsuccessful grant applications, the original research plan was modified into a small qualitative study of experts working in the field to fit the PhD timescale and format. A short qualitative study was designed to explore the benefits and barriers of implementing screening for PTSD policy within primary care. The study sample was purposive and participants were identified through the relevance of their expertise and work in the following areas: clinical psychology, general practice, and mental health policy development, planning, implementation and funding. Participants were contacted in writing and invited to take part in short (30-40 minute) semi-structured, face-to-face or telephone interviews depending on their preference.

In consultation with my supervisors, I designed a questionnaire that included a core set of questions for all participants, and a set of specific questions for the following participant groups: a) clinicians, b) academics, c) general practitioners, and d) policy developers. The choice of questions was guided by the findings and recommendations from the review of the literature on prospects of screening for PTSD.

The questions, set out in Appendix C, explored the perspectives of each stakeholder with the aim of providing a comprehensive view of the benefits and practicalities of introducing such policy. The core set of questions included six questions on participants' background information, two questions on participants' views of feasibility and the appropriate setting for screening for PTSD, logistical and organisational challenges in implementing screening policy and the ways to overcome them, and finally an open-ended question on important aspects of this topic that I did not address in the interview.

Questions for GPs explored the challenges of and ways to adapt screening for PTSD in a general practice setting, and suggestions for improving detection and pathways into treatment. Questions for clinicians involved issues around average waiting times for PTSD treatment, information on common pathways into treatment, and help-seeking behaviour. Additional questions for

clinicians discussed the proposal to include a PTSD screener into protocols already applied in general practice such as screening for depression, the appropriateness of screening the general population for PTSD, and the characteristics of a PTSD screening instrument suitable for use in general practice. Policy developers were asked about the role of evidence in service planning and development, and about the process of introducing a PTSD screening policy.

In total, 14 interviews were carried out with a purposive sample of stakeholders, viewed as representative of the experts involved in the policy-making process. Purposive sampling was used to maximise the likelihood of obtaining a complete range of views of all important stakeholders in the process of introducing the screening for PTSD policy. Participants were identified through the relevance of their expertise and work in the following areas: general practice, research in clinical psychology, and policy development, funding and implementation, or by employing a 'snowballing' technique by asking those already taking part in the study to nominate other potential participants. All the contacted participants agreed to be interviewed as a part of the study.

- research in clinical psychology particularly in the context of PTSD:

- Professor of clinical psychology (CL 1);
- Consultant clinical psychologist (CL 2);
- Professor of Psychology (CL 3);

- general practice:

- GP and Clinical Senior Lecturer (GP 1);
- GP and Senior Clinical Lecturer (GP 2);
- medical doctor (GP 3);
- GP and adviser to IAPT (GP 4);
- former GP and academic director for mood, anxiety and personality disorders at UK's academic health science centre (GP 5);
- GP and a partner at a London based practice (GP 6);

- GP and a collaborator on NICE guidelines for PTSD (GP 7);
 - GP (GP 8);
- *policy development, funding and implementation (PD):*
- Clinical psychologist and an IAPT collaborator (PD 1);
 - former GP (PD 2);
 - National Programme Director for a NHS mental health programme (PD 3);

Interviews lasted between 30 and 60 minutes and each interview was recorded with the participant's permission and transcribed for analysis. Questions employed in the interviews covered recommendations from the screening criteria presented by the UK National screening committee and literature on screening for depression and PTSD. Directed qualitative content analysis (Hsieh & Shannon, 2005) was undertaken on the recorded material. This is a form of thematic analysis, which starts with a couple of themes identified by a specific theory or previous research, in this case the Literature Review. This method enables systematic analysis of the data by identifying and coding emerging themes (Hsieh & Shannon, 2005). The main questions in the interview reflected the findings from the literature and presented the main themes in the coding process. The open-ended form of questions along the semi-structured format of the interview allowed new themes to emerge from the interviews and be added to the analysis (Fereday & Cochrane, 2006). Validity of the emerging themes was tested by triangulation with data identified in the Literature Review, and exploration of participants' underlying views on the emerging themes and discussion of the themes.

Table 8.1 Summary of the survey topics

-
- Screening as a valid method for detecting PTSD and as a pathway into treatment.
 - The most common pathway into treatment for people with PTSD.
-

-
- Implementing PTSD screening policy – best approach and setting.
 - Screening the general population vs. targeted screening of high-risk groups.
 - Suggestions about screening procedures.
 - Issues regarding referral to detailed assessment or treatment.
 - Logistical and organisational challenges in implementing PTSD screening policy and how to overcome them.
 - Views and suggestions on improvement of GP education on PTSD and pathway into treatment for people with PTSD.
-

3.8 Summary

This study used a mixed-method approach. The choice of design was determined by the complexity of the subject and the attempt to provide a comprehensive outlook on the effects of PTSD. A heterogeneous methodological approach that included quantitative analysis (cost of illness study and cost-effectiveness analysis) and a qualitative study, was best suited for this task.

The downside of such an approach is a potentially fragmented chapter structure. The structure of this chapter (and thesis) reflects the intention for each objective to add another layer of complexity to the analysis, and serve as a building block for the next level of analysis. I start by describing and measuring all the costs and effects of the London bombings on exposed individuals. My intention was to try and comprehensively identify and measure all the costs individuals experienced due to their exposure to the LB. However, apart from the ST programme costs, which were collected by an independent source, all the other cost estimates rely heavily on the ability of the individuals to recall the services they used, facilitated by a set of questions covering exposure, injuries, service use and effects on individual's productivity. Furthermore, although it was not possible for the evaluation study to rectify independently participants'

accounts of their service use associated with the LB solely (and control for example pre-existing conditions that could have been affected by exposure) the evaluation study made a great effort to highlight to the participants the need to only report service use due to their exposure to the LB. The next level of the analysis explores costs while controlling for exposure and sociodemographic characteristics of the participants. In the next step, I use cost and outcome data in the cost of illness and cost-effectiveness analysis of the ST programme. Finally, building on economic evaluation of the ST programme, guided by the findings from the literature on the role of screening in prevention of chronic PTSD, I conduct a brief qualitative study that explored feasibility of screening for PTSD in general practice.

The richness of the dataset allowed me to approach the subject from various angles including health, social and economic domains, as well as individual and societal perspectives. It allowed exploration of costs while controlling for exposure and sociodemographic characteristics of the participants. Furthermore, such a design allowed the comparison of participants from different segments of the programme in terms of their reported costs, mental health outcomes and type of services they used. This provides interesting material for service planners and funders as it offers a view into the programme running, costs and outcomes.

This study represents an example of 'real world research' and one that tries to turn methodological limitations imposed by observational study design into strengths. The main strength of this study lies in its high ecological validity. Secondly, in my view, the study has made an important contribution in evaluating mental health interventions in real world settings by innovatively approaching the challenges imposed by the observational study design. In order to achieve robust predictions, the study used a regression framework to control for the influences of various socio-demographic and exposure factors on costs and outcomes. Furthermore, the study used a set of well-known outcome and cost measures with high psychometric properties, which allow for comparison.

Chapter 4 Costing impacts of the London bombings

4.1 Introduction

The foundation of any robust economic evaluation is reliable and valid information on costs and outcomes. The aim of this chapter is to describe and measure the health, social and economic impact of the London bombings on the survivors and society as a whole. I will do so by rigorously applying costing principles and rules to the context of the naturalistic observational study and describing all the challenges associated with this particular study design. This costing study will serve both as an introduction and foundation for exploring cost variations in Chapter 5 and for the economic evaluation of the ST programme in Chapters 6 and 7.

The first important task in this chapter is to list all the services used, and match them with an adequate unit of measurement. The next step involves allocating the costs to each service unit by consulting published and unpublished sources in order to be able to combine the two and derive total costs. In this chapter I will therefore provide an overview of the data collection and costing methodology before describing the cost impact.

4.2 Costing health services

4.2.1 Theory and practice

Cost definition and consequently measurement depend on the purpose for which they are being used (Ellwood, 1996). Depending on the aim and objectives of the study, costs can be measured in terms of their present market value (the accountant's view), or in terms of their forgone opportunities (the economist's view; Mogyrosy & Smith, 2005). Furthermore, the perspective chosen for the study will determine the scope of the costing: service provider (such as the NHS), individual (costs to service users), government (all public spending) or societal perspective (the above, plus lost productivity, costs to families).

There are two distinctive characteristics of economic evaluation seen from the theoretical viewpoint: the adoption of opportunity costing and a societal perspective. Economic evaluation aims to provide evidence to allow the maximisation of effectiveness in the context of a scarcity of resources and growing demands for health care services (Drummond, 2005). Opportunity cost “reflects the resource implications of opportunities forgone rather than of amounts spent” (Beecham, 2000, p. 14). This definition underlines the ‘decision-making’ aspect of economic costing (Smith & Barnett, 2003; Mogyrosy & Smith, 2005), reflected in the view of cost in terms of value of resources in its “next best alternative use” (Drummond, 1996, p. 279).

The principle of welfare economics is to maximise welfare (i.e. the wellbeing) of the society as a whole (Drummond, 2005). Effectiveness and equity in resource allocation in the context of the scarce resources are the two main criteria that lie at the core of economic evaluation (Drummond, 2005). Ideally, cost measurement should be based on long-run marginal opportunity costs (Beecham, 1995). However this is hard to achieve in practice. Defining and measuring long-run marginal opportunity cost is both time- and resource-consuming, as one would need to measure all alternative uses and their utilities. If long-run marginal costs have been measured they tend to be study-specific, which limits their generalisability and use in other studies (Byford, 2003; Mygorosy, 2005). Therefore, the common approach in the economic costing field is to use short-term average costs containing all capital, revenue and overhead costs as a proxy to long-run marginal costs (Beecham, 2000).

Some ‘costing rules’ have been suggested for economic evaluation (Beecham, 1995; Knapp & Beecham, 2000; Drummond et al., 1997; Beecham, 2000; Knapp, 1998):

- a. costs should be comprehensively measured and include all elements of a service or treatment/care package
- b. cost variations should be addressed (and examined) as they can be a source of important policy and practice information
- c. only like-with-like comparisons should be made (e.g. making adjustment for differences in the characteristics of people

treated or supported when comparing two intervention strategies)

d. costs should be presented and interpreted alongside outcomes

These costing rules have foundation in economic theory applied to health and social care (Knapp, 1995; Drummond et al., 2005).

The first step in costing health care services is to define and describe all services provided over a specified time period. The next task is to define appropriate units of measurement for each service, such as cost per hour or per session depending on the nature of the service. The final step is to allocate a cost to each unit of service, ideally a long-run opportunity cost (but see above for the practical approach usually taken), and to calculate unit cost (Beecham, 1995). In this study, unit cost is defined as a cost per working hour of health and social care professionals, the cost per session of treatment, or cost per inpatient day.

There are two approaches in cost calculation: top-down and bottom-up, and each comes with its advantages and disadvantages. Bottom-up costing, known also as micro or activity-based costing (Mygorsy et al., 2005), is individually based. It identifies all services, allocates a cost to each service and sums it up. The advantage is a detailed overview of the services and costs that reflects inter-client variability and is readily comparable with clinical outcome measures also collected at the individual level (Beecham & Knapp, 2001). The top-down approach looks at all the costs associated with service provision and divides the total amount by a measure of the number of produced units (such as psychotherapy sessions or hospital bed-days). It is less time- and resource-consuming, but consequently gives less detailed insight into elements of service provision, resulting in a potentially over-simplistic view of service utilisation. Both approaches have valid contributions to make and can be combined in costing different service elements depending on the data, resources and time availability.

The next section translates costing theory into practice and describes how I have allocated costs to the services used by individuals affected by the London bombings. To begin with, I will briefly recapitulate the study context and data collection methods.

In order to describe all the costs associated with exposure to the London bombings I have used two data sources, one on costs associated with set-up and running the ST programme as a mental health response to the LB, and a separate dataset on all services used by individuals due to their exposure to the LB. Data on costs associated with the set-up and running of the ST programme were collected during the running of the programme, while data on service use were collected by administration of a modified version of CSRI (Chisholm et al., 2000; Knapp et al., 1990) during the evaluation of the ST project. A copy of the questionnaire is attached in Appendix B, and a detailed overview of the modifications is discussed in Chapter 3, Section 3.4.3.

All the service use data were collected retrospectively, on average 24.2 months after the LB. Service use and productivity costs were measured from an individual perspective and allocated in a bottom-up approach, while the ST programme costs were calculated using a top-down approach. The ST programme specific unit costs are presented below, alongside unit costs per services used due to exposure to the London bombings.

4.2.2 The screen and treat (ST) programme specific unit costs

The aim of the screen and treat programme was to contact and follow up as many survivors and affected individuals as possible, to provide them with information about posttraumatic responses and immediate sources of help, to screen them at regular intervals using validated instruments to identify those who still had symptoms of PTSD, and to deliver appropriate therapy to that subset of people. Chapter 3 provides detailed information on screening, assessment and treatment protocol and instruments.

The ST programme-associated costs were collected from the invoices sent to the programme's funders, containing data on the start-up costs (hardware purchase, advertising, furniture and fittings), staff costs (general

non-pay costs and clinical/management support costs), premises overheads and other costs such as patient travel reimbursement.

The costs of the set-up and running of the ST programme are based on screening, assessment and provision of therapy for all users of the ST programme based on the intention-to-treat sample.

Therapists in each clinic recorded type, number of therapy sessions and outcome in a form of direct and indirect half-hour units. Data was collected on a monthly basis and stored in an Excel spreadsheet. During the running of the ST programme, a database containing all information on screening, assessment and treatment outcomes was set up and passed on to the evaluation team at the end of the programme. Treatment costs were collected using the top-down approach by dividing total cost by the total number of provided sessions (including did-not-attend sessions).

Table 4.1 Total cost break down for the screen and treat programme

	2005/2006	2006/2007	2007/2008	Total
Start-up costs	32400	0	0	32400
Management	70498	0	0	70498
Screening and Assessment	116577	227177.38	101377.74	445132.12
Treatment				
Clinic 1	131810	267720.71	107095.11	506625.82
Clinic 2	38436	64485.07	15434.46	118355.53
Clinic 3	60204	83078.3	38623.54	181905.84
Treatment total	230450	415284.08	161153.11	806887.19
Total	449925	974667.24	262 530.86	1354917.31

Table 4.1 shows the costs for the 2-year screen and treat programme, identifying the start-up costs, administrative costs incurred for managing the project, the costs of the centralised screening team and the treatment costs. The total cost of screening is based solely on recorded costs from the screen and treat programme and does not include costs incurred or recorded by other organisations. I have standardised the cost figures across years for inflation. The total cost was just under £1.4 million, of which 7% went on administration,

33% on screening and assessment, and the remaining 60% on direct (therapist time) and indirect (management, supervision, overheads) treatment costs.

If we assume that start-up costs and half of the management costs should be allocated to the screen/assessment part of the programme, these activities absorbed £523,125.50 at 2007-08 prices. This assumption was made in the absence of the other information on cost allocation in the programme. Figure 3.1 shows that 596 people were screened, there were 363 detailed assessments, and that 304 (276 identified by the programme and 28 referred from other places) of them were considered to be in need of treatment. Unfortunately the data are not sufficiently detailed to allow us to estimate the costs of screening and assessment separately. Screening, for example, included collecting participants' details through negotiation with organisations involved in the London bombings response such as the Metropolitan Police or NHS, setting up the contacts database, contacting individuals, sending out screening questionnaires at several time-points (up to five screeners per person) and referral management. Assessment activities included contacting participants, a clinical interview that could last up to 1.5 hours and liaising with treatment centres.

However, I could estimate two unit costs from these data:

- The cost of finding, screening (up to five times) and assessing a person for PTSD following a traumatic event in 2007/08 prices is £877.70 (£523,125.50 / 596)
- The cost of identifying a person who requires treatment following a traumatic event in 2007/08 prices is £1895.40 (£523,125.50 / 276).

In order to cost individuals who were screened only and/or screened and assessed, I made an assumption, after discussion with my supervisors, that 50% of costs related to finding, screening and assessing individuals were allocated to assessment, and the other half to finding and screening the person. This translates to £438.85 per screened and £435.85 per assessed person only. It is important to point out that the cost of identifying a person who needed treatment included identifying, screening and managing their referral, which could be difficult if they lived elsewhere in UK.

Better data on time use are available for the treatment component of the screen and treat programme. Clinicians spent 68% of their time in direct contact with individuals in treatment, while 32% of their time was accounted for by indirect activities such as preparation, supervision, travelling to the sites and in vivo therapy that included gradual exposure to the feared stimuli. Thus, on average for each hour of therapist direct contact time, there was a further half-hour of indirect time. Both direct and indirect therapist time was recorded in half-hour units, and the duration of the treatment sessions varied from one to 12 half-hour units, depending on the stage and type of treatment offered. Although the range of direct-time half-hour units is very wide, on average there were 2.94 direct half-hour units per session per client.

As Table 4.2 shows, a total of 9658.5 half-hours of direct time and 4627 half-hours of indirect contact time were administered throughout the programme across all three clinics, which corresponds to 7143 hours of therapy. Clinic 1 treated more clients with a higher number of direct and indirect hours than the other two clinics, and there was some variation between the clinics in the balance of direct and indirect time. Table 4.2 also shows that in total, 3277 therapy sessions were provided through the screen and treat programme, an average 13 sessions per client, although this varied slightly between the clinics, as did the number of clients. Clients made decisions on the treatment location based on their personal preferences, perhaps location or transportation convenience. Treatment cost involved the costs of getting to and from treatment and parking facilities for individuals living outside London.

Table 4.2 Total number of therapy sessions, hours and direct and indirect half-hours

	Direct 1/2hrs	Indirect 1/2hrs	Total 1/2hrs	Total hours per programme	Sessions Used	N of patients	M sessions
All clinics	9658.5	4627	14285.5	7142.75	3277	248	13.2
CLINIC 1	6134	2649	8783	4391.5	2091	160	13.1
CLINIC 2	1516	978	2494	1247	456	38	12.0
CLINIC 3	2008.5	1000	3008.5	1504.3	730	50	14.6

These data on time use, client numbers and costs can again be combined to enable an estimation of unit costs. Using the assumption that half the management costs accrue to the treatment arm of the programme, and the total costs of treatment are £857,283.60 at 2007-08 prices, the following unit costs can be calculated:

- Costs per half-hour of direct or indirect time: £60.01
- Cost per hour: £120.02 (£857,283.60 / 7142.75)
- Cost per hour of treatment: £180.03 (an hour of direct time, plus 30 minutes indirect activities)
- Average cost per session: £261.60 (£857,283.6 / 3277)
- Average treatment cost per person: £3,453.20 (average cost per session x 13.2)

When analysing the costs of the screen and treat programme one must bear in mind the context and novelty of the approach, as well as the difficulties involved in setting up and running the programme. This was the first time a mass mental health response had been set up in this manner; there was no previous experience on which to build, yet the situation demanded an urgent response. Nor was this programme set up as a research activity; its main focus was to deliver a mental health intervention. Thus caution is advised in interpreting the costs outside of the context of this programme. In the first place, the services, and therefore the associated costs, are not representative or comparable to routine clinical services.

4.2.3 Costs of service use associated with exposure to the London bombings

As previously mentioned, I used a modified version of the CSRI questionnaire (Chisholm et al., 2000; Knapp et al., 1990), to identify all services used as a consequence of exposure to the LB alongside the units of measurement. Data on service use were collected as part of the evaluation of the ST programme which inquired into health, social and economic effects of the exposure to the London bombings on a sub-sample of the programme users and potential users (please see Chapter 3 for details).

The CSRI measured all statutory and non-statutory (voluntary and private sector) health-related service use, medication intake and hospitalisation episodes. The CSRI also measured the effect of the bombings on work in terms of number of hours reduced, days of work lost due to sick-leave and weeks of unemployment, and any effect on social and family domains of each participant's life.

One of the characteristics of the CSRI is that it is easily adapted to different study populations as well as different means of administration (Knapp & Beecham, 2000). In the evaluation study we used various forms of data collection ranging from face-to-face, postal or telephone interviews in order to ensure flexibility in reaching participants and maximise participant response.

The next step was to list all the services, alongside their appropriate units of measurement and assign costs. Firstly, I categorised reported services into sub-categories for the purpose of data analysis and presentation. I used already-published sources of costs such as PSSRU's annual Unit Costs of Health and Social Care compendium and NHS Reference Costs alongside data from various sources such as annual reports, published studies and (in a few cases) market prices.

It is important to highlight that service use data was collected only on a sub-sample of 153 followed-up ST programme users and 77 potential programme users who did not use the programme either by choice or because they were not aware of it. Evaluation was not planned for or built in from the outset of the ST programme and consequently collection of service use data only started at the follow-up point and only on a sub-sample of users.

I standardised all costs to 2007/08 prices as data collection included all the costs associated with the LB until the data collection point in the evaluation study, which ended in 2008.

a. Medication costs associated with exposure to the London bombings

The British National Formulary (BNF) was the main source of information on medication unit costs as it provides the most complete source of information on "selection, prescribing and dispensing of medication" (BNF, 2010, p.6). It aims to present the best evidence drawn from multiple sources such as

“manufacturers’ product literature, medical and pharmaceutical literature, UK health departments, regulatory authorities, and professional bodies (BNF, 2010). I used the 60th Edition, available online at <http://bnf.org/bnf/> (accessed between 20 and 25 October 2011) and adjusted 2010 prices accordingly to 2005, 2006, 2007, 2008 values.

During the interview, participants were asked the name of the medication used, dosage, frequency and the duration of the medication intake. However, due to the long recall period, between 13 and 22 months after the London bombings, information on dosage and frequency was often missing while in some cases the only available data was a description of the medication or the main reason for intake. If dosage and frequency of medication were missing, I either used the group median value or, if that was not available, I used data on recommended dosages and frequency from the BNF. When participants stated they have used the medication ‘as needed’ or ‘occasionally’ I used group median values as the best available estimate. Where the medication name was missing or just a reason for intake was given I randomly chose a medication from a list recommended by BNF for the specific condition taking into account the available information on injuries or reason for hospitalisation. I applied the same principle in cases where a generic name was reported: I randomly allocated a branded drug.

The costs of medication are calculated as per-tablet cost² and have been multiplied by the daily dosage and the total number of medication intake days for each participant.

² Drawn from the British National Formulary 2010. Number 61, March 2011. Joint publication of the British Medical Association and Royal Society of Great Britain.

Medication name	Dosage and Price
Amitriptyline	10 mg 3.85p; 25 mg 3.9p; 50 mg 4.32p
Amoxicillin	250 mg 6.14p; 500 mg 7.76 p
Antihistamine (Promethazine)	10 mg 5.09p
Betahistine	8 mg 3.29p; 1.71p; 16 mg 2.86p
Blood-thinning injection (Heparin-sodium)	5000 units/mL, 5-mL amp 506p
Chloramphenicol 5%	10 ml 509 p
Citalopram	10 mg 4.39p; 20 mg 4.96p; 40 mg 5.6p
Co-codamol	500 mg 4.33p
Codeine	500 mg 4.33p
Cortisone injections (Kenalog)	1-mL vial 149p
Diazepam	2 mg 3.67p; 5 mg 3.71p; 10 mg 3.755p
Diclofenac	25 mg 1.59p; 50 mg 1.7p
Dihydrocodeine	30 mg 5.67p
Doxepin	25 mg 13.46p; 50 mg 20.39p
Escitalopran (Ciprallex)	5 mg 32.03p; 10 mg 53.25p; 20 mg 90p
Fluoxetine	20 mg 8.36p; 60 mg 228.93p
Gallstone tablets (Urdox)	300 mg 44.16p
Gaviscon	500 mg 5.11p
Hepatitis injections (Havrix)	1-mL prefilled syringe, 2214p
Ibuprofen	200 mg 2.11p; 400 mg 2.11p; 600 mg 4.96p
Liquid paraffin	150ml 169p
Loprazolam	10 mg 64.28 p
Lorazepam (Benzodiazepin)	1 mg 23.57p; 2.5 mg 36.32p
Maxidex	142p per 5 ml
Morphine (Tramadol Hydrochloride)	50 mg 5.86p; 2.75p
Optrex solution for eyes	10 ml 400p
Paracetamol	500 mg 1.06p; 1.62p
Paroxetine (Seroxat)	10 mg 42.28p; 20 mg 42.3p; 30 mg 74.26p
Prednisolone	1 mg 3.82p; 5 mg 4.28p; 25 mg 53.57p
Propranolol	10 mg 3.71p; 40 mg 3.82p; 80 mg 3.03p; 160 mg 6.21p
Prozac	20 mg 16.66p
Salbutamol inhaler	200-dose unit 352p
Sertraline	50 mg 5.17p; 100 mg 6.07p
Symmetrel	100 mg 28.96p
Syprolex (Ciprallex)	5 mg 32.03p; 10 mg 53.25p; 20 mg 90p
Tranquilisers (Buspirone)	5 mg 50.66p; 10 mg 56.16p
Valerian tablets	150 mg 20.4p
Vancomycin	125 mg 473p; 250mg 473p
Voltarol	25 mg 3.5p; 50 mg 5.44p
Warfarin	500 mg 5.92p; 1 mg 3.89p; 3 mg 4.03p; 5 mg 4.21p
Xanax (Alprazolam)	250 mg 4.95p; 500 mg 9.48p
Zopiclone	3.75 mg 5.6p; 7.5 mg 5.42p

b. Hospitalisation costs associated with exposure to the London bombings

Unit costs for hospitalisation episodes were taken from the NHS Reference Costs compilation for 2006/07. Although all hospitalisations occurred in 2005 and 2006, I chose the 2006/07 compilation due to its comprehensiveness and completeness, and have adjusted costs accordingly to 2007/08 values. The unit costs are grouped into two categories depending on the length of hospitalisation: one to four days and more than four days.

For the hospital stays from one up to four days for first hospitalisation, I used the 'Accident and Emergency Services: Leading to Admitted' section as I assumed all participants used Accident and Emergency to reach health care services after the incident. Depending on the severity of the injury, I used Category 1 investigation with Category 3-4 treatment costs of £123, or Category

2 investigation with Category 3 treatment costs of £158. However, in the case of second and third hospitalisation I used the 'Non-elective Inpatient HRG' section and multiplied it by the total days of hospitalisation.

For stays longer than four days I used relevant treatment categories under the 'Non-elective Inpatient HRG' section and multiplied by the number of days hospitalised. In the cases where reason for admission was missing or the participant did not want to disclose it I used the 'General Trauma and Blast Injuries' category. The NHS Reference category used is given in brackets next to the reported reason for admission.

The costs of hospitalisation are calculated as cost per attendance and have been multiplied by the total days of hospitalisation for each participant.

c. Statutory service use costs associated with exposure to the London bombings

This section outlines NHS-provided services used by the individuals involved in the London bombings and their unit costs. The costs are reported from the two national compilations of costs for health and social care published annually: Unit Costs of Health and Social Care (UCHSC) and NHS Reference Costs (NHSRC).

For costing community and hospital-based health and social care services, I used UCHSC, while for costing specialised hospital-based services I consulted NHSRC.

Data on service usage covers different points of service use, ranging from hours, to up to three years after the London bombings. Therefore the service costs are calculated on the basis of the average service costs listed in the appropriate costing publications for the years 2005, 2006, 2007 and 2008 and adjusted for inflation, in order to cover the timeframe of ST and evaluation projects. Particulars and assumptions behind the costing for each source of information are described in greater detail below.

Unit Costs of Health and Social Care (UCHSC)

The services costs used do not reflect London wages, as many participants were not London residents. Costs include direct care staff with

qualifications and are expressed as costs per hour or per surgery consultation in pounds sterling. Where appropriate, the costs are broken down to first and subsequent appointments in order to take into account the difference in the costs. If cost information was not available for the appropriate year, data from the next available year was included and adjusted for inflation by using the relevant year Pay and Price Index for Hospital & Community Health Services³.

Type of service	Unit cost (£ per time unit)
<i>A&E</i>	109.00 per hour
<i>Care support worker</i>	15.33 per hour
<i>Community nurse</i>	30.67 per hour
<i>Dietitian</i>	24.00 per hour
<i>General Practitioner</i>	31.66 per surgery consultation lasting 11.71
<i>Hospital check-up</i>	109.00 per hour
<i>Mental health nurse</i>	25.66 per hour
<i>NHS Counsellor</i>	39.25 per hour
<i>NHS Psychiatrist</i>	111.33 per hour
<i>NHS Psychologist</i>	39.33 per hour
<i>Other nurse</i>	26.66 per hour
<i>Paramedic</i>	108.00 per hour
<i>Physiotherapist</i>	25.33 per hour
<i>Podiatrist</i>	23.00 per hour
<i>Rehabilitation specialist</i>	25.33 per hour
<i>Social worker</i>	27.00 per hour
<i>Surgeon</i>	108.67 per hour
<i>Home care worker</i>	15.33 per hour

NHS Reference Costs (NHSRC)

In order to cost specialist services I used consultant-led first and follow-up attendance outpatient face-to-face contact categories in the NHS reference costs manual. Due to changes in reporting format, data for 2005, 2006 2007 and 2008 were not directly comparable and so I used the 2007/08 dataset as it provided the most complete data, and then adjusted for inflation accordingly by using the Pay and Price Index for Hospital & Community Health Services for 2005/06 and 2006/07 values (DH, 2011). Total cost is the mean value of the

³ Drawn from Pay and Price Index for Hospital & Community Health Services <http://www.healthcaresupply.org.uk/health-service-cost-index/> accessed on October 27 2011.

2005/06, 2006/07 and 2007/08 unit costs. When cost information was not available for the relevant year, data from the next available year was included and adjusted for inflation by using the relevant year Pay and Price Index for Hospital & Community Health Services⁴.

All costs are expressed in pounds sterling per time unit, for first and follow-up appointments.

Type of service	Unit cost (£ per time unit)
<i>Audiologist</i>	*169.75, **169.34 per hour
<i>Back specialist</i>	*120.12, **77.70 per hour
<i>Blood test</i>	2.98 per test
<i>Cardiologist</i>	*158.83, **104.59 per hour
<i>Ear specialist</i>	*169.75, **169.34 per hour
<i>ENT specialist</i>	*105.23, **68.73 hour
<i>Maxillofacial specialist</i>	*125.8, **83.67 per hour
<i>Neurologist</i>	*195.56, **127.50 per hour
<i>Ophthalmologist</i>	*105.23, **64.75 per hour
<i>Optician</i>	*105.23, **64.75 per hour
<i>Pain specialist</i>	*163.80, **98.61 per hour
<i>Plastic surgeon</i>	*117.14, **77.70 per hour
	* First appointment
	** Follow-up appointment

d. Private Sector Provided Services

Private sector services costs were obtained from various sources such as average market prices, direct out-of-pocket payments made by the participants, estimations based on previous research in the area, or from information found in the literature, participants' records, direct communication with service providers or the media.

Unit costs for the private sector services are based on 2008 market prices adjusted for inflation to reflect 2005, 2006, and 2007 prices. Other therapies' prices are based on average donations estimates from the National Survey of Volunteering and Charitable Giving (Institute of Volunteering, 2008).

⁴ Drawn from Pay and Price Index for Hospital & Community Health Services <http://www.healthcaresupply.org.uk/health-service-cost-index/> accessed on October 27 2011.

The unit cost is expressed as an average price based on three randomly selected London and non-London based service providers.

Type of service	Unit cost (£ per time unit)
<i>Acupuncture</i>	57.68 per session
<i>Counselling</i>	62.33 per session
<i>Counsellor provided by work</i>	62.33 per session
<i>Grief counsellor</i>	38.83 per session
<i>Herbalist</i>	64.31 per session
<i>Homeopathy</i>	59.37 per session
<i>Hypnotherapist</i>	69.26 per session
<i>Massage</i>	39.58 per session
<i>Pilates</i>	29.68 per session
<i>Psychiatrist</i>	125.66 per session
<i>Psychological assessment</i>	94.00 per session
<i>Psychologist</i>	59.37 per session
<i>Psychotherapy</i>	94.00 per session
<i>Yoga</i>	9.89 per session
Other therapies	
<i>Healer</i>	4.94 per session
<i>Spiritualist</i>	4.94 per session

e. Voluntary sector service use costs associated with exposure to the London bombings

Costing of not-for-profit organisations proved to be challenging on many levels. I based my calculations on records in the published and unpublished (grey) literature, personal records or available information found in the electronic media. Firstly, most of the organisations involved have no data available on the prices for their services per hour. Therefore where available I based the costing of the services on their annual financial reports comparing total number of service users with total year expenditure on the services in question. This approach was used for costing St. John's Ambulance, Cruse Bereavement and Red Cross service units. In estimating service unit costs for 7th of July Assistance Centre art therapy, counselling and massage services I used market prices of the activities as proxies. In addition to those services, 7th of July provided other services that included information letters, running service users support groups, sharing information on other available services and support groups as

well as information and assistance on legal and financial matters associated with the bombings. I used the unit costs of the Citizens Advice Bureau (CAB), based on the total number of clients divided by the total income spent on service provision and education for 2009. Data on Alcoholics Anonymous (AA) UK branch unit costs is based on the organisation's costing policies published on the Internet. AA funding is based on limited individual and member donations and after each session, participants donate voluntary contributions to cover for the running of the session. However, as the number of members was not available, I used £5 as a proxy for voluntary donations based on the findings from National Survey of Volunteering and Charitable Giving on the average amount people donate per week to charity (IOV, 2008). Due to the lack of available data on Disaster Action and Victim Support service unit costs, I used the unit cost for the CAB as a proxy.

Type of service	Unit cost (£ per time unit)
<i>7th of July Assistance Centre:</i>	
<i>art therapy</i>	59.37 per session
<i>counselling</i>	62.33 per session
<i>massage</i>	39.58 per session
<i>other services</i>	39.58 per session
<i>AA</i>	4.94 per session
<i>Cruse bereavement</i>	106.20 per session
<i>Disaster action</i>	39.58 per session
<i>Flexi care</i>	16.33 per session
<i>Priest</i>	0 per session
<i>Red Cross</i>	128.34 per emergency respons
<i>St. John's Ambulance</i>	85.09 per emergency response
<i>Victim support</i>	39.58 per session

Participants reported using two support groups set up by the London bombings survivors: King's Cross United and Tavistock Square Help Group. Both were informal support groups, set up and run by survivors and both provided a platform for provision of support and information sharing. The groups run Internet forums and organised regular meetings in local informal settings, such as pubs. Appropriate unit cost allocation for support groups would mean establishing the opportunity cost for survivors behind the

organisation and group users, but the data on both is unavailable and hence zero costs were allocated.

Type of service	Unit cost (£ per time unit)
<i>Informal</i>	0 per session
<i>Internet</i>	0 per session
<i>King's Cross United</i>	0 per session
<i>Tavistock Sq help group</i>	0 per session

4.2.4 Occupation and earnings costs – productivity loss

The following data are taken from the 2005 Annual Survey of Hours and Earnings (ASHE) analysis by occupation. For simplicity, the table below lists only the main employment categories and median, weekly and hourly gross annual earnings followed by median weekly hours. I allocated a 4-digit Standard Occupational Code for each participant based on the job title they provided and the corresponding median weekly earnings. Where a 4-digit code was not available I used the corresponding 3 or 2-digit code instead.

Total productivity loss from absenteeism was calculated as a sum of daily productivity loss due to sickness leave, the total number of reduced hours of work, and the daily productivity loss due to unemployment as a consequence of involvement in the London bombings. The daily productivity loss represented one fifth of the median weekly wage (a daily wage) and was multiplied by the number of days on sick leave due to the London bombings. In order to calculate the productivity loss from reduced hours, I have multiplied the total number of hours reduced by the median hourly earnings for each employment category. Productivity loss from unemployment was estimated as a total number of days unemployed due to the London bombings and multiplied by the median daily earnings for the employment category (Table 4.3). Productivity loss costs are based on 2008 market prices adjusted for inflation to reflect 2005, 2006, and 2007 prices. I have asked participants to recall how many days were they on the sick-leave, if they had reduced hours at work or become unemployed due to exposure to the LB. As in some cases participants were interviewed up to two years after the LB, it is appropriate to question if and to what degree self-recall is accurate. Such a long recall period can consequently result in under- or overestimation of productivity costs.

Table 4.3 Occupation and earnings categories (ASHE, 2005)

Occupation group	Med. gross annual earnings	Med. gross weekly earnings	Med. Hourly earnings	Med. Weekly hours
Managers and senior officials	32,216	609.4	16.25	37.4
Professional occupations	30,783	594.4	18.13	35.0
Associate professional and technical occ.	24,093	456.9	12.77	37.0
Administrative and secretarial occupations	14,644	279.4	8.33	35.0
Skilled trades occupations	20,708	390.0	9.47	40.0
Personal service occupations	10,649	209.6	7.02	30.3
Sales and customer service occupations	8,454	161.2	5.76	27.9
Process, plant and machine operatives	18,790	357.2	8.19	40.1
Elementary occupations	10,710	195.3	6.00	34.4

4.3 Costs of being involved in the London bombings

This section will explore service use for a sample of people involved in the LB. I will present costs collected for a sub-sample of 230 participants as a part of the evaluation of the ST programme undertaken between September 2006 and September 2008. I have already described in Chapter 3 the participants, their socio-demographic characteristics and occupation, alongside details about how they were affected by the bombings and, if they used the ST programme, the type, length and outcome of their treatment. The time frame for the estimates of costs varies significantly between the participants, as all participants were asked to recall their service use due to the LB from the exposure to the LB until their participation in the evaluation study. Due to the heterogeneity of the follow-up timing, the estimated costs are more accurately portrayed as snapshots of the period post the LB up to the data collection point rather than total overall costs due to exposure to the LB, in particular for individuals with long-term physical or mental health concerns. However, for participants with only short-term consequences due to exposure, these estimates should reflect the overall effects of the exposure to the LB.

Literature on costing or evaluation of health care very often categorises costs into direct, indirect, and intangible. Direct costs are often associated with measurable resources spent in the health care sector and could also refer to patient's direct out-of-pocket spending. Indirect costs are commonly defined in

the context of productivity loss in terms of days off work due to sickness, hours reduced, unemployment or presenteeism. Intangible costs refer to unmeasurable or difficult to measure constructs such as effects of pain and suffering or increased quality of life. Although Drummond (2005) has argued against this practice due to inconsistency of terminology use among different studies, I have adhered to it in the thesis as it has been frequently-used. In order to ensure clarity and consistency of its use throughout the study, I will provide a detailed description and operationalise each cost category.

The service costs category includes costs associated with all resources and services used by the participants as a result of their involvement in the 2005 London bombings. Direct costs are categorised as follows: the ST programme (screening and assessment, and treatment costs); NHS provided primary and secondary services; hospitalisation; medication; private sector services and voluntary sector services.

Productivity loss costs include: workplace productivity loss due to sick leave, reduced work hours, and unemployment resulting from involvement in the London bombings. Fourteen participants reported diminished productivity at work (presenteeism) even though the CSRI did not ask specifically about it. At this point these costs are not included in the analysis. Table 4.4 presents total estimated costs reported by a sample of 230 individuals involved in the London bombings, with the total overall cost of £2,592,346 at 2007/08 prices. Indirect costs represented 62% of the total reported costs. All cost distributions are significantly different from a normal distribution due to a great variability and dispersion of costs reported by the service users (see the results of the Kolmogorov-Smirnov test in Table 4.4). A number of individuals did not use services; around 12% reported zero costs for services and around 40% for productivity costs. Four participants (1%) had total costs greater than £100,000, resulting in a long tail in the cost distribution and a large dispersion of the data. Around 70% of participants reported total costs associated with the London bombings of between £1,000 and £10,000 per person.

Table 4.4 Total costs associated with exposure to the London bombings

	Service use costs	Productivity loss costs	Overall costs
N	230	230	230
M	4362.45	6026.62	10389.22
Min	£0	£0	£0
Max	£156480.81	£167089.6	£178842.5
SD	£12702.6	£19798.92	£24875.25
N (%) of participants with zero costs	28 (12.2)	93 (40.3)	21 (9.1)
Total	£1003364.03	£1386156.22	£2389520.45
% of overall costs	37.78	62.22	
Normality of distribution test	Z=5.632, p<0.001	Z=5.775, p<0.001	Z=5.169, p<0.001

4.3.1 Service Costs

The following categories are included in direct costs: the ST programme screening and assessment, the ST programme treatment, health services, hospitalisation, medication, private and voluntary sector services.

Table 4.5 Service costs categories: screening and assessment, treatment, health services and hospitalisation costs

	Screening and Assessment	Treatment	Health services	Hospitalisation
N	149	97	175	24
M	488.5	1439.75	£439.09	£15623.33
Min	£439	£262	£27	£123
Max	£878	£16742	£10692	£153993
SD	£198	£3025	£953	£12256
Total costs	£112356.3	£331185.60	£113642.06	£374960.00
% of direct costs	11.20	33.01	11.33	37.37

Table 4.6 Service costs categories: medication, private and voluntary sector costs

	Medication	Private sector	Voluntary sector
N	68	82	39
M	£22.03	£228.71	£384.74
Min	£0	£10	£40
Max	£931	£3518	£3428
SD	£98	£563	£320
Total costs	£4296.23	£51919.00	£15004.84
% of direct costs	0.43	5.17	1.50

Tables 4.5 and 4.6 show the variation in costs between participants per service categories. Costs are not normally distributed and this needs to be taken into account in data analysis and interpretation. The most frequently-used services were health services followed by screening and assessment, with around 65% of participants reporting using one of these services. However, although they were the most frequently-used, each service only contributes up to 11% of all service costs. It is the opposite with hospitalisation costs, where a relatively small number of users reported high costs: 10% hospitalised participants accounted for 37% of all direct costs. This was followed by treatment under the ST programme, 33% of the service costs. Medication, voluntary sector and private costs accounted for only up to 7% of total service costs.

a. Screening and Assessment

In total, 149 participants were screened and assessed with a total cost of £112,356.30 at 2007/08 prices. Participants were screened from one up to five times, with 73% of participants screened once.

b. Treatment

The cost of treatment was £331,185.60 at 2007/08 prices and this was the second highest service cost (Table 4.8).

c. Health care services

Although health care costs represent a very small percentage of reported direct costs (around 7%), they are the most frequently-used services after assessment and screening, with around 63% of participants reporting using one of the associated NHS services. For simplicity of presentation I have grouped the following services within hospital outpatient services: ear specialist, eye specialist, podiatrist, knee specialist, leg injury specialist, neurologist, maxofacillo specialist, cardiologist, ENT specialist, rehabilitation specialist, pain specialist and plastic surgeon. NHS psychiatrist, psychologist and counsellor are grouped under NHS mental health services. As Table 4.7 shows, more commonly used services included GPs, followed by A&E, and NHS-provided mental health services (in particular, psychologist and counsellor). A small number of participants used more specialised health care services depending on the type of health problem they experienced. Use of GP services varied from 1-150 contacts.

Table 4.7 Use of health care services

Health care services	N of users	% of users	% of total costs
GP	155	67.39	29.53
A&E	68	29.57	7.77
NHS mental health	100	43.57	34.42
Audiologist	8	3.48	3.68
Physiotherapist	8	3.48	3.57
Surgeon	6	2.61	2.58
Other nurse	6	2.61	0.45
Blood test	3	1.30	0.00
Hospital outpatients	2	6.88	10.37
Mental health nurse	2	0.87	0.05
Health care services	N of users	% of users	% of total costs
Dietician	1	0.43	0.06
Social worker	1	0.43	0.17
Care support worker	1	0.43	0.01
Paramedic	1	0.43	0.16
Hospital check visit	1	0.43	0.29

d. Private sector services

Fewer participants reported using private sector services in comparison to NHS provided services. The cost of private services was £51,919.00. Formal mental health services included the following service categories: counselling provided by employers, other counselling, psychotherapist, psychiatrist, psychologist, psychological assessment. Among formal mental health services, counselling and psychotherapy were the most commonly used services.

Alternative or complementary services included acupuncture, massage, herbalist, osteopath, homeopathy, hypnotherapy, yoga and spiritualist services.

Table 4.8 Use of private sector services

Type of service	N of users	% of participants	% of total costs
Formal mental health services	63	27.30	71.25
Alternative or complementary services	29	13.58	28.75

e. Voluntary sector services

In total, costs for voluntary sector services absorbed only 1.5% of total direct costs, and only 43 participants reported using voluntary sector services, with a total cost of £ 15,004.84 (Table 4.9). Voluntary sector services used were most frequently provided by organisations set up specifically to address the needs of individuals involved in the London bombings. Table 4.9 shows that the majority of respondents used 7th July Assistance centre, followed-by King's Cross United, Cruse Bereavement and Victim Support.

Table 4.9 Use of voluntary sector services

Type of service	N of users	% of participants	% of total costs
7/7 Assistance centre - other	21	9.13	30.86
7/7 Assistance centre - counselling	14	6.09	41.98
7/7 Assistance centre - massage	6	2.61	9.50
Kings Cross United	5	2.17	0.00
Cruse	3	1.30	3.43

Victim Support	3	1.30	1.32
Home help	1	0.43	1.43
Flexicare	1	0.43	16.97
Red Cross	1	0.43	0.86
St. Johns' Ambulance	1	0.43	0.57
7/7 Assistance centre - art therapy	1	0.43	2.38
AA	1	0.43	6.58
Disaster Action	1	0.43	0.26
Tavistock Square group	1	0.43	0.00
Priest	1	0.43	0.00

f. Hospitalisation – types of services used

In total, 24 respondents reported being hospitalised, the maximum number being three times. Length of stay averaged five days for first hospitalisation, 19 for the second and seven for the third. The most frequent reasons that participants were hospitalised were the trauma and blast injuries, followed by amputations and eye injuries (table 4.10). The cost of hospitalisation was very high, 37% of total direct costs being attributed to hospitalisation costs. In particular, the cost of interventions for MRSA infection, skin graft surgery and amputations was very high, accounting for almost 78% of total hospitalisation costs.

Table 4.10 Use of hospital services

Hospitalisation reason	N of service users	%	% of the total costs
General trauma and blast injuries	7	3.04	1.44
Eye injury	3	1.30	0.19
Traumatic Amputations	3	1.30	12.22
Back injuries	2	0.87	0.09
Burns	2	0.87	1.98
Knee injury and operation	2	0.87	0.03
Operations to face	1	0.43	0.04
Leg surgery	1	0.43	1.97
Head injury and cuts	1	0.43	0.03
Wrist surgery	1	0.43	0.17
Chest pain	1	0.43	0.42
Right eardrum graft skin repair	1	0.43	1.84
Shock	1	0.43	0.03
Broken arm	1	0.43	0.03
Skin graft	1	0.43	25.44
Head, neck, shoulder injuries	1	0.43	1.35

Overdose	1	0.43	0.03
Nose bleed and other injuries	1	0.43	0.03
Irregular heart beats	1	0.43	1.34
Depression	1	0.43	0.96
MRSA infection	1	0.43	41.03

g. Medication

63 participants reported using medications, on average two medications per person. Twenty-one out of the 50 medications reported by the participants were mental health medications, and other medications covered physical health problems mostly related to the injuries received during the London bombings. Table 4.11 shows that the most frequently-used medications were pain-killers followed by mental health medications such as antidepressants, insomnia treatment and anxiolytic medication.

Table 4.11 List of prescribed medications

Medication	N of users	%
Painkillers (Ibuprofen)	17	7.39
Antidepressant (Amitriptyline)	17	7.96
Sleeping pills (Zopiclone)	13	5.65
Diazepam	11	4.78
Citalopram	8	3.48
Antibiotics (Amoxicillin)	7	3.04
Relaxation remedy (Valerian tablets)	4	1.74
Anti-inflammatories (Ibuprofen)	3	1.30
Paracetamol	3	1.30
Antihistamine (Promethazine)	2	0.87
Codeine	2	0.87
Ear drops (Chloramphenicol 5%)	2	0.87
Eye drops (Maxidex)	2	0.87
Fluoxetine	2	0.87
Psychotropic medicine (Prozac)	2	0.87
Tranquilisers (Buspirone)	3	1.5
Voltarol	2	0.87
Antibiotics for MRSA (Vancomycin)	1	0.43
Betahistine	1	0.43
Blood-thinning injection (Heparin-sodium)	1	0.43
Co-codamol	1	0.43
Cortisone injections (Kenalog)	1	0.43
Diclofenac	2	0.43
Dihydrocodeine	1	0.43
Escitalopran (Ciprallex)	1	0.43
For heart flutter (Warfarin)	1	0.43
Gallstone tablets (Urdox)	1	0.43

Gaviscon	1	0.43
Heart medicine (Warfarin)	1	0.43
Hepatitis injections (Havrix)	1	0.43
Herbal medicine for sleeping (Valerian capsules)	1	0.43
Inhailers (Salbutamol)	2	0.43
Liquid paraffin	1	0.43
Lorazepam (Benzodiazepin)	2	0.86
Optrex solution for eyes	1	0.43
Paroxetine (Seroxat)	2	0.43
Propranolol	1	0.43
Prozac	1	0.43
Sertraline	1	0.43
Steroid tablets (Prednisolone)	1	0.43
Symmetrel	1	0.43
Syprolex (Cipralext)	1	0.43
Xanax (Alprazolam)	1	0.43

4.3.2 Productivity loss costs

The productivity costs category includes costs associated with productivity loss due to hours of work being reduced, sick leave and unemployment caused by exposure to the London bombings. Productivity costs make up around 60% of total costs, and the biggest average reported cost was due to unemployment. Productivity costs by type of absence from work are presented in Table 4.12. Only 28 participants reported being unemployed, although the total cost of unemployment of £544,627.12 at 2007/08 prices accounted for almost 45% of productivity costs. Length of unemployment ranged from 3 to 320 weeks, with a median of eight weeks. The most frequently reported productivity costs were associated with sick leave, with 56% of participants reporting taking sick leave in duration of between 1 and 1112 days. A relatively small number of participants (N=29) reported reducing their hours of work, ranging from 7 to 780 with the total cost of £63,932.16 at 2007/08 prices.

Data on occupation were missing for 20 participants. I performed multiple imputation to impute weekly median wages based on the sample.

Table 4.12 Productivity loss costs by type of absence from work

	Productivity loss (£)		
	Hours reduced	Sick leave	Unemployment
N	29	124	28
M	277.96	3380.83	2367.94
Min	54	50	1253.70
Max	17573.20	155591.04	124066.80
SD	3646.05	17135.50	30978.79
Total costs	63932.16	777596.26	544627.12
% of work related costs	4.01	51.73	44.29

In addition to data on productivity loss, as a part of the evaluation, participants were asked about the effects of the LB on their work and leisure activities. In total, 24 participants who received treatment reported that the bombings had affected their work. Eight participants reported career effects such as: abandoning their current career due to injuries, loss of career opportunities such as promotions, missing job interviews or underperformance at job interviews, and loss of job opportunities that required travel to London. Nine participants stopped working or reported job/income losses due to the bombings, one participant retired early and five reported diminished work productivity. Seventeen participants reported difficulties with travelling and/or using public transport. Furthermore, participants reported effects on social life and educational opportunities. These effects, usually grouped into intangible costs (Drummond, 2005), are difficult to cost and are consequently more often than not omitted from costing studies. Nevertheless, these effects are imposing a significant burden on individuals, their families and economy as a whole and should not be overlooked. In the evaluation study, 24 participants reported effects on social life that prevented them from “from going out, enjoying their leisure activities, and seeing their friends”, resulting in diminished social activities. Six participants reported strain on their family life, resulting in ending relationships/divorcing, or being overprotective of their children.

4.4 Comparisons with other studies

It is interesting to investigate how the ST programme treatment costs compare to other reported PTSD CBT treatment costs. In their paper, Layard et al (2006) reported a cost of £750 for a course of CBT therapy and the IAPT study reported average cost of £4.33 per minute over the 2 years with the average contact time per patient of 129 min over an average of 3 sessions, giving an average cost per patient of £559. NICE guidelines estimate treatment cost to the NHS as £825 for ten treatment sessions (1– 1.5 h in duration; NICE, 2005).

However, the validity of this comparison is questionable due to different methods of data collection used in studies (top-down vs. bottom-up), who delivered the therapy (clinical psychologist, computer administered therapy or nurse), type of disorder (depression, PTSD, travel phobia), and whether both direct and non-direct therapist time were included in the cost. Some of these elements are not clear from the data presented in the published papers, which further complicates the comparison. What is observable though is that the ST programme reported higher average treatment session costs alongside a higher average number of sessions per patient when compared to numbers reported both by Layard and NICE guidelines. However, when comparing the ST programme and IAPT, the ST programme's costs are well under, at on average £3 per minute in comparison to £4.33 in 2008/09 prices.

It is also interesting to compare these results with the economic impact of PTSD in a Northern Ireland (NI) study, although due to sampling size and differences, the nature of the traumatic event, data collection instruments, timeline and cultural factors there are many limitations to this comparison. It is still worthwhile as this is the only other study looking into the economic impact of PTSD I have found. The NI cost-of-illness study interviewed 1,986 participants as a part of a representative household survey of English speakers in NI and included screening and assessment for depression and general anxiety, and PTSD in a face-to-face interview format (Ferry et al 2008). The study assessed direct service costs including health service use and medication, alongside indirect costs including costs of lost work productivity and presenteeism costs for a one-year period in 2008 for all individuals with PTSD.

In total, 1,095 individuals completed the section on PTSD in the study and were included in the analysis.

Apart from methodological and potential cultural differences between studies, another possible impediment to this comparison lies in the fact that data from the LB study includes participants with PTSD alongside a number of participants without a PTSD diagnosis, while the NI study looks at PTSD-related costs only. However in the NI study, PTSD was not assessed by clinicians using standard clinical instruments such as SCID, and the study reports using “further questions on re-experiencing, avoidance and hyper-vigilance symptoms on random event and worst event” on participants who endorsed traumatic event(s) (Ferry et al, 2008, p.7). In addition, the NI study sample included a sub-sample comprised of individuals who “screened into the core disorder, a random sample of 25% of individuals who did not screen into the core disorders and 50% of individuals who are sub-threshold core disorder cases” (Ferry et al, 2008, p.9). Therefore in my view the NI study sample resembles the LB study sampling criteria and I have decided to proceed with comparison of the results.

Both studies reported high indirect costs, in both cases related to work productivity loss. The NI study reported a higher percentage of indirect costs (81%) in comparison to the LB study (62%). Most cost-of-illness studies in the mental health domain report a similarly high contribution of indirect costs (Thomas & Morris, 2003; Knapp, 2003; Knapp et al., 1999).

In the NI study, productivity losses represented 66% of total costs among individuals with PTSD in 2008, while presenteeism accounted for 15% of total costs (Ferry et al., 2008). Sick leave (52%) and unemployment (44%) accounted for most of the productivity costs in the LB study, but presenteeism was not measured, although some of the interviewed individuals did report it.

When I compare direct costs reported by the NI and LB studies, treatment/mental health services and hospitalisation costs accounted for the highest percentage of the direct costs: 41% in the NI study and 33% in the LB study for treatment, and around 30% for hospitalisation costs in both studies.

Anti-depressants, hypnotics and anxiolytics were the most prominently reported medications in both studies. In the NI study, anti-depressants represented 57% of total medication costs, followed by psychoses and related disorders drugs (17%), and hypnotics and anxiolytics (16%; Ferry et al., 2008). In the LB study anti-depressants (7%) were the most frequently reported medications, followed-by hypnotics and anxiolytics (6%) and painkillers (6%).

4.5 Summary

Data presented in this chapter describes both the direct and indirect costs reported by individuals who were exposed to the bombings. At the time of data collection, this was the first time individuals exposed to such an event have reported services they used as a direct consequence of their exposure. Furthermore, to my knowledge, this is the only attempt to measure productivity-related costs associated with exposure to the LB. The presented costs highlight productivity costs as the largest cost category (62%), almost twice as big as the reported direct (service use) costs (38%). In the direct (service use) cost category the most costly services when looking at the total costs were hospitalisation (38%) and treatment (32%).

The time frame for the estimates of costs varies significantly between the participants, and due to the heterogeneity of the follow-up timing the estimated costs are more accurately portrayed as snapshots of the period post the LB up to the data collection point, rather than total overall costs due to exposure to the LB.

The LB study sample is only indicative of individuals exposed to the LB, and it is very likely that self-selection affected the evaluation follow-up sample as only a part of the contacted participants agreed to participate in the evaluation study; some participants refusing to take a part and a number of participants who it was not possible to contact. Furthermore, it is a valid question if the ST programme users were representative of the population of individuals exposed to the LB.

Although there is a limit to the generalisability of these findings due to possible self-selection of the sample and the size of the sample, this study provides a unique opportunity for insight into the effects of a traumatic event of a relatively large scale on individuals and their health, social and work domains. This study provides an insight and documents all the challenges of measuring the effects of interventions applied in a real-world context. This chapter serves as a foundation for the cost variation analyses presented in Chapter 5 and the economic evaluation of the ST programme explored in Chapters 6 and 7.

Chapter 5 Exploring variations in the costs of involvement in the London bombings

"No single model is best under all circumstances." (Basu et al., 2004, p. 751)

5.1 Introduction

The investigation of the relationship between cost and its potential determinants while controlling for other covariates is of importance to decision-makers (Knapp & Beecham, 2001). Analysis of cost variations enables the researchers and policy-makers to explore how participants with different needs and characteristics differ in their costs (and in the underlying patterns of services use). In the example of the ST programme, this approach aids in answering the following question: how costs for individuals sent to treatment compare to costs for individuals who either did not use the programme or were considered to be coping well without any need for treatment, having taken into account the characteristics of those individuals.

The aim of this chapter is to explore by using multivariate analysis the impact on health, social, and economic activity for those affected. Applied to the costs associated with the LB, multivariate analysis will give us information on which participant, exposure and service characteristics appear to have an effect on cost and on the nature of these relationships. In addition, Chapter 5 will lay a foundation for the analysis presented in Chapters 6 and 7.

I will start by briefly recapitulating challenges with the analysis of health service data and ways around them before proceeding with a description of the data analysis and interpretation of the results.

Having estimated the cost of exposure to the LB in Chapter 4, this chapter will explore the following questions:

- a. How do costs relate to the characteristics of the participants, exposure factors and service type?
- b. Which factors are associated with being diagnosed with PTSD?

- c. What is the cost of being diagnosed with PTSD?

5.2 Exploring cost variations

Understanding factors that explain differences in costs is crucial for any informed decision based on the costing study. Differences in costs might be attributed to systematic factors such as a participant's characteristics and needs, and the broad approach to treatment response, as well as non-systematic factors otherwise known as random or stochastic variation (Knapp et al., 1995). The cause of the latter could include random fluctuations in data recording, participants' responses to research questions and measurement errors.

a. Cost variation – Two-stage model

In a cost variation analysis, both OLS and GLM will only include participants with cost data. However, information on whether participants used services alongside information on their characteristics should be reflected in the analysis. This information loss is avoided by use of two-stage model analysis, which combines the odds of incurring costs with information on cost variations. It does so by combining binary regression analysis with GLM. Binary regression/multiple logistic regression analysis (Dunn, 2003) explores differences between participants who did and did not use services, and estimates odds ratios of incurring a cost for each explanatory variable and statistical significance. The first step predicts which participants will incur costs and the second stage models incurred costs and participants' characteristics (Dunn, 2003). The total cost per person is a product of a probability of being in the group that incurs costs, multiplied by modelled cost for the group (Dunn et al., 2003).

Some authors have used OLS with untransformed cost data and compared results with OLS with bootstrapping, and GLM. Their conclusion was that all three models produced similar results (Byford et al., 2003) or they preferred log transformed OLS model (Knapp et al., 2002). However, this approach has been criticised (Dunn et al., 2003) and statistical techniques

appropriate to handling skewed distributions in such cases are recommended (O'Hagan & Stevens, 2003).

As costs were measured at different time points for different participants, depending on the timing of the evaluation follow-up interview, I have expressed all costs in a cost-per-month format to enable comparison.

The choice of data analysis method depends on data characteristics. Therefore, my first step will be to conduct descriptive analysis of the dataset and test normality of distributions of dependent variables. In light of the recommendations from the literature discussed above, for non-normally distributed dependent variables I used the GLM approach. I preferred the GLM approach to the alternatives discussed above due to the simplicity of the analysis that avoids all caveats of re-transformation. For normally distributed variables I will employ OLS. In cases where participants reported zero costs I will use a two-stage model.

b. Handling missing data

Missing data is a problem many studies face, and the literature suggests a number of approaches for dealing with this and prevent sample reduction. One way to approach this problem is to exclude cases with missing data from the analysis. However, this will cause a significant sample reduction and is a problem especially with small samples (Sterne et al., 2009). Another potential strategy is to calculate a group mean or mode for the whole variable or to use the last recorded value, depending on the variable distribution, and replace missing values (Carpenter & Kenward, 2008). This strategy is problematic as it does not account for uncertainty and affects standard errors (Sterne et al., 2009). Another option is to conduct multiple imputation (MI). In brief, in order to account for the estimation uncertainties, MI creates a number of simulated versions of the dataset (usually 5-10) and predicts the missing values and confidence intervals for each predicted set and pools the results (Schafer, 1999). This approach reflects the relationships between variables and does not alter their influence on the predicted values (Rubin, 1987; Little & Rubin, 2002), and

preserves characteristics of the joint distribution in the imputed values (Schaffer & Graham, 2002).

However, the robustness and validity of the MI approach depend on the reason behind the missing data. Following Little and Rubin (2002), for the purposes of MI, data are classified as: missing completely at random (MCAR) where missing values are independent of other values, missing at random (MAR) in cases where missing data depends on observed data only, and missing not at random (MNAR). MI only delivers unbiased estimation in the case of MCAR, while in the case of MAR it is necessary to conduct a sensitivity analysis to explore the differences in assumptions behind missing data (Sterne et al, 2009). Collins et al (2001) demonstrated that although a wrong assumption of MAR did affect the results, it did not seriously distort estimates and standard errors (Schaffer & Graham, 2002; Schaffer & Olsen, 1998).

Schaffer (1999) has advised cautious use of this MI approach and identifies the effects of its misuse on “estimates, standard errors and hypothesis tests” (p.4). He advises further on the importance of compatibility of methods used to impute datasets and those used for subsequent data analysis, and a preference for a more general imputer’s model that contains a large number of associations (Schaffer, 1999). This should ensure that distributional characteristics that are explored in future analysis are reflected in the MI in order to obtain valid inferences (Schaffer & Olsen, 1998; Schaffer, 2003). Another important issue in MI is including all relevant variables that carry information on missing data and are linked with missing variables, including outcome (dependent) variables (Sterne et al., 2009). Caution is also advised when conducting MI on skewed distributions, outliers and fifth or 95th percentile values (Schaffer, 1999). If the MI procedure assumes data are normally distributed, it is important to transform non-normally distributed data before imputation by using logarithmic or other power transformations (Sterne et al., 2009, Schaffer and Graham, 2002).

I decided to employ MI for all socio-economic and exposure variables with missing values (presented in Table 5.2) by using SPSS 17-automated MI

model based on the scan of the data set. For non-normally distributed variables I used a logarithmic transformation prior to imputation to approximate normal distribution. As previously discussed, in such cases transformed variables need to be re-transformed again after MI to their original values by using Duan's smearing estimator, which is equal to the mean of the anti-log of the residuals (Duan, 1983). This step is necessary to avoid retransformation bias (Mullahy, 1998), which will result in underestimated values (Dunn et al., 2003; Duan, 1983).

c. Data analysis protocol

The first part of the analysis will look into the effects of socio-demographic variables such as age, gender and ethnicity on costs. Secondly, I will look at the effects of exposure characteristics on costs. I will firstly explore unadjusted costs per service and participant group category. Following this, I will conduct analysis in the form of several two-stage GLM or OLS models depending on the type of data distribution in order to predict costs. I will conduct the analysis on the sample as a whole (N=230) and for each participant group per each cost category.

Finally, in a set of models I will explore the factors associated with being diagnosed with PTSD by using ICD-10 classification criteria. I chose this particular criterion instead of DSM-IV due to its wider scope, which will enhance the number of participants included in the analysis. I will use the same criteria of model allocation as in the previous two analyses.

5.3 Effects of socio-demographic and exposure characteristics on costs

In an attempt to identify and describe cost drivers I will start by exploring the effects of socio-demographic and exposure characteristics by looking at the sample as a whole. Due to the design of the study (discussed in Chapter 3), analysis involving the whole sample was limited in its scope as different participant sub-groups were followed-up with different outcome measures.

As shown in Table 5.1, costs were not normally distributed due to a number of participants reporting zero costs and a few participants reporting very high costs, resulting in an asymmetric cost distribution. Variables and missing values used in the model are listed in Table 5.2.

Table 5.1 One-sample Kolmogorov-Smirnov tests for normality of the cost per month distributions

Variable	Z	p
Total cost per month	5.336	0.00
Direct costs per month	5.75	0.00
Work costs per month	5.92	0.00

Table 5.2 Number of missing values per variables

Variable	Overall sample size N=230	N missing	% missing
Age		7	3
Gender		0	0
White British ethnicity		36	15.7
Median week salary		13	5.7
Months since LB		0	0
Q1. Injured in LB		21	9.1
Q2. You felt you might be injured or killed?		23	10
Q3. You saw someone who was injured or killed?		26	11.3
Q4. A family member or a close friend was killed?		26	11.3
Q5. A family member or a close friend was injured?		25	10.9
Q6. You felt a family member might be injured or killed?		25	10.9
Q7. You personally witnessed effects of LB?		24	10.4
Total cost per month		0	0

A comprehensive imputation model, as advised by STATA analysis manual (2010), “must include all predictors relevant to the missing-data mechanism, and it must preserve all data characteristics likely to be explored at the analysis stage” (STATA MI help guideline, 2010, p. 8). I have therefore included all variables that I thought had a relevant relationship with the prediction of the missing values, as listed in Table 5.2, even though by doing so there is a risk of arriving at artificially-inflated regression coefficients due to ‘double-counting’ of the variables, by using them both in the imputation and prediction model. Although the percentage of missing values is not very high, as Table 5.2 shows, it is still important to interpret weak statistically significant coefficients cautiously.

Two variables, total monthly cost and days since the LB, were not normally distributed and as MI uses logistical regression, which relies on the normal distribution inferences, I used logarithmic transformations of both variables in order to approximate a normal distribution. Both variables were re-transformed again after IM to their original values by using Duan’s smearing estimator that equals the mean of the anti-log of the residuals (Duan, 1983).

I have expressed costs in a costs-per-month form, estimated in order to account for different time points of data collection as evaluation interviews took place over a period ranging from 13 to 38 weeks since the LB. Prior to the data analysis, I explored the relationship between independent variables and costs by using correlation for scale variables and analysis of variance for categorical variables. The only significant relationship was found between being injured and total costs per month, with on average statistically higher costs for participants who have been injured ($F=5.27$, $df=1$, $p<0.05$).

As the distribution of total cost per month is significantly different from normal, $Z(209)=4.978$, $P<0.001$, I applied the two-stage model with logarithmic transformation and gamma distribution family. The results of the two-stage model are reported in Table 5.3. A significance level of around 10% was used. Analysis was conducted on 230 individuals followed-up as a part of the evaluation of the ST programme. Analysis of cost variations offers a relatively

narrow view into factors that may be associated with the costs of the LB exposure, as only data on service use, socio-demographic characteristics and exposure details were available for the whole sample. This was due to the nature of the sampling and data collection protocol in the evaluation, described in greater detail in Chapter 3. However, this analysis still offers an interesting insight into how costs were distributed between participant categories before focusing the analysis on the particular participant sub-groups.

The Park test confirmed that this was the appropriate choice of family distribution and transformation, as $\Lambda=1.94$ (1.71-2.1). The model suggests that, after controlling for other factors, age, female gender, ethnicity group, injury, and feeling the threat of being killed or injured are factors associated with higher costs. In order to calculate predicted monthly costs I multiplied the regression coefficients for people who generated costs with the probabilities of having a non-zero cost. On average, injured participants reported three times higher costs than those who did not report injuries (£717.80 vs. £206.91). Women reported on average double costs in comparison to men (£432.85 vs. £208.17), and participants who were not white British had double the costs of those who were (£480.85 vs. £249.07).

Table 5.3 Two-part model of factors associated with (i) reporting costs and (ii) total costs per month among those who used services in connection to exposure to the LB

<i>Potentially associated factors</i>	<i>Logistic regression of total costs per month due to the LB</i>	<i>GLM of total costs per month due to the LB</i>
	<i>N=230 observations</i>	<i>N=209 observations</i>
	<i>Odds ratio</i>	<i>Coefficient</i>
	<i>(95% confidence interval)</i>	<i>(95% confidence interval)</i>
Age	0.98 (0.92, 1.02)	0.03*** (0.01, 0.04)
Males relative to females	0.38 (0.26, 0.66)	-0.83*** (-1.17, -0.58)
White British relative to other ethnic categories	0.26* (0.14, 1.23)	-0.63* (-1.36, 0.10)

Q1. Being injured relative to not being injured	6.23 (0.61, 9.71)	0.92*** (0.62, 1.68)
Q2. You felt like you might be injured or killed?	3.85 (1.85, 30.33)	0.58*** (0.32,0.84)
Q3. You saw someone who has been injured or killed?	2.42 (1.22, 9.48)	0.24 (-0.67, 0.67)
Months since LB	1.13** (0.02,2.20)	0.00 (-0.01, 0.02)
Constant	-	4.59*** (3.90, 5.29)
Link function	-	Log
Distributional family	-	Gamma
Link test p-value	-	
Pearson's chi-squared test p-value	0.99	
Hosmer-Lemeshow chi-squared test p-value	0.76	
Likelihood ratio chi-squared p-value	0.00	
Per cent correctly classified	90.87%	

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

These cost predictions must be interpreted with caution. The first potential problem lies in the skewed distribution of costs and the fact that cost outliers might affect prediction, which is reflected in large residuals, even though I have employed an appropriate family distribution and transformation. Although the data were analysed in line with the theoretical background, there are potentially many factors contributing to the variation for which data were not collected for the whole sample, and therefore cannot be controlled for in this analysis. Thus this model risks offering a 'narrow' view of the pattern of cost variation.

Heterogeneity in the participant sample is another feature of this study. Heterogeneity is present partially due to the bombings being a random traumatic event, with involvement in the bombings potentially being the only common characteristic of the individuals involved. Secondly, heterogeneity of the sample is introduced by the study sampling procedure, as the sample comprises individuals who for different reasons used or did not use the ST

programme. There is a distinction even among the ST programme users, as only a part of this group received treatment after screening and assessment, while others were screened and assessed only. Finally, for evaluation purposes, a third group of participants was introduced based on the convenience sample of people who did not use the programme for various reasons.

As a consequence, the study sample resembles a 'patchwork' of participants with different needs and service experiences after the LB, with the common underlying factor being that they experienced the bombings. Therefore, I wanted to explore heterogeneity and control for differences between participants in further analysis and so divided participants into three groups that represented their role in the ST programme, linking the analysis with the evaluation sampling strategy. I will start with looking at the unadjusted costs and proceed to the cost model analysis. I explored differences between participants' groups per cost category in a series of two-stage GLM models for each service type, as costs distributions were not normally distributed, as shown in Table 5.1.

As illustrated in Figure 5.1, participants with the highest unadjusted total average costs, including productivity loss and service use costs, are the ones who received treatment within the ST programme, when compared to those who did not use the programme or were only screened and assessed. Programme non-users reported double unadjusted average service use costs when compared to the screen and assessed group, while both groups reported similar average productivity loss and total costs.

Figure 5.1 Unadjusted average costs by cost type and participant group

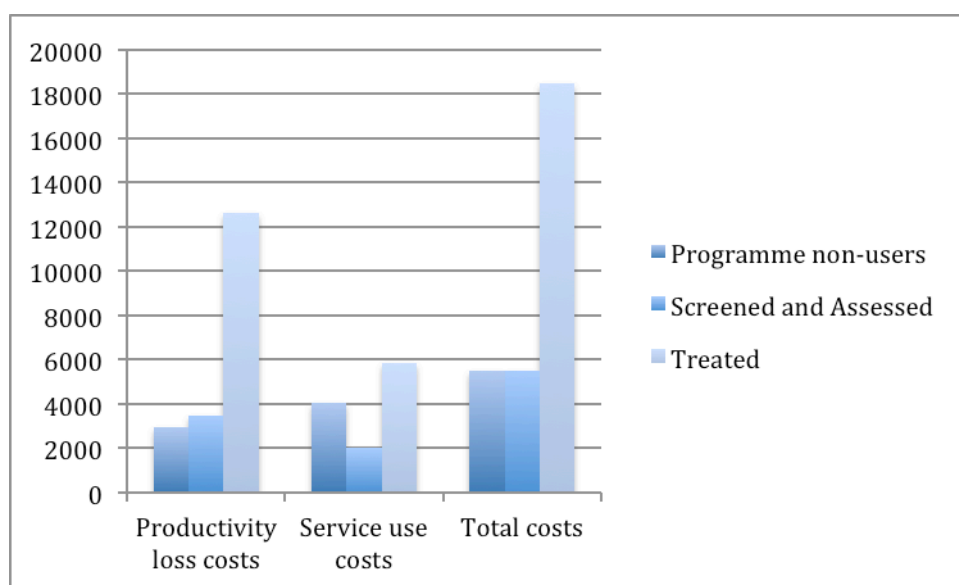


Table 5.4 presents a two-stage GLM model for service costs. Factors associated with having a higher odds of reporting costs were being of non-white British ethnic origin, feeling one might be injured or killed, and seeing someone being injured or killed. Being injured in the bombings and receiving treatment within the ST programme were significant predictors of reporting service use costs. Although participants who did use the ST programme appeared to report higher costs than those who did not use the programme (453.87 vs. 136.33) the difference was not statistically significant. However, participants who received treatment under the ST programme, while controlling for other factors, reported significantly higher costs than the rest of the participants. On average, treated participants reported up to four times higher costs in comparison to other participants (£680.98 per month in comparison to £148.78 per month at 2007-08 prices).

Table 5.4 Two-stage GLM model for service use costs associated with the LB exposure

<i>Potentially associated factors</i>	<i>Logistic regression of costs per month due to the LB</i>	<i>GLM of costs per month due to the LB</i>
	<i>N=230 observations</i>	<i>N=209 observations</i>
	<i>Odds ratio</i>	<i>Coefficient</i>
	<i>(95% confidence interval)</i>	<i>(95% confidence interval)</i>
Age	0.99 (0.92, 1.02)	0.02 (-0.004, 0.061)
Males relative to Females	0.52 (0.11, 1.17)	-0.58* (-1.47, -0.18)
White British relative to Other ethnic categories	0.26* (0.14, 1.23)	-0.13 (-1.36, 0.10)
Q1. Being injured relative to Not being injured	3.80 (0.61, 9.71)	1.53*** (0.62, 1.68)
Q2. You felt like you might be injured or killed?	9.30** (1.85, 30.33)	-0.20 (-0.22, 1.08)
Q3. You saw someone who has been injured or killed?	3.20** (1.22, 9.48)	-0.50 (-0.67, 0.67)
Did not use ST programme	-	-0.00 (-1.16, 0.88)
Treated	-	0.63*** (0.19, 1.85)
Months since LB	1.13** (1.01, 1.30)	0.94 (2.93, 6.66)
Constant	-	4.01*** (2.48, 5.75)
Link function	-	Log
Distributional family	-	Gamma
Link test p-value	-	
Pearson's chi-squared test p-value	0.99	
Hosmer-Lemeshow chi-squared test p-value	0.42	
Likelihood ratio chi-squared p-value	0.00	
Per cent correctly classified	74.65%	

* p<0.10; ** p<0.05; *** p<0.01

In the next step I wanted to compare the use of services between the groups *excluding* the cost of the ST programme. As a result, the difference in

service costs between programme users and non-users was no longer found. Furthermore, this analysis showed that gender, ethnicity, injury, helplessness and horror are significant predictors of costs. In more detail: women were twice as likely to report service use costs, and so were people from non-white British ethnic backgrounds. Being injured in the bombings and being of female gender were significant predictors for service use, as presented in Table 5.5.

Table 5.5 Two-stage GLM model for service use costs excluding the ST programme costs associated with exposure to the LB

<i>Potentially associated factors</i>	<i>Logistic regression of costs per month due to the LB</i>	<i>GLM of costs per month due to the LB</i>
	<i>N=230 observations</i>	<i>N=182 observations</i>
	<i>Odds ratio</i>	<i>Coefficient</i>
	<i>(95% confidence interval)</i>	<i>(95% confidence interval)</i>
Age	1.00 (0.97, 1.04)	0.01 (-0.004, 0.061)
Males relative to Females	0.46** (0.21, 1.01)	-0.44* (-1.47, -0.18)
White British relative to Other ethnic categories	0.46* (0.19, 1.10)	-0.00 (-1.36, 0.10)
Q1. Being injured relative to Not being injured	8.17*** (1.85,36.14)	2.02*** (0.62, 1.68)
Q2. You felt like you might be injured or killed?	2.30* (0.85, 6.310)	-0.10 (-0.22, 1.08)
Q3. You saw someone who has been injured or killed?	0.91 (0.32, 2.23)	-0.43 (-0.67, 0.67)
Median weekly wage	0.99 (0.99, 1.00)	0.00 (-0.00, 0.002)
Did not use ST programme	-	-0.29 (-1.16, 0.88)
Treated	-	-0.11(0.19, 1.85)
Months since LB	1.04 (0.99, 1.11)	-0.00 (2.93, 6.66)
Constant	-	3.63*** (2.48, 5.75)
Link function	-	Log
Distributional family	-	Gamma
Link test p-value	-	
Pearson's chi-squared test p-value	0.96	

Hosmer-Lemeshow chi-squared test p-value	0.41
Likelihood ratio chi-squared p-value	0.00
Per cent correctly classified	84.65%

* p<0.10; ** p<0.05; *** p<0.01

Figure 5.2 presents the percentages of participants for the most frequently-used health service categories, presented separately for each participant group. The treated group has the highest percentage usage for most health care categories, although for the GP and A&E categories all three groups reported similar patterns.

Figure 5.2 Percentages of participants using health care services

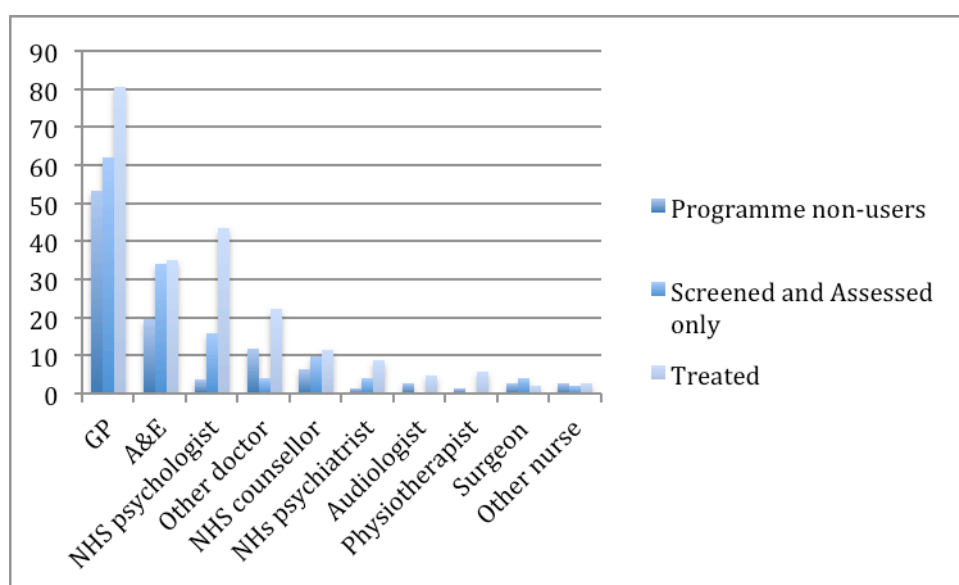


Table 5.6 Two-stage GLM model for the health care service costs associated with exposure to the LB

<i>Potentially associated factors</i>	<i>Logistic regression of costs per month due to the LB</i>	<i>GLM of costs per month due to the LB</i>
	<i>N=230 observations</i>	<i>N=175 observations</i>
	<i>Odds ratio</i>	<i>Coefficient</i>
	<i>(95% confidence interval)</i>	<i>(95% confidence interval)</i>
Age	1.01 (0.98, 1.05)	-0.01 (-0.04, 0.01)
Males relative to Females	0.47* (0.22, 1.03)	-0.18* (-0.64, 0.28)
White British relative to Other ethnic categories	0.36** (0.15, 0.87)	-0.40 (-0.89, 0.08)
Q1. Being injured relative to Not being injured	7.57*** (2.07,27.70)	1.14*** (0.65, 1.63)
Q2. You felt like you might be injured or killed?	2.45* (0.95, 6.33)	0.15 (-0.42, 0.70)
Q3. You saw someone who has been injured or killed?	1.06 (0.45, 2.49)	-0.22 (-0.77, 0.34)
Median weekly wage	0.99 (0.99, 1.00)	-0.00 (-0.00, 0.00)
Did not use ST programme	-	-0.01 (-0.06, 0.02)
Treated	-	1.19*** (0.60, 1.75)
Months since LB	1.06** (1.00 1.13)	-0.01 (-0.03, 0.26)
Constant	-	3.03*** (1.57, 4.45)
Link function	-	Log
Distributional family	-	Gamma
Link test p-value	-	
Pearson's chi-squared test p-value	0.92	
Hosmer-Lemeshow chi-squared test p- value	0.47	
Likelihood ratio chi-squared p-value	0.00	
Per cent correctly classified	80.35%	

* p<0.10; ** p<0.05; *** p<0.01

As shown in Table 5.6, health care costs were associated with being injured and with receipt of treatment within the ST programme. Being injured

was associated with seven times higher odds of reporting costs. White British participants were less likely than participants from other ethnic backgrounds to report health care service costs.

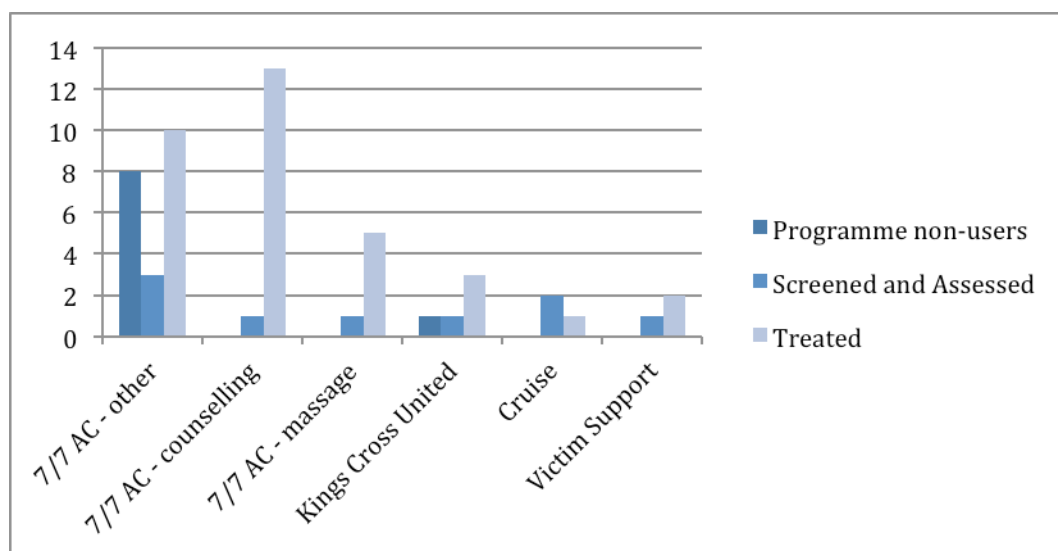
Table 5.7 Two-stage GLM model for medication costs associated with exposure to the LB

<i>Potentially associated factors</i>	<i>Logistic regression of costs per month due to the LB</i>	<i>GLM of costs per month due to the LB</i>
	<i>N=230 observations</i>	<i>N=68 observations</i>
	<i>Odds ratio</i>	<i>Coefficient</i>
	<i>(95% confidence interval)</i>	<i>(95% confidence interval)</i>
Age	1.02 (0.99, 1.05)	0.04 (-0.04, 0.01)
Males relative to Females	0.34** (0.16, 0.74)	-0.40 (-1.90, 1.09)
White British relative to Other ethnic categories	0.71 (0.29, 1.73)	-1.28* (-2.70, 0.13)
Q1. Being injured relative to Not being injured	5.70*** (2.65,12.26)	0.01 (-1.28, 1.30)
Q2. You felt like you might be injured or killed?	5.24*** (2.26,12.11)	-0.19 (-1.82, 1.45)
Q3. You saw someone who has been injured or killed?	0.50 (0.22, 1.15)	0.12 (-1.47, 1.74)
Median weekly wage	0.99 (0.99, 1.00)	0.00 (-0.00, 0.00)
Did not use ST programme	-	0.74 (-1.83, 3.02)
Treated	-	0.11 (-1.29, 1.55)
Months since LB	1.05* (0.99 1.11)	0.01 (-0.06, 0.76)
Constant	-	-1.39 (5.59, 1.81)
Link function	-	Log
Distributional family	-	Gamma
Link test p-value	-	
Pearson's chi-squared test p-value	0.86	
Hosmer-Lemeshow chi-squared test p-value	0.58	
Likelihood ratio chi-squared p-value	0.00	

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

The results presented in Table 5.7 show that white British participants reported lower medication costs than participants from other ethnic groups. Again, being of female gender, being injured, witnessing someone's death or injury were characteristics associated with higher odds of reporting medication costs.

Figure 5.3 Percentages of participants using voluntary sector services



Costs associated with use of voluntary sector services were predicted by witnessing death or injury, with injured participants being up to three times more likely to use voluntary sector services. The estimated model is shown in Table 5.8.

Table 5.8 Two-stage GLM model for voluntary services costs associated with exposure to the LB

<i>Potentially associated factors</i>	<i>Logistic regression of costs per month due to the LB</i>	<i>GLM of costs per month due to the LB</i>
	<i>N=230 observations</i>	<i>N=39 observations</i>
	<i>Odds ratio</i>	<i>Coefficient</i>
	<i>(95% confidence interval)</i>	<i>(95% confidence interval)</i>
Age	0.98 (0.95, 1.02)	-0.01 (-0.06, 0.03)
Males relative to Females	0.63 (0.29, 1.37)	0.61 (-0.42, 1.65)
White British relative to Other ethnic categories	1.18 (0.48, 2.93)	0.02 (-1.25, 1.29)
Q1. Being injured relative to Not being injured	3.56*** (1.57,8.07)	-0.31 (-1.97, 1.35)
Q2. You felt like you might be injured or killed?	0.77 (0.32,1.85)	1.18*** (0.57, 3.05)
Q3. You saw someone who has been injured or killed?	0.63 (0.25, 1.51)	-0.70 (-2.61, 1.19)
Median weekly wage	0.99 (0.99, 1.00)	-0.00 (-0.00, 0.00)
Did not use ST programme	-	-0.80 (-2.38, 2.82)
Treated	-	-0.88 (-2.29, 0.91)
Months since LB	1.07** (1.00 1.14)	-0.07** (-0.13, 0.00)
Constant	-	5.30 (2.79, 7.81)
Link function	-	Log
Distributional family	-	Gamma
Link test p-value	-	
Pearson's chi-squared test p-value	0.79	
Hosmer-Lemeshow chi-squared test p-value	0.59	
Likelihood ratio chi-squared p-value	0.00	
Per cent correctly classified	89.52%	

* p<0.10; ** p<0.05; *** p<0.01

Figure 5.4 Percentage of participants using private sector services

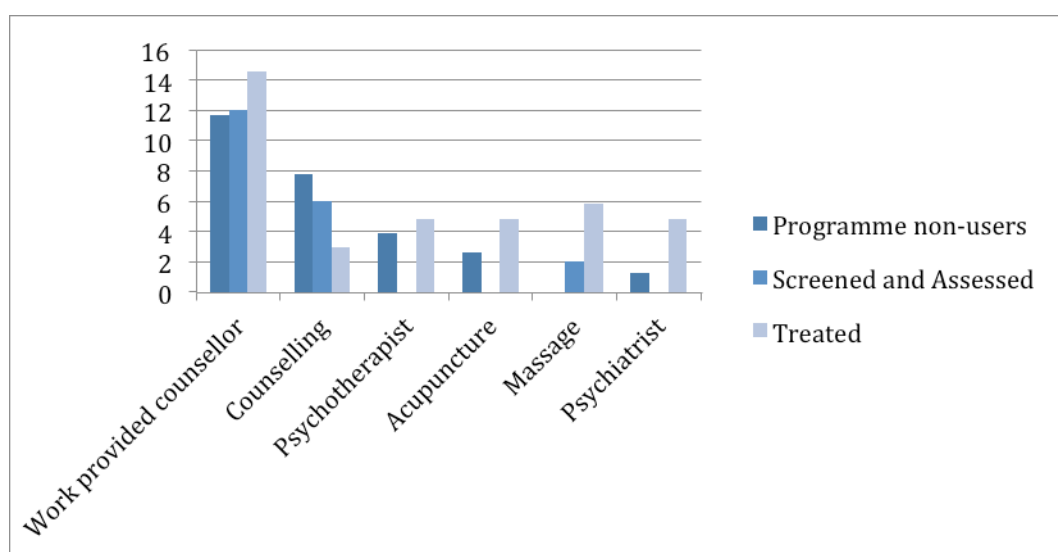


Figure 5.4 shows the most frequently-used services provided by the private sector. Mental health services are prominently represented, with counselling being used by the largest number of participants. Again, treatment group participants used more services in comparison to other participants. The costs of private sector services were also predicted by being injured, with women being three times more likely and injured participants two times more likely to report such costs (Table 5.9).

Table 5.9 Two-stage GLM model for private sector services costs associated with exposure to the LB

Potentially associated factors	Logistic regression of costs per month due to the LB	GLM of costs per month due to the LB
	N=230 observations	N=82 observations
	Odds ratio	Coefficient
	(95% confidence interval)	(95% confidence interval)
Age	0.99 (0.96, 1.02)	0.00 (-0.2, 0.03)
Males relative to Females	0.39** (0.21, 0.73)	-0.45 (-1.02, 0.11)
White British relative to Other ethnic categories	0.82 (0.44, 1.53)	0.13 (-0.40, 0.66)

Q1. Being injured relative to Not being injured	2.00** (1.02,3.90)	0.47* (-0.07, 1.01)
Q2. You felt like you might be injured or killed?	1.41 (0.72,2.73)	0.30(-0.47, 3.05)
Q3. You saw someone who has been injured or killed?	0.75 (0.35, 1.61)	0.13 (-0.45, 0.70)
Median weekly wage	1.00 (0.99, 1.00)	0.00 (-0.00, 0.00)
Did not use ST programme	-	0.96** (0.13, 1.78)
Treated	-	0.30 (-0.50, 1.12)
Months since LB	1.01** (0.95 1.04)	-0.03 (-0.06, 0.02)
Constant	-	2.59*** (0.88, 4.16)
Link function	-	Log
Distributional family	-	Gamma
Link test p-value	-	
Pearson's chi-squared test p-value	0.83	
Hosmer-Lemeshow chi-squared test p-value	0.62	
Likelihood ratio chi-squared p-value	0.00	
Per cent correctly classified	84.52%	

* p<0.10; ** p<0.05; *** p<0.01

Table 5.10 Two-stage GLM model for hospitalisation costs associated with exposure to the LB

<i>Potentially associated factors</i>	<i>Logistic regression of costs per month due to the LB</i>	<i>GLM of costs per month due to the LB</i>
	<i>N=230 observations</i>	<i>N=24 observations</i>
	<i>Odds ratio</i>	<i>Coefficient</i>
	<i>(95% confidence interval)</i>	<i>(95% confidence interval)</i>
Age	1.00 (0.96, 1.05)	0.06 (-0.2, 0.03)
Males relative to Females	0.72 (0.21, 2.73)	0.89 (-1.02, 0.11)
White British relative to Other ethnic categories	0.74 (0.24, 2.53)	0.69 (-0.40, 0.66)
Q1. Being injured relative to Not being injured	16.56*** (4.02, 55.90)	0.82 (-0.07, 1.01)

Q2. You felt like you might be injured or killed?	1.24 (0.37,4.07)	-1.40(-0.47, 3.05)
Q3. You saw someone who has been injured or killed?	0.75 (0.18, 3.06)	-0.79 (-0.45, 0.70)
Median weekly wage	0.99 (0.99, 1.00)	-0.00 (-0.00, 0.00)
Did not use ST programme	-	0.85 (0.13, 1.78)
Treated	-	0.48 (-0.50, 1.12)
Months since LB	1.01 (0.93 1.09)	-0.01 (-0.06, 0.02)
Constant	-	3.19 (0.88, 4.16)
Link function	-	Log
Distributional family	-	Gamma
Link test p-value	-	
Pearson's chi-squared test p-value	0.73	
Hosmer-Lemeshow chi-squared test p-value	0.65	
Likelihood ratio chi-squared p-value	0.00	
Per cent correctly classified	81.42%	

* p<0.10; ** p<0.05; *** p<0.01

Unsurprisingly, hospitalisation costs are associated with being injured, and those participants were up to 16 times more likely to report hospitalisation costs (Table 5.10).

Table 5.11 Two-stage GLM model for productivity loss costs associated with exposure to the LB

<i>Potentially associated factors</i>	<i>Logistic regression of costs per month due to the LB</i>	<i>GLM of costs per month due to the LB</i>
	<i>N=230 observations</i>	<i>N=137 observations</i>
	<i>Odds ratio</i>	<i>Coefficient</i>
	<i>(95% confidence interval)</i>	<i>(95% confidence interval)</i>
Age	1.00 (0.97, 1.05)	0.03* (-0.00, 0.06)
Males relative to Females	0.54** (0.36, 0.97)	-0.75 **(-1.52,- 0.00)
White British relative to Other ethnic	0.92 (0.47, 1.53)	-0.77* (-1.56, 0.02)

categories		
Q1. Being injured relative to Not being injured	1.56*(0.98,3.90)	0.39 (-0.47, 1.27)
Q2. You felt like you might be injured or killed?	1.54 (0.78,2.92)	0.13(-0.97, 1.19)
Q3. You saw someone who has been injured or killed?	0.85 (0.41, 1.71)	0.39 (-0.41, 1.21)
Median weekly wage	1.00* (0.99, 1.00)	0.00 (-0.00, 0.00)
Did not use ST programme	-	0.17 (-0.91, 1.28)
Treated	-	0.90* (-0.04, 1.85)
Months since LB	0.99 (0.95, 1.03)	-0.00 (-0.05, 0.03)
Constant	-	3.79*** (1.92, 5.66)
Link function	-	Log
Distributional family	-	Gamma
Link test p-value	-	
Pearson's chi-squared test p-value	0.69	
Hosmer-Lemeshow chi-squared test p-value	0.61	
Likelihood ratio chi-squared p-value	0.00	
Per cent correctly classified	84.25%	

* p<0.10; ** p<0.05; *** p<0.01

As presented in Table 5.11, higher productivity loss costs are predicted by being of female gender. Moreover, women were more likely to report costs in comparison to men. The results presented in this section are not unexpected or surprising. High costs of service use and productivity loss associated with mental health problems in general, and more particularly with anxiety disorders due to trauma exposure, have been reported in previous studies, as discussed in Chapter 2. Nor it is surprising that a larger proportion of the costs is associated with productivity loss in comparison to service use cost. Factors associated with higher service use, and consequently costs highlighted by the models shown above are being of female gender, having a non-white British background, experiencing injury, and fear and hopelessness. These are well-known risk factors for developing PTSD identified by the literature, as reviewed in Chapter 2.

Analysis suggests that participants with the highest overall monthly costs are those with mental health needs identified by the ST programme. Health services costs have the same pattern. However, when the costs of the ST programme are excluded, there is no longer a statistical difference in service costs between programme users and non-users while holding other factors constant. In fact, when looking at the services provided by the private sector solely, participants who did not use the ST programme reported statistically higher costs compared to programme users. This suggests that (some) individuals who did not use the ST programme may have sought treatment privately.

5.4 Factors associated with being diagnosed with PTSD

As found from the Literature Review, PTSD is a common mental health disorder following exposure to traumatic events with a significant impact on individuals and society as a whole. Evaluation of the LB mental health response is an opportunity to describe and measure the impact of PTSD in terms of costs, and cost function analysis provides a useful tool. This section will explore links between PTSD and costs in two separate analyses on a sub-sample of participants who were assessed within the ST programme. The first model will assess potential risk factors associated with being diagnosed with PTSD by using PTSD ICD-10 criteria, while the second one will examine cost predictors. PTSD is the predominant primary diagnosis within the sub-sample used in this PhD study, as well as among the original sample of ST programme users. In total, 77 participants were diagnosed with PTSD; 67 were diagnosed under both DSM-IV and ICD-10 criteria (64%) and a further 10 (10%) participants received PTSD diagnosis based on ICD-10 criteria only. Other reported diagnoses were travel phobia (6%), adjustment disorder (6%), complicated grief (5%) and depression (2%).

Table 5.12 lists all variables explored in the prediction model, with the number and percentage of missing values. I used MI to estimate missing values in the same manner as described in the previous section by using SPSS 17's automatic MI option that accommodates the imputation model to the pattern of

the missing data. In the imputation model I included all variables that I will later use in the analysis including the outcome variables used only as a predictor.

Table 5.12 Variables with missing values

Variable N=117	Overall sample size	N missing	% missing
Age		0	0
Gender		0	0
White British ethnicity		11	9.4
Median week salary		6	5.1
Months since LB		3	2.6
Q1. Injured in LB		14	12
Q2. You felt you might be injured or killed?		15	12.8
Q3. You saw someone who was injured or killed?		17	11.3
Variable N=117	Overall sample size	N missing	% missing
N of previous trauma		14	11.3
PDS		13	10.9
BDI		13	10.9
EQ5D		37	10.4
Total cost per month		0	0
Screened positive at 1st screener		0	0
N of screeners		0	0
PTSD ICD-10		0	0

The model explores predictors of being diagnosed with PTSD ICD-10 primary diagnosis and the analysis included all 117 participants who were assessed during a structured clinical interview for DSM-IV Axis I Disorders (SCID), which is commonly used to diagnose PTSD (First et al, 1996). Statistically significant factors identified by the model are witnessing death or

injury and feeling one will die or sustain injury. Participants with those experiences were four to five times more likely to have primary diagnosis of PTSD ICD-10 in comparison to the other participants. This finding is not surprising as witnessing injury and death, and experiencing helplessness and horror are components of criterion A as defined by DSM-IV (APA, 1994).

Two further statistically significant factors were the number of screeners and being screened positive on the first screen. The more screeners an individual had, the less likely they were to receive a diagnosis, which can be interpreted as showing that the screening process was sensitive and discriminated well between participants with mental health needs and those without, as on average participants were sent to assessment and treatment on their first screener. Participants who screened positive at the first screener were five times more likely to receive the PTSD diagnosis in comparison to other participants. However, this effect is probably due to collinearity between screening positive and assessment, and consequently contributes little to the interpretation of the equation.

Interestingly, two variables I expected to have an association with receiving a PTSD ICD-10 primary diagnosis, that is, having a premorbid condition and the number of previous trauma experiences, were not significant. Nor were demographic variables such as gender or ethnic background.

Table 5.13 Potential risk factors associated with being diagnosed with PTSD ICD-10 criteria on a sample of the ST programme users

<i>Potentially associated factors</i>	<i>Odds ratio</i>
<i>Logistic regression N=117 observations</i>	<i>(95% confidence interval)</i>
Age	1.00 (0.92, 1.06)
Males...relative to females	0.72 (0.08, 1.23)
White British...relative to other ethnic categories	0.89 (0.37, 5.34)
Q1. Being injured...relative to not being injured	1.55 (0.26, 5.71)
Q2. You felt like you might be injured or killed?	4.00** (0.09, 15.45)
Q3. You saw someone who has been injured or killed?	5.61*** (0.12, 49.48)

Median weekly wage	1.00 (0.99, 1.00)
Assessment date	1.06 (0.99, 1.20)
N of previous trauma	0.95 (0.41, 1.70)
Premorbid condition...relative to No premorbid condition	1.5 (0.29, 8.06)
N of screeners	0.21*** (0.07, 0.58)
Screened positive at 1 st screener	5.11* (0.80, 32.54)
Pearson's chi-squared test p-value	0.41
Hosmer-Lemeshow chi-squared test p value	0.51
Likelihood ratio chi-squared p-value	0.00
Per cent correctly classified	82.91%

* p<0.10; ** p<0.05; *** p<0.01

The next model, presented in Table 5.14, examines the impact on costs of participant and exposure characteristics measured at the screening and assessment point. I used a GLM model with a gamma distribution and log transformation due to the skewed distribution. There was no need for a two-stage model as all participants had non-zero costs. Younger age, PTSD ICD-10 primary diagnosis, earlier assessment date and non-white British background were predictors of higher average monthly costs at the follow-up point. Translated to actual costs, participants with PTSD ICD-10 primary diagnosis reported up to three times higher costs than other participants (£628 vs. £252), and non-white British participants reported double monthly costs in comparison to the rest of the sample (£692 vs. £392).

Table 5.14 Generalised linear model of factors potentially associated with reporting costs in connection to exposure to the LB on a sample of the ST programme users

<i>Potentially associated factors</i>	<i>Coefficient</i>
<i>GLM, N=117 observations</i>	<i>(95% confidence interval)</i>
Age	0.02* (0.01, 0.04)
Males...relative to females	-0.14 (-0.27, 0.23)
White British...relative to other ethnic categories	-0.45* (-0.54, -0.04)

Q1. Being injured...relative to not being injured	0.17 (-0.14, 0.18)
Q2. You felt like you might be injured or killed?	-0.05 (-0.21, 0.31)
Q3. You saw someone who has been injured or killed?	0.57** (0.18, 0.73)
Median weekly wage	0.00 (-0.00, 0.00)
Assessment date	-0.00** (-0.001, 0.00)
N of previous trauma	0.19 (-0.27, 0.24)
Premorbid condition	-0.72 (-0.93, 0.17)
Months since LB	-0.02 (-0.23, 0.37)
PTSD ICD-10	0.62** (0.28, 0.87)
Constant	5.62*** (1.44, 6.18)
Link function	Log
Distributional family	Gamma

* p<0.10; ** p<0.05; *** p<0.01

Interpretation of the model is challenged by intercorrelations between some of the independent variables, namely PTSD and potential risk factors such as exposure variables (Q2 and Q3), though, interestingly, the model on risk factors for PTSD presented in Table 5.13 did not show a link between ethnicity and PTSD as expected. Although intercorrelations do not affect the predictive power of the model as a whole (Knapp et al., 1995) it is difficult to separate the effects of those individual variables. It appears, however, that costs were higher for individuals who were assessed earlier in the programme, individuals with PTSD ICD-10 diagnosis and participants who saw someone being injured or killed. The reasons behind why participants who were assessed earlier in the programme reported higher costs are discussed in greater detail in Chapters 6 and 7. Finding a link between reporting costs and PTSD diagnosis was expected as the Literature Review documented that PTSD diagnosis is associated with increased service use, various physical and mental health comorbidities and productivity loss costs. Seeing someone being injured or killed is a risk factor for PTSD, and the model presented in Table 5.13 confirmed expected significant association between PTSD diagnosis and this variable, hence association between reporting costs and witnessing death and/or injury is explained by intercorrelations.

5.5 Summary

In this chapter I explored relationships between costs and the following variables: participants' characteristics, exposure factors and the type of the services they have used. The cost function approach is a very useful tool in this kind of exploration, as it enables the analysis to show the relationship between variables of interest while keeping other variables constant. The main cost drivers identified in the analysis on the whole sample of individuals exposed to the LB were female gender, being in a non-white British ethnicity group, experiencing injury, age and feeling one might be killed and/or injured. Participants who had received treatment within the programme reported on average three times higher costs in comparison to the rest of participants, while women and participants of non-white British origin reported on average double costs compared to men and the white ethnic group, respectively.

When comparing health service use between programme users and non-users, and excluding the ST programme costs, the difference in overall reported costs was no longer evident between the groups. Again, the analysis confirmed gender, ethnicity, injury and experiencing helplessness and horror as significant cost predictors. These results were consistent for health care costs and medication costs, while for private sector-provided services, females and people who had been injured were twice as likely to report costs compared to other people.

Lastly, models using data only for the ST subsample looked first at factors associated with being diagnosed with PTSD ICD-10, and identified that witnessing death or injury, and feeling one might be injured or killed as significant, with those participants being four times more likely to receive the diagnosis. Participants with PTSD ICD-10 diagnosis reported up to three times higher costs in comparison to the rest of the sample. A second model for the ST group found that two well-known risk factors for PTSD, younger age and non-white British background, were significantly associated with higher costs.

This analysis has been constrained by the study design (including the observational nature of the study, alongside the sampling strategy and size), but suggests one observation and a possible conclusion. First, the identified factors associated with higher mental health needs and service use are well known from the literature as predictors of PTSD. Second, this data possibly suggests that the ST programme was successful in identifying participants with higher mental health needs and providing them with treatment. This is supported by the finding that the more screeners an individual had the less likely they were to be diagnosed with PTSD, which indicates that the screening process was sensitive, and under the assumption that higher costs are positively associated with higher mental health needs, that individuals treated within the programme experienced higher mental health needs in comparison to the rest of the sample. The increased total cost of treated individuals possibly suggests that they were more severely affected than the programme non-users and individuals who were screened only. However it is difficult to know from the available data how and if the ST programme made any economic difference to this group, such as averted high future costs associated with chronic PTSD and possible comorbid disorders, or if it had reduced productivity and unemployment.

In my view, the biggest contribution of this chapter is not in producing robust cost predictions and models, but in describing challenges encountered in analysing cost data in the context of an observational study conducted as a part of the wider evaluation. Nevertheless, while acknowledging the methodological difficulties, this is an exciting and unique dataset and the findings offer a perfect learning opportunity for future studies.

Costs described in this chapter will serve as a foundation for a cost-effectiveness analysis of the ST programme described in Chapters 6 and 7.

Chapter 6 Comparing costs and outcomes of the ST programme

6.1 Introduction

The ST programme was an innovative mental health approach after a major traumatic event on a large scale and was a rare example of the direct translation of evidence-based recommendations from previous literature on putting a mental health response policy into practice. In order to inform policies on mental health responses after major traumatic events as well as usual practice on treating PTSD, it was of importance to conduct an economic evaluation of the ST programme. However, as this chapter will demonstrate, it is a challenging task to conduct a robust economic evaluation given the real-world context in which the ST programme was delivered.

This chapter brings together work conducted in the previous two chapters into a new and integrated approach which, to cite a familiar Gestalt principle, is greater than the sum of its parts (Hothersall, 2004).

To elaborate, Chapters 4 and 5 have set the scene for the economic evaluation, which is the main subject of this and the subsequent chapter. In Chapter 4, I identified all the services used by the sample of individuals affected by the LB and associated costs to the individuals and society as a whole. Following on from that, in Chapter 5 I explored costs and outcomes variations, linked to individuals' socio-demographic characteristics, the nature of their involvement in the LB and the extent of their use of the ST programme. The aim of this chapter is to report the economic evaluation in the context of the mental health response, within the framework of an observational study, and from a societal perspective. The chapter will also discuss a number of methodological and econometric challenges and the ways I sought to address them. As discussed in Chapter 3, I identified three potential comparator groups for the economic evaluation. I will present the economic evaluation of the ST programme in two chapters. Chapter 6 will present analysis comparing ST users with participants who did not use the programme. In addition, I will compare people who were treated within the programme to those who were screened and assessed only. Following on from these analyses, Chapter 7 will

compare early and late treatment groups within the ST programme, using cost-effectiveness analysis.

The guiding idea behind this chapter is to discuss and explore all available avenues and approaches in this challenging context and to demonstrate the difficulties encountered and potential ways around them. The aim is not to provide an ultimate answer in how to approach evaluation of mental health interventions, but to explore and discuss available choices within the framework of applied clinical psychology research in the real world context, and provide practical lessons and insights for future evaluations in this field.

6.2 Methods summary

Economic evaluation is a relatively young yet potentially very useful and increasingly sought-after tool for evidence-based decision-making in relation to mental health and other interventions. The outcome information that is available will determine the type of the economic evaluation that is possible. Within the context of the ST programme, the suitable economic evaluation tools were cost-effectiveness and cost-utility analyses. One of the major evaluation challenges was to identify appropriate comparator groups. As I described in Chapter 3, I identified three ways to approach the evaluation of the ST programme, each with its own merits and limitations. The comparisons on which I focussed were: (a) early treatment versus later treatment group; (b) ST programme users versus participants who did not use the programme; and (c) participants who received treatment under the ST programme versus participants who were screened and assessed only.

In order to minimise and adjust for observable biases introduced by the observational study design, I used multivariate regression to adjust both costs and outcomes for the same group of covariates based on theoretical and statistical criteria. In practice, this translates to running a set of GLM models for prediction of both costs and outcomes. The model protocol is outlined in Table 6.1.

Table 6.1 Costs and effects model protocol

GLM model protocol
<p>** Step A1: GLM model for COSTS**</p> <pre>glm COST i.group \$covariates if COST>0, fam(gamma) link(log) predict yhat1 if e(sample), mu</pre> <p>**Step A2: estimate person-specific COSTS **</p> <pre>gen yhat1c=phat1*yhat1</pre> <p>** Step A3: GLM model for EFFECTS (e.g. BDI score follow up)**</p> <pre>glm BDI i.group \$covariates, fam(gamma) link(log)</pre> <p>**Step A4: estimate person-specific EFFECTS **</p> <pre>predict yhat2 if e(sample), mu</pre> <p>**Step B1: obtain mean predicted costs for group 0 and 1, then subtract to get difference in group mean**</p> <pre>margins COSTS treatment timing =(0 1) atmeans</pre> <p>* **Step B2: obtain mean predicted BDI for group 0 and 1, then subtract to get difference in group mean**</p> <pre>margins EFFECTS (treatment timing =(0 1) margins</pre>

I used SPSS 12 and STATA 11 statistical packages to analyse costs and outcomes. I will start the analysis with a descriptive analysis of participants' sociodemographic characteristics, exposure and clinical characteristics. For costs and outcome categories for each participant group, I will present unadjusted mean values before presenting the models and adjusted estimates. Due to time and word constraints I will focus on three cost categories:

a. *ST programme costs*

b. *direct costs:* aggregate consisting of statutory provided health care services, hospitalisation, medication, voluntary and private sector services, and

c. *total costs:* aggregate consisting of the ST programme, direct costs and work-related costs due to sick leave, unemployment and reduced work hours.

I adjusted all costs and effects models for the following covariates: age; gender; ethnicity; if the person was injured (Q1); if the person thought they will be injured or killed (Q2); if the person saw someone who was injured or killed (Q3); and follow-up timing (days since LB). Although Q1, Q2 and Q3 are correlated I decided to include them in the analysis as Q1 reflected the type of exposure while Q2 and Q3 are predictors for PTSD.

I firstly present results of model evaluation, followed by assessment of the model fit by running a Park test, a link test to check linearity of the response and checking the distribution of the residuals to test for heteroscedasticity.

In this chapter I cover comparisons: (b) ST programme users versus participants who did not use the programme; and (c) participants who received treatment under the ST programme versus participants who were screened and assessed only. The type of data available for those two comparisons and perspective offered by the analysis allows only for a partial economic evaluation (Drummond, 2005) involving costs and outcomes description. Analyses of comparisons (b) and (c) offers an insight into the process and outcomes of the ST programme as they compare groups of participants with different mental health needs and status determined by the screening process. However, this is more of a descriptive analysis with insufficient scope for a comprehensive cost-effectiveness analysis.

6.3 Comparison between the ST programme users and non-users

Comparison of costs and outcomes between individuals who used the ST programme and those who did not provides an interesting and useful insight into the effectiveness of the programme. As mentioned in Chapter 3, the ST programme evaluation study followed up 103 individuals who used the ST programme and 77 individuals who did not. Followed-up individuals were asked to report all services they used due to involvement in the LB, and the impact of the LB on work performance in terms of sick leave, unemployment or reduced hours.

In terms of the outcome measures, the ST users were followed-up with TSQ questionnaire if they were screened only, and with BDI and PDS outcome measures if they were assessed and treated within the programme. Use of different instruments for different participant groups introduced a challenge in comparing their outcomes, and a solution to this problem was to compare TSQ items with items on PDS that correspond to the same symptoms. In Appendix D, I have highlighted items on PDS that correspond to TSQ items: there are slight differences in wording but in general the matched questions address the same symptoms.

The TSQ consists of 10 questions that address frequency of five re-experiencing and five arousal symptoms in the past week (Brewin et al., 2002), while PDS consists of 49 items that cover all DSM-IV criteria for PTSD (A to F) including re-experiencing and arousal symptoms within a time frame of the past month (McCarthy, 2008). In order to be able to compare users with non-users I have used 10 questions from PDS that address arousal and re-experiencing symptoms and that correspond to the questions in TSQ. The TSQ items and corresponding PDS items are listed in Appendix D. A score of two or higher on items 1, 2, 3, 4, 5, 13, 14, 15, 16 and 17 of PDS counted as a yes on the equivalent question in TSQ. This approach only offers a crude approximation of the TSQ scores translated from PDS due to different psychometric properties of the questionnaires. Furthermore, as the questionnaires address different time periods (past week for TSQ; past month for PDS), interpretation of the results should be approached with caution.

Before comparing costs and outcomes of participants who used the ST programme to those who did not, I wanted to compare their socio-demographic and exposure characteristics (see Table 6.2).

Table 6.2 Comparison of socio-demographic and exposure characteristics between participants who used the ST and those who did not

	ST non-users N=77		ST users		
	N	%	N	%	p
Female	28	36	61	59	0.54
Ethnicity – white British	57	74	64	62	0.05
Employment category					
>£500 median weekly salary	31	40	42	41	0.25
<£500 median weekly salary	36	46	53	52	0.42
Student	3	4	7	5	0.43
Retired	2	3	2	1	0.32
Unemployed	1	1	0	0	0.65
Exposure					
Q1. Injured?	19	25	52	34	0.71
Q2. Thought you might be injured/killed?	26	34	92	60	0.00
Q3. Witnessed injury or death?	71	92	108	70	0.00
Q4. Family member/ close friend killed?	1	1	16	11	0.00
Q5. Family member/ close friend injured?	0	0	4	3	0.74
Q6. You felt family member or a close friend might be injured/killed?	1	1	15	10	0.07
Q7. Personally witnessed effects of the bombings?	74	96	131	86	0.00
Screened positive at follow-up	31	40	31	20	0.00
Age (mean)	42.55 (11.52)		41.27 (11.47)		0.31

There are several differences in socio-demographic and exposure characteristics of people who did and did not use the ST programme. Significant differences are the larger proportion of white British participants and participants who were directly involved in the LB for programme non-users. In

addition, a higher percentage of participants who used the ST programme reported being more affected by the bombings in terms of witnessing injury and death, bereavement, fear for their own or a life of a close person. Most interestingly, a significantly higher proportion of participants who did not use the ST programme screened positive at the follow-up: 40% in comparison to 20% of programme users.

Before proceeding with prediction cost and outcome models in which I will be adjusting for the same group of baseline covariates, I will present unadjusted costs and outcomes for both groups.

6.3.1 Outcomes – TSQ score at the follow-up

TSQ score at follow-up was the only available outcome measure for both ST users and the non-user group. In the first model I compared individuals who used the ST programme with those who did not by using a GLM model with Gauss family and identity link function, as confirmed by the Park test. After adjusting for socio-demographic and exposure characteristics, there is no difference in the follow-up TSQ score between the two groups: 2.05 for non-users and 2.35 for ST users. Women and non-white British respondents had significantly higher predicted TSQ end scores (3) in comparison to male and participants from other ethnic groups (2). However, this result is below the threshold of screening positive at TSQ, which was set at endorsing six symptoms or more (Brewin et al., 2002).

Table 6.3 OLS on TSQ between participants who used the ST programme and those who did not

<i>Potentially associated factors</i>	<i>Coefficient</i>
<i>N=220 observations</i>	<i>(95% confidence interval)</i>
Age	0.01 (-0.06, 0.05)
Males relative to females	-0.87*** (-1.57, -0.24)
White British relative to other ethnic categories	-1.21*** (-2.06, -0.06)
Q1. Injured?	1.50*** (0.75, 2.27)
Q2. Thought you might be injured/killed?	0.03 (-1.44, 0.86)

Q3. Witnessed injury or death?	0.75 (-3.19, 1.65)
Q7. You personally witnessed effects of the LB?	-0.50 (-1.81, 0.87)
ST users vs. non users	0.30 (-0.49, 1.04)
Constant	1.98*** (4.26, 11.63)
Link function	Identity
Distributional family	Gauss

6.3.2 Costs

For descriptive purposes, I start this section by presenting unadjusted costs for both programme users and non-users. The ST programme users reported on average higher costs in all categories when compared with non-users. However, the only significant difference between unadjusted average costs is for NHS services, voluntary sector services and medication in the direct cost category, overall work-related costs and, more specifically, costs associated with productivity loss (table 6.4). None of the costs are normally distributed.

Table 6.4 Unadjusted average costs per cost category for ST users and non-users

	ST users (N=153)		ST non-users (N=77)		p
	M	SD	M	SD	
NHS health services	654.28*	164.95	159.95*	287.27	0.00
Private sector provided services	272.42*	100.42	224.26*	87.03	0.58
Voluntary sector provided services	85.83*	63.48	22.37*	52.07	0.05
Hospitalisation	1361.27*	342.75	552.04*	2164.01	0.65
Medication	25.99*	20.48	5.52*	6.13	0.00
Total direct costs	2406.28*	422.23	2576.99*	508.08	0.93
Productivity loss	4185.96*	3373.44	1790.12*	926.20	0.09
Hours reduced	359.15*	321.22	115.27*	22.67	0.21
Unemployment	3427.33*	3191.80	262.66*	1779.28	0.04
Total work costs	9313.54*	5021.07	2159.31*	2363.74	0.01
Total overall costs	11719.68*	5518.67	4736.79*	2532.54	0.00

*not normally distributed costs $P < 0.05$

Figure 6.1 Cost breakdown for ST users

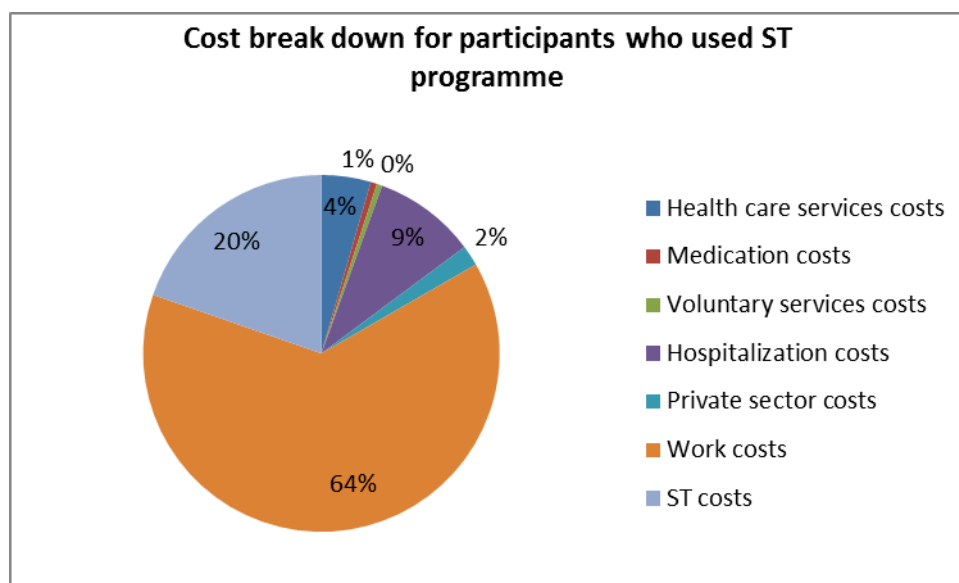
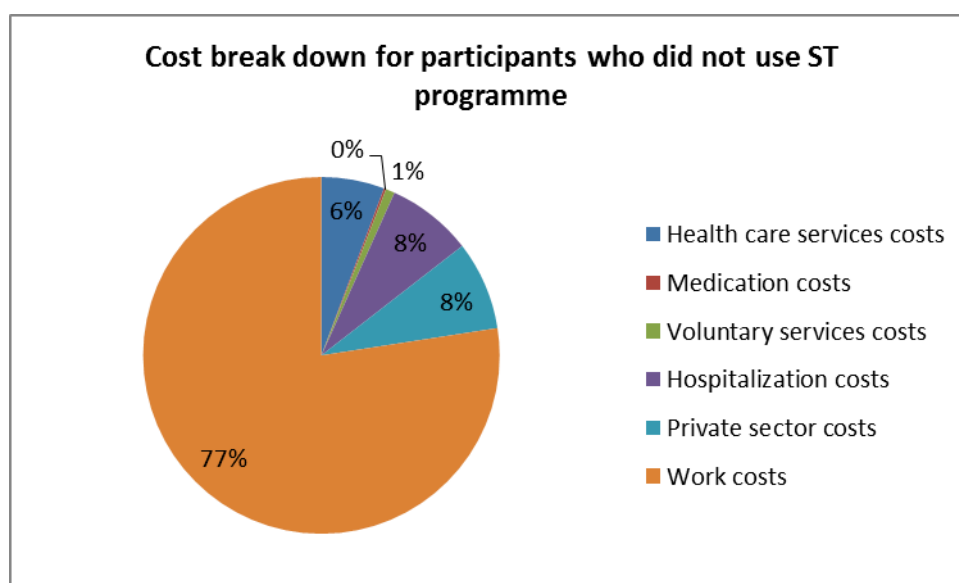


Figure 6.2 Cost breakdown for participants who did not use the ST programme



In terms of the total contribution to overall costs, the dominant cost components for both ST users and non-users were work-related costs, followed by equal shares of hospitalisation and private sector costs for non-users, while for ST-users these were ST programme-related costs followed by hospitalisation costs. Health care services costs, although the most frequently-used, made a relatively small contribution to overall costs for both groups when compared with other cost components.

Figure 6.3 Percentage of participants who reported costs per cost category

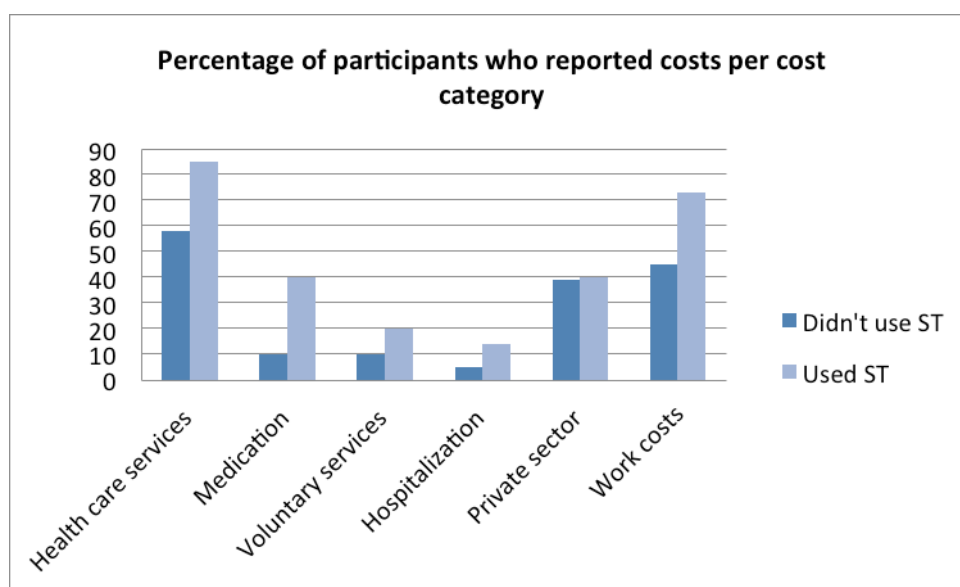


Figure 6.4 Percentage of participants who reported costs per cost type

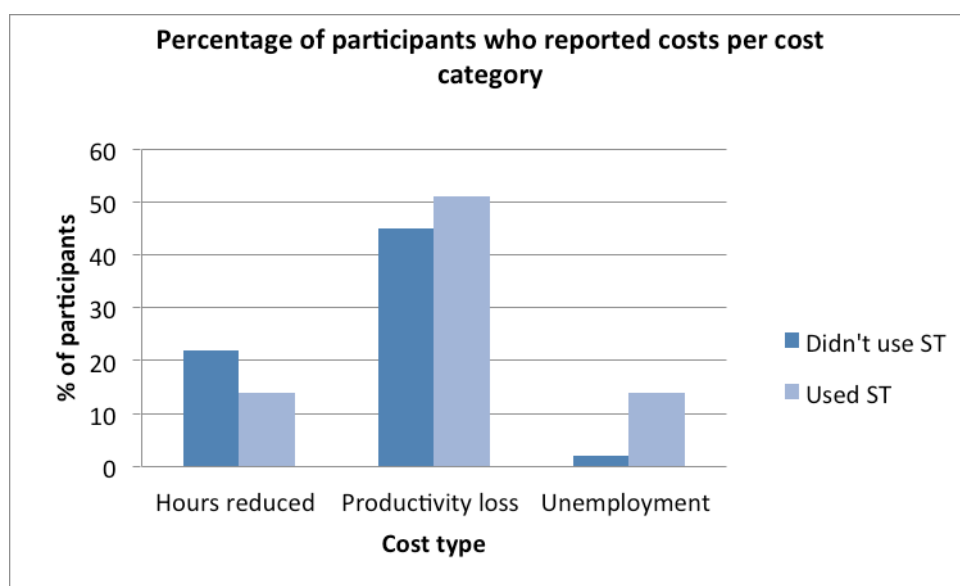


Table 6.5 GLM on direct costs between ST users and non-users

Potentially associated factors	Coefficient
N=206 observations	(95% confidence interval)
Age	-0.00 (-0.06, 0.05)
Males relative to females	-1.13 (-0.57, 1.54)
White British relative to other ethnic categories	-0.48 (-1.06, 0.06)
Q1. Injured?	1.42*** (0.25, 2.59)
Q2. Thought you might be injured/killed?	0.20 (-1.44, 0.86)
Q3. Witnessed injury or death?	-0.96 (-3.19, 1.65)
Non-users vs. ST users	-1.58*** (-1.49,- 0.40)
Constant	7.17*** (4.26, 11.63)
Link function	Log
Distributional family	Gamma

When comparing ST users with non-users, the difference in mean predicted direct cost is statistically significant when controlling for socio-demographic and exposure factors, with ST users reporting on average £1526 in comparison to £484 for non-users. Again, injury was the only significant positive predictor of direct costs.

Table 6.6 GLM on total costs between ST users and non-users

Potentially associated factors	Coefficient
N=206 observations	(95% confidence interval)
Age	0.01 (-0.06, 0.05)
Males relative to females	-0.83* (-1.57, 0.01)
White British relative to other ethnic categories	-0.68 (-1.06, 0.06)
Q1. Injured?	1.29*** (0.25, 2.59)
Q2. Thought you might be injured/killed?	0.75* (-1.44, 0.86)
Q3. Witnessed injury or death?	-0.96 (-3.19, 1.65)

ST Non-users vs. Users	-1.22*** (-1.19,- 0.40)
Constant	8.27*** (4.26, 11.63)
Link function	Log
Distributional family	Gamma

ST programme users had 3.4 times higher average total predicted costs, including work-related costs and direct costs (£11454 in comparison to £2380), when controlling for socio-demographic and exposure characteristics. Injury was again a strong positive predictor of total costs.

Results presented in this section suggest that the ST programme users reported higher average total, work and direct costs as a result of their exposure to the LB when compared to participants who did not use ST services. This difference is even larger when ST users are compared to participants who chose not to use services for other reasons explored earlier in the chapter, and presumably due to the fact they were recovering naturally or received enough support from alternative sources such as social networks or other services used. An alternative explanation could lie in the fact that the ST programme resulted in increased costs by pathologising the recovery of the programme users. However it is impossible to assess this assumption further as it is not possible to determine exactly when the reported costs occurred – prior to entry, during or after being discharged from the ST programme. Furthermore, the treatment effect size on PDS for treated participants was 1.74 and 1.17 for BDI which both indicate large treatment effect size. There was no statistically significant difference for either BDI or PDS scores at the treatment end and follow-up, indicating that the treatment gains have been well maintained over time (Brewin et al., 2009).

6.3.3 Comparison between participants who did not know of the ST programme and those who did not want to use it

It was important to address the reasons behind not using the ST programme, as participants who knew of the programme and decided not to use it might differ in their characteristics, costs and outcomes from participants

who did not know of the programme. Although dividing an already small sample of people who did not use the programme into two is a statistically risky endeavour, it could still be informative in the context of future mental health response programmes to explore and describe potential differences between two sub-samples in terms of their experiences, costs and outcomes.

I have compared participants who did not know of the ST programme with those who did not want to use it on socio-demographic and exposure characteristics by using Chi-square test. The only significant difference was in relation to ethnicity, with a higher number of white British participants in the category of participants who chose not to use the ST programme. Nevertheless, one must be cautious with conclusions based on such a small sample even if this finding is in line with previous literature reporting ethnicity as one of the important predictors in mental health resource use (Clark, 2011). Furthermore, power issues may explain the absence of statistically significant differences.

Out of 77 ST non-users, 33% of individuals did not hear about the ST programme or had no time or opportunity to respond, while 77% felt they did not need the services. Reasons for not using the ST programme were: not feeling entitled or affected (14 participants), having used other resources or services (14 participants), having negative initial contact with services (5 participants), not being based in London (5 participants), wanting to move on (2 participants), finding out about services too late (2 participants), thinking service use would bring additional stress (1 participant), other coping mechanisms: engaged in 'cathartic' activities (1 participant).

a. Outcomes

Participants who did not know of the ST programme had significantly higher unadjusted TSQ scores at follow-up ($Z=-3.76$, $p<0.01$). This result was confirmed by the GLM model controlling for participant and exposure characteristics: the predicted TSQ follow-up score for participants who did not know of ST programme was 3.50 in comparison to 1.56 for those who chose not to use it. Similar to the previous model, women and non-white British respondents had significantly higher predicted TSQ end scores, and being

injured in the bombings was positively correlated with follow-up TSQ score. 70% of participants who did not know of the programme reported the following symptoms: feeling upset by reminders of the bombings, heightened awareness of potential dangers to yourself and others, and being jumpy or startled. Around 40% of participants who did not know of the ST programme reported having upsetting thoughts or memories about the bombings that come to mind against one's will and having upsetting dreams about the bombings.

Table 6.7 GLM on TSQ between users who did not know about the ST programme versus participants who chose not to use it

<i>Potentially associated factors</i>	<i>Coefficient</i>
<i>N=71 observations</i>	<i>(95% confidence interval)</i>
Age	-0.01 (-0.06, 0.05)
Males relative to females	-0.28 (-0.57, 0.04)
White British relative to other ethnic categories	-1.58*** (-2.06, -0.06)
Q1. Injured?	0.95*** (0.55, 2.29)
Q2. Thought you might be injured/killed?	0.40 (-1.44, 0.86)
Q3. Witnessed injury or death?	0.46 (-3.19, 1.65)
Q7. You personally witnessed effects of the LB?	0.81 (-1.80, 1.49)
Didn't need vs. Didn't know	-1.93*** (-2.97, -0.89)
Constant	4.73*** (2.26, 7.63)
Link function	Identity
Distributional family	Gauss

This result suggests that on average ST non-users reported a higher level of symptoms even almost two years after the exposure to the LB in comparison to the programme users. Individuals who did not know about the programme reported higher screening scores in comparison to the individuals who chose not to use it, however for both groups the screening score was below the positive screening threshold. One possible conclusion could be that the ST non-users would potentially have benefitted from using the ST programme, especially the screening and monitoring aspect. This explanation is based on the assumption that from the clinical, social and ethical perspectives, screening

would not harm individuals by pathologising the natural recovery and re-traumatising individuals by reminding them of the effects of the bombings, but instead providing information on the natural recovery process, support and potential safety-nets should individuals need it. From an economic perspective, screening would not incur additional costs to the programme as the clinicians' wages, the costs of the screening team and the costs of the premises were fixed. Actually, the larger number of the programme users would bring down the total average cost per user and ensure better use of resources.

b. Costs

Table 6.8 Unadjusted average costs per cost category for participants who did not use the ST programme

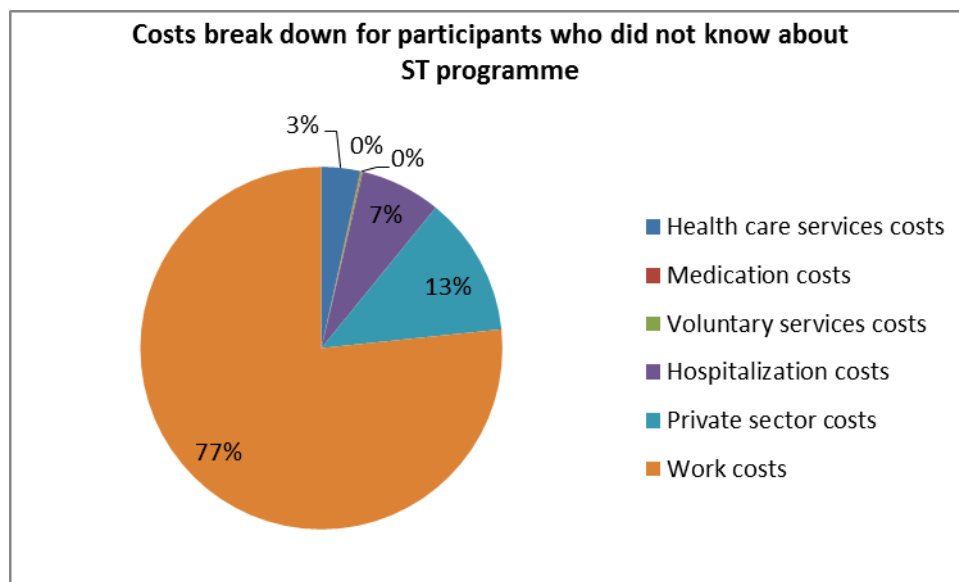
	Did not need ST (N=51)		Did not know of ST (N=26)		p
	M	SD	M	SD	
NHS health services	175.28*	537.95	128.95*	149.27	0.01
Private sector provided services	102.42*	478.42	462.26*	871.03	0.00
Voluntary sector provided services	31.83*	163.48	6.37*	18.07	0.86
Hospitalisation	3131.27*	21562.75	267.04*	1339.01	0.50
Medication	6.99*	43.48	2.52*	8.13	0.57
Total direct costs	3448.26*	21898.23	867.29*	1773.08	0.00
Productivity loss	1621.96*	7807.44	2123.12*	5817.20	0.61
Hours reduced	104.15*	598.22	136.27*	592.67	0.72
Unemployment	83.33*	595.80	612.66*	3124.28	0.04
Total work costs	1808.54*	8429.07	2847.31*	6896.74	0.14
Total overall costs	5256.79*	24321.54	3739.68*	7032.58	0.00

*not normally distributed costs $P < 0.05$

Looking at unadjusted mean costs, participants who did not know of the ST programme reported higher average costs associated with private sector-provided health care services. For all other direct cost categories and total costs, participants who chose not to use ST reported unadjusted higher average

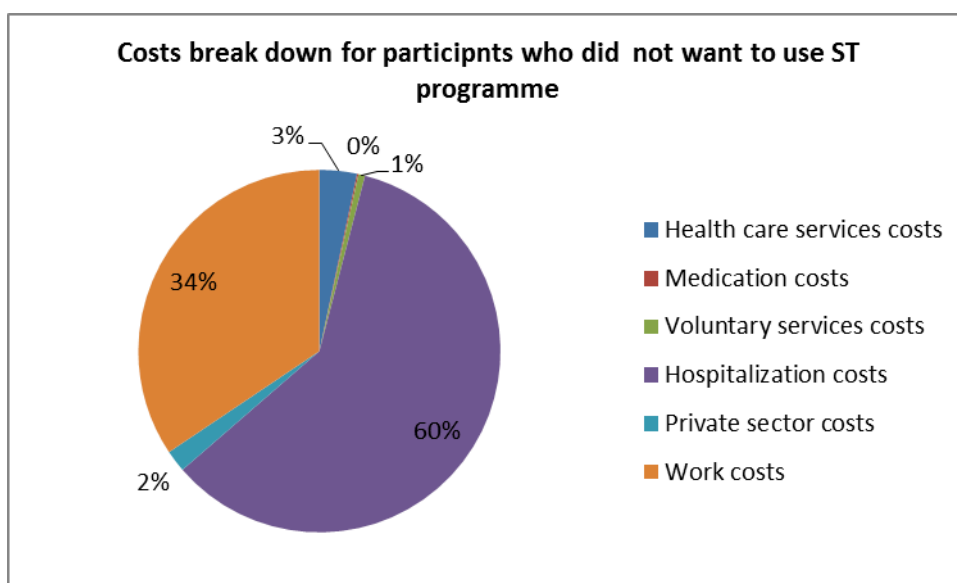
costs (Table 6.8). However, the presented unadjusted costs are purely for illustrative purposes, as all cost variables are skewed and therefore mean values are not representative of groups, and costs have not been adjusted for all differences in socio-demographic and exposure factors. Participants who did not know of the ST programme had a similar proportion of work-related costs as the ST users (77% of total cost), followed by private sector services costs and hospitalisation (Figure 6.5). However the absence of the statistically significant differences in costs between the two groups might be explained by the sample power issues in particular in the case of hospitalisation, productivity and total work costs.

Figure 6.5 Cost breakdown for participants who did not know about the ST programme



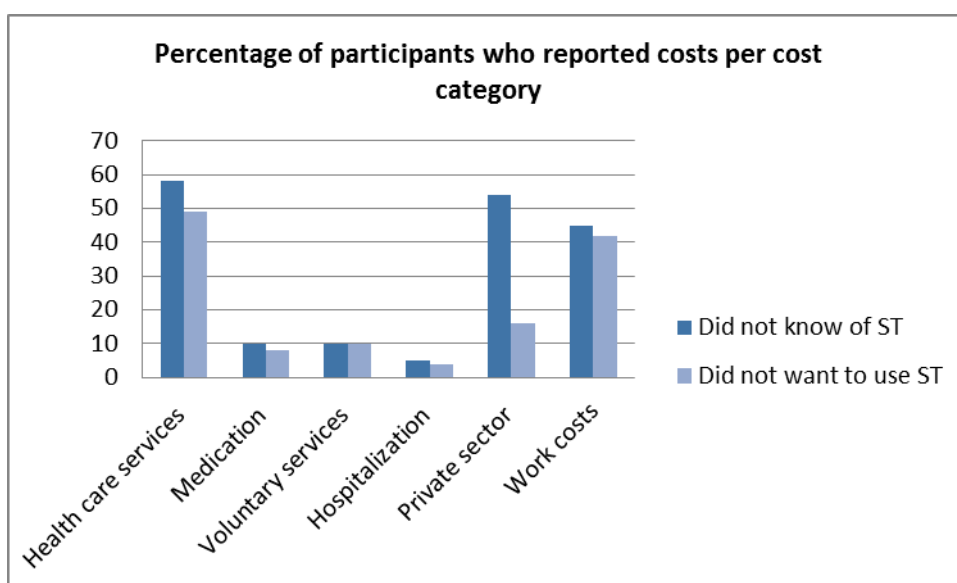
On the other hand, for participants who did not want the ST services hospitalisation costs were the largest total cost component, covering more than 60% of costs, followed by work-related costs and smaller percentages of private sector and hospitalisation costs (Figure 6.6).

Figure 6.6 Cost breakdown for participants who did not want to use the ST programme



However, from Figure 6.7 it is clear that a very small percentage of participants reported very high hospitalisation costs.

Figure 6.7 Percentage of participants who reported costs per cost category

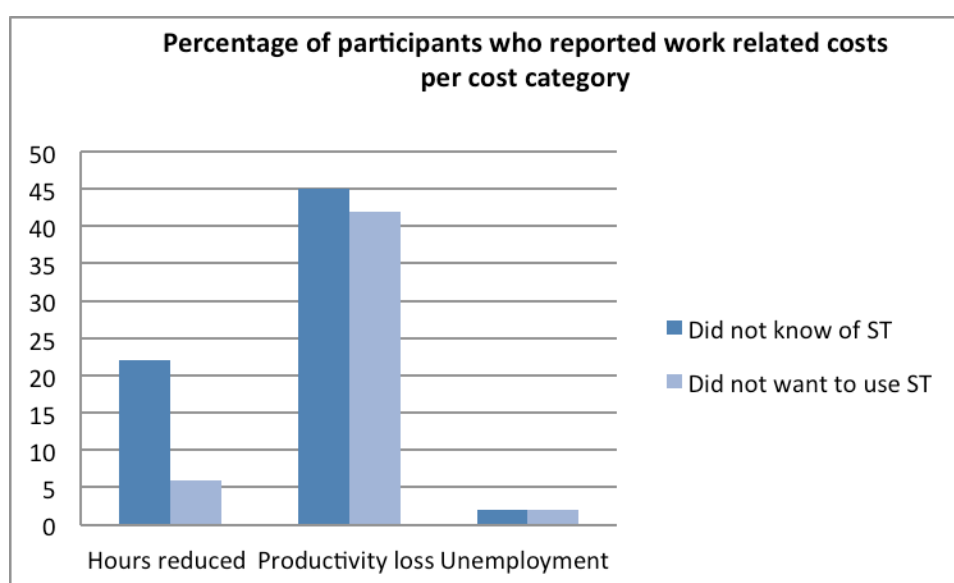


The next step is to compare percentages of participants who reported using services in order to understand which services were most frequently reported. For both groups, the most frequently-used services were health care followed by private sector services. Work-related costs were also frequently reported for both groups. Participants who used the programme reported higher percentages of service use and consequently higher costs for all cost

groups. Productivity loss-related costs were reported by the largest percentage of participants in both groups, as shown in Figure 6.8.

There is not much difference in the percentage of participants reporting medication, voluntary sector services and hospitalisation between participants who did not know or chose not to use ST. However, significantly more participants who did not hear of the ST programme reported using private sector services (Pearson-Chi square=32.8, $p=0.02$). There was no difference between the number of people who reported number of hours reduced (Pearson-Chi square=5.49, $p=0.36$). For both groups, the largest percentage of participants (around 50%) reported health care services, while around 40% of participants reported work-related costs. As shown in Figure 6.8, in both groups, the largest percentage of participants reported productivity loss-related costs. Participants who did not know of the ST programme reported up to four times higher costs associated with reduced work hours in comparison to participants who did not want to use the programme, although the difference is not statistically significant.

Figure 6.8 Percentage of participants who reported work-related costs per cost category



When controlling for age, gender, ethnicity and exposure factors, individuals who did not use the programme because they did not know about it

had 4 times higher statistically significant overall costs, on average £2430 versus £655, in comparison with individuals who choose not to use it (Table 6.9).

Table 6.9 GLM on total costs for participants who did not need versus participants who did not know of the ST programme

Potentially associated factors	Coefficient
N=71 observations	(95% confidence interval)
Age	-0.16 (-0.07, 0.05)
Males relative to females	0.52 (-0.57, 1.54)
White British relative to other ethnic categories	-1.48** (-4.06, -0.06)
Q1. Injured?	2.17*** (1.25, 2.59)
Q2. Thought you might be injured/killed?	0.86 (-0.44, 0.86)
Q3. Witnessed injury or death?	-0.99 (-1.19, 0.05)
Didn't need vs. Didn't know	-1.38** (-2.49, -0.10)
Constant	13.17*** (9.26, 17.63)
Link function	Log
Distributional family	Gamma

* p<0.10; ** p<0.05; *** p<0.01

Although average predicted direct costs were higher for participants who did not know of the ST - £469 versus £269 for participants who choose not to use the programme - this difference was not statistically significant. Injury was the only significant positive predictor of direct services costs (Table 6.10).

Table 6.10 GLM on direct costs for participants who did not need versus participants who did not know of the ST programme

Potentially associated factors	Coefficient
N=71 observations	(95% confidence interval)

Age	-0.00 (-0.06, 0.05)
Males relative to females	-1.13 (-0.57, 1.54)
White British relative to other ethnic categories	-0.48 (-1.06, 0.06)
Q1. Injured?	1.62** (0.25, 2.59)
Q2. Thought you might be injured/killed?	0.20 (-1.44, 0.86)
Q3. Witnessed injury or death?	-0.96 (-3.19, 1.65)
Didn't need vs. Didn't know	-0.58 (-1.49, 0.10)
Constant	7.17*** (4.26, 11.63)
Link function	Log
Distributional family	Gamma

* p<0.10; ** p<0.05; *** p<0.01

6.3.4 Discussion and conclusions

My analyses suggest there is no significant difference in the adjusted follow-up TSQ score between the ST programme users and participants who did not use it, and for both groups average reported TSQ scores are well below the positive screening threshold of endorsing six symptoms (Brewin et al., 2002). Average adjusted follow-up TSQ score for participants who did not know of the ST was 3.5, just below the screening positive threshold margin, in comparison to 1.5 for participants who did not need it.

However, when adjusting for socio-demographic and exposure factors, participants who used the programme reported significantly higher average direct and total costs. As the category of participants who did not use the ST services is not homogeneous, one third of participants reporting not knowing about the programme while others chose not to use it, it was important to explore differences in outcomes and costs between those two groups and ST users. In regard to the average predicted costs, participants who did not know about the ST reported four times higher average total costs due to large productivity loss, and while they reported numerically larger direct costs, the difference was not significant from participants who did not need the programme. Another frequently reported cost group for participants who did not know of the ST programme were private sector services with 50% of

participants reporting using them in comparison to only 12% of participants who did not need the programme, and when looking at unadjusted average costs the difference in average private sector services costs is significant between the two groups. Furthermore their cost breakdown was similar to the ST users, although average adjusted costs were five times smaller.

Symptoms most frequently reported by this group even (on average) 2.5 years after LB were related to heightened awareness and alertness to the potential dangers and being upset by reminders of the LB event.

The power issues may explain the absence of statistically significant differences between the two groups, as the samples were small, particularly when comparing individuals who chose not to use the programme with participants who did not know about the programme. Due to the small and unrepresentative sample of individuals who did not know of the ST any conclusions based on this analysis are not generalisable. Nevertheless, my results suggest that interviewed participants who did not know of the ST would have been a target population for the ST programme and would have potentially benefited from screening and assessment in order to possibly avoid or reduce costs associated with use of private sector provided services.

6.4 Comparison between ST users who received treatment and ones who were screened and assessed only

Another perspective on the effectiveness of the ST programme to identify participants in need of treatment may come from comparing individuals who were screened and assessed but were not sent for treatment with those individuals who were screened, assessed and were then treated within the ST programme. In my view, comparing costs due to LB exposure, the outcomes at the entry point to the ST programme and at the follow-up provide interesting information on which aspects these two groups differ prior to entry to the programme and on average two years later from the LB, and what are possible cost and outcome predictors for both groups. This information might be useful for the future mental health responses as they provide insight into which socio-

economic and exposure factors are associated with referral to treatment and natural recovery. As in the previous section, I present unadjusted costs and outcomes followed by cost and outcome prediction models. Participants who were screened and assessed only were less likely to be white British in comparison to the treated group. Differences are also observed on some of the exposure variables, with a higher percentage of screened and assessed only participants reporting bereavement and a lower percentage being directly involved in the bombings when compared with the treated group.

In the treated group, on the other hand, a larger percentage of participants reported witnessing and fear of injury or death. There was no difference in the average age between the groups. Unsurprisingly, the screened and assessed group had on average a higher number of screeners when compared to the treated group who were on average referred to treatment after the first screener, while participants in the assessed group were screened up to five times, and on average twice. There was no observed difference in average unadjusted score on TSQ measure at the treatment follow-up: 2.08 for screened and assessed only group versus 2.14 for treated group (Mann-Whitney $Z=1.14$, $p=0.25$). Similarly, there was no difference in unadjusted EQ5D score at the follow-up between two groups: 0.86 for screened and assessed only and 0.80 for the treated group ($Z=-1.5$, $p=0.13$).

Table 6.11 Socio-demographic and exposure characteristics of screened and assessed only participants and participants treated within the ST programme

	Screened and assessed only (N=50)		Treated (N=103)		
	N	%	N	%	p
Female	38	71	61	59	0.54
Ethnicity – white British	15	30	64	62	0.05
Employment category					
>500 £ median weekly salary	18	36	42	41	0.25
<500 £ median weekly salary	23	46	53	52	0.42
Student	5	8	3	3	0.43
Retired	1	2	1	0	0.32
Not stated	2	4	2	2	0.65
Exposure					
Q1. Injured?	16	32	36	35	0.71
Q2. Thought you might be injured/killed?	19	38	73	71	0.00
Q3. Witnessed injury or death?	25	50	83	80	0.00
Q4. Family member/ close friend killed?	10	20	6	6	0.00
Q5. Family member/ close friend injured?	1	2	3	3	0.74
Q6. You felt family member or a close friend might be injured/killed?	8	16	7	7	0.07
Q7. Personally witnessed effects of the bombings?	34	68	97	92	0.00
Age (mean)	42.86 (14.32)		40.52 (9.52)		0.31
Number of screeners (mean)	1.98 (1.09)		1.04 (0.54)		0.00

6.4.1 Outcome models – TSQ follow-up score

Table 6.12 Predictive GLM on follow-up TSQ score between ST users: treated compared to screened and assessed only users

Potentially associated factors	Coefficient
N=138 observations	(95% confidence interval)
Age	0.02 (-0.00, 0.04)
Total score at first screener	0.26*** (0.12, 0.39)
Males relative to females	-0.63** (-1.15, -0.05)
White British relative to other ethnic categories	-0.75*** (-1.26, -0.11)
Q1. Injured?	0.77** (0.25, 1.59)
Q2. Thought you might be injured/killed?	-0.90** (-1.23, 0.06)
Q3. Witnessed injury or death?	0.78* (-0.09, 1.66)
Q7. You personally witnessed effects of the LB?	-0.36 (-1.43, 0.73)
Total number of screeners	-0.46** (-0.82, -0.01)
Treated vs. Screened and assessed only	-1.16*** (-0.82, -0.01)
Constant	0.37** (-1.05, 1.33)
Link function	Log
Distributional family	Gamma

* p<0.10; ** p<0.05; *** p<0.01

The average predicted TSQ score for treated group was 1.06 (0.73, 1.57), and 3.39 for not treated participants (1.2 - 5.27). The treated group had a significantly lower average predicted TSQ score at follow-up when adjusting for covariates in comparison to the screened and assessed only group: 1 versus 3 symptoms. Although average predicted TSQ follow-up scores were lower than the screening threshold of endorsing six symptoms (Brewin et al., 2002), this indicates a higher number of reported symptoms for participants who were not treated. Again, due to the small sample and the nature of the data collection process, these findings need to be treated with caution.

Table 6.13 Predictive GLM on EQ5D score at follow-up between ST users: treated compared to screened and assessed only users

Potentially associated factors	Coefficient
N=138 observations	(95% confidence interval)
Age	-0.00 (-0.00, 0.04)
Males relative to females	0.02 (-0.08, 1.05)
White British relative to other ethnic categories	0.08 (-0.62, 0.23)
Q1. Injured?	-0.21***(-0.31, -0.09)
Q2. Thought you might be injured/killed?	0.08 (-0.23, 0.20)
Q3. Witnessed injury or death?	-0.06(-0.09, 1.66)
Q7. You personally witnessed effects of the LB?	0.18*(-0.00, 0.01)
Follow-up timing	0.00(-0.82, 0.42)
Treated vs. Screened and assessed only	-0.10(-0.82,-0.01)
Constant	-0.28*** (-0.63, 0.05)
Link function	Log
Distributional family	Gamma

* p<0.10; ** p<0.05; *** p<0.01

Another outcome measure available for comparison between screened and assessed only and participants who received treatment, was EQ5D score at treatment follow-up. Average predicted EQ5D scores for the non-treated group was 0.89 (0.79, 1.00), and 0.80 (0.76, 0.85) for treated participants. There was no difference between two groups after adjusting for covariates, both groups reporting, on average, high quality of life. Injury was a negative predictor of the total EQ5D score at follow-up.

6.4.2 Cost description and models

With the exception of the unadjusted mean hospitalisation costs, for all cost categories the treated group reported higher average unadjusted costs when compared to the screened and treated only group (Table 6.13). None of the costs were normally distributed, as tested by Kolmogorov-Smirnov test.

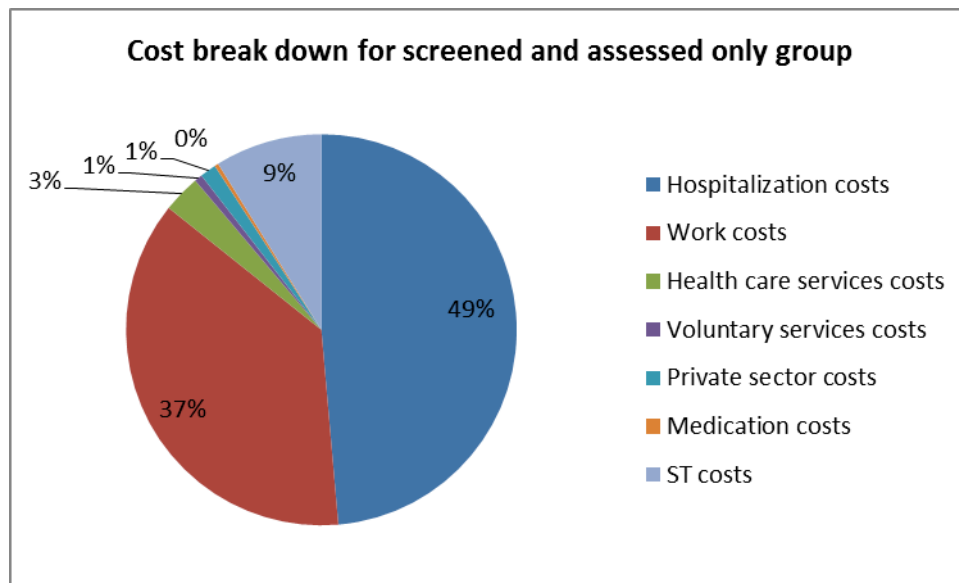
Participants who received treatment within the ST programme were less likely to screen positive at follow-up (OR=0.29, p=0.00): 36% individuals who were screened and assessed only within the programme screened positive at follow-up in comparison to 13% from the treated group (Chi square=8.68, p=0.00).

Table 6.14 Average unadjusted costs per cost and participant category

	Screened and assessed (N=50)		Treated (N=103)		p
	M	SD	M	SD	
NHS health services	199.28*	324.95	874.95*	1650.27	0.00
Private sector provided services	86.42*	180.42	362.26*	680.03	0.01
Voluntary sector provided services	41.83*	150.48	106.37*	441.07	0.04
Hospitalisation	3130.97*	14426.75	502.04*	2224.01	0.20
Medication	20.99*	20.48	27.08*	6.13	0.02
NHS costs	3350.89	14539.22	1404.88	3168.41	0.01
Total direct costs	3479.28*	14516.23	1886.99*	3322.08	0.10
Productivity loss	1499.82*	3667.99	5489.05*	17480.31	0.03
Hours reduced	302.12*	1173.95	388.02*	1991.33	0.02
Unemployment	586.98*	2772.00	4806.78	18017.82	0.31
Total work costs	2388.84*	5156.07	6509.31*	12674.74	0.00
Total overall costs	5867.91*	17011.36	14560.47*	29243.25	0.02

*not normally distributed costs P<0.01

Figure 6.9 Cost breakdown for screened and assessed only participants



Hospitalisation costs account for up to 50% of the reported costs for screened and assessed only group, followed by work costs and the ST programme costs (Figure 6.9). Although hospitalisation costs were high, only a small percentage of participants (18%) reported high costs due to injuries in the bombings (Figure 6.11). For participants who received treatment, 68% of the total cost was work-related, mainly productivity loss costs. The ST programme-related costs represented 20% of the total cost, followed by a small percentage of health service costs and hospitalisation costs (Figure 6.10).

70% of participants in both groups reported using health care services, followed by private sector services and medication, and these were the most frequently-reported costs for both groups. The most frequently-reported services by the screened and assessed only group were GP, accident and emergency services, followed-by private sector services, medication and NHS mental health services.

For all costs types except hospitalisation, a higher percentage of treated participants reported using services. Productivity loss-associated costs are highest among all work-related costs, with around 50% of participants in both groups reporting costs (Figure 6.12).

Figure 6.10 Treated group costs

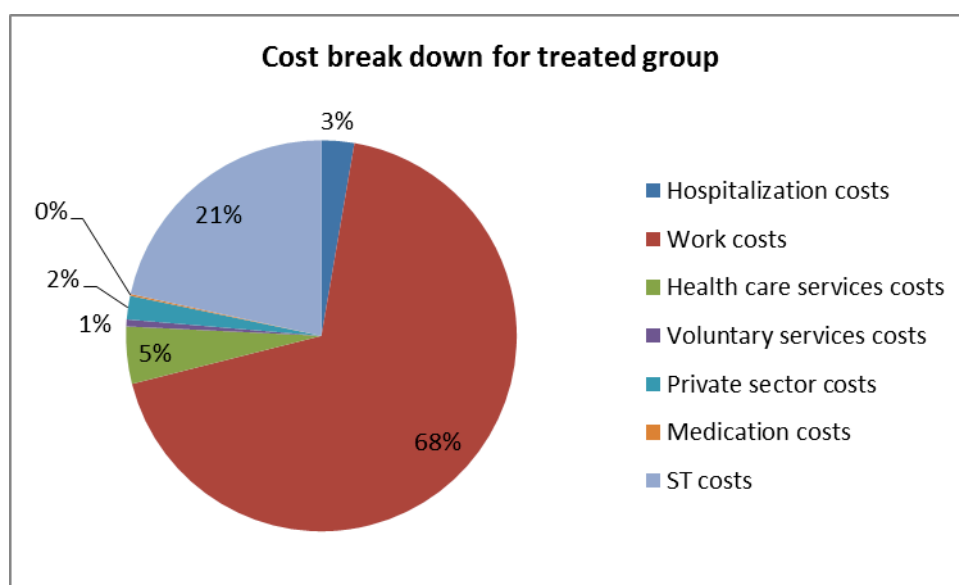


Figure 6.11 Percentage of participants who reported costs per cost category

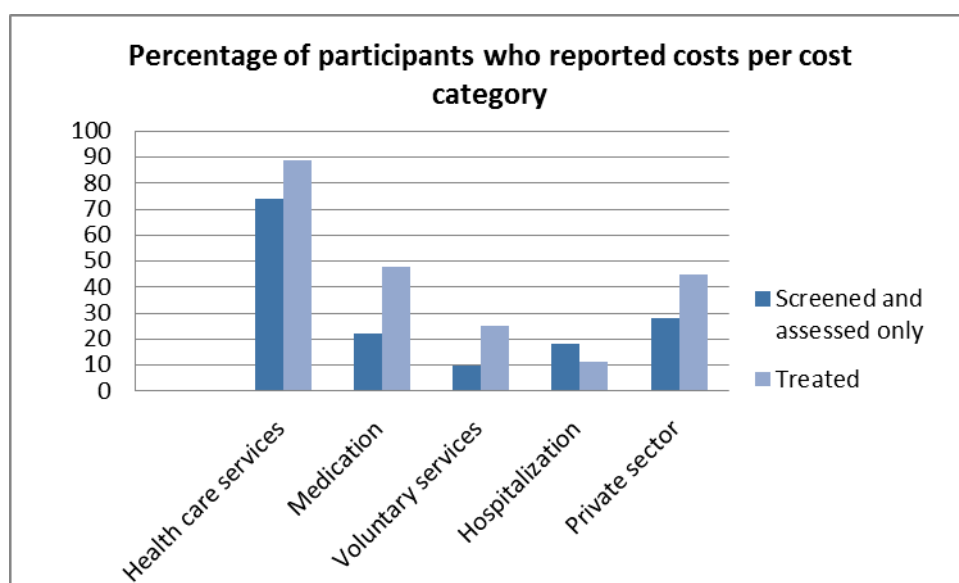


Figure 6.12 Percentage of participants who reported work related costs

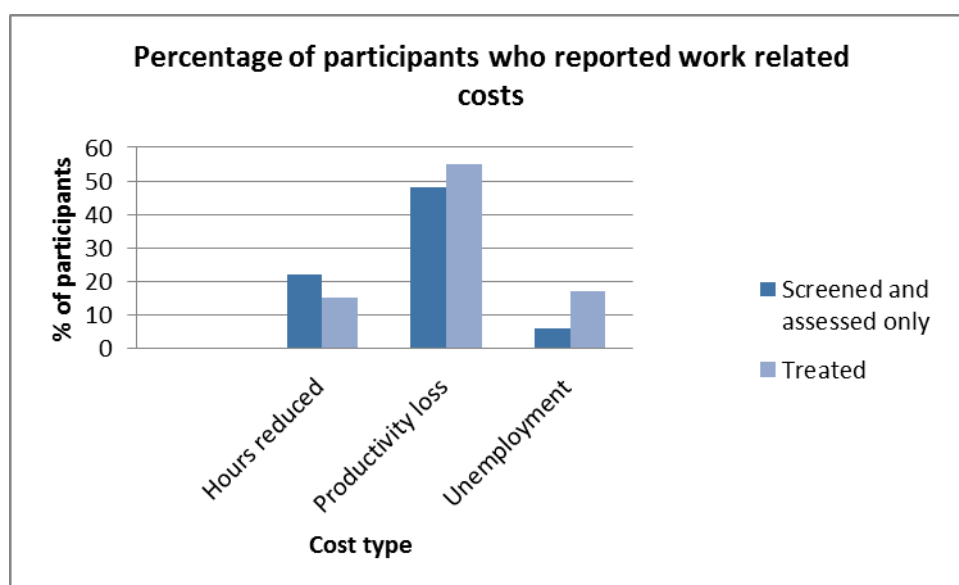


Table 6.15 The most frequently-used services reported by screened and assessed only group

	Screened and assessed only (N=50)	
	N	%
NHS physical health:		
GP	31	62
Accident and Emergency	20	40
Surgeon	3	6
Other nurse	2	4
NHS provided MH services*	11	22
Privately provided MH services*	9	18
Medication	13	26
Hospitalisation	11	22
Private sector services	14	28
Voluntary sector services	8	16

Table 6.16 Predictive GLM on direct costs between ST users: treated compared to screened and assessed only users

Potentially associated factors	Coefficient
N=138 observations	(95% confidence interval)
Age	0.02* (-0.00, 0.04)
Total score at first screener	0.28 (0.12, 0.39)
Males relative to females	0.28 (-0.15, 1.05)
White British relative to other ethnic categories	0.05 (-0.62, 0.23)
Q1. Injured?	1.21*** (0.52, 1.99)
Q2. Thought you might be injured/killed?	-0.48 (-1.23, 0.06)
Q3. Witnessed injury or death?	-0.44 (-0.09, 1.66)
Q7. You personally witnessed effects of the LB?	1.10* (-0.43, 2.27)
Follow-up timing	0.40 (-0.82, 0.42)
Treated vs. Screened and assessed only	0.44 (-0.82, -0.01)
Constant	3.77*** (2.05, 5.33)
Link function	Log
Distributional family	Gamma

* p<0.10; ** p<0.05; *** p<0.01

Average predicted direct costs for participants who did not receive treatment were £963.64 (398.35 - 1528.94) and £1496.92 (985.23 - 2008.60) for the treated group. Although numerically almost double, average predicted direct costs for the treated group are not statistically different from the screened and assessed only group. The only significant positive predictor of direct costs is injury.

Table 6.17 Predictive GLM on total costs between ST users: treated compared to screened and assessed only users

Potentially associated factors	Coefficient
N=138 observations	(95% confidence interval)
Age	0.05*** (0.01, 0.08)
Males relative to females	-0.56 (-0.15, 1.05)
White British relative to other ethnic categories	0.19 (-0.62, 0.23)
Q1. Injured?	1.26*** (0.52, 1.99)
Q2. Thought you might be injured/killed?	0.08 (-0.73, 0.90)
Q3. Witnessed injury or death?	0.24 (-0.86, 1.36)
Q7. You personally witnessed effects of the LB?	-0.80 (-0.43, 2.27)
Follow-up timing	0.02 (-0.02, 0.68)
Treated vs. Screened and assessed only	1.07** (0.18, 1.97)
Constant	5.84*** (4.05, 7.33)
Link function	Log
Distributional family	Gamma

* p<0.10; ** p<0.05; *** p<0.01

Predictive general linearised model on total costs between treated participants and participants who were screened and assessed only shows that after adjusting for covariates, the treated group reported on average three times larger total costs, £11052 (6477.23-15627.60) versus £3755 (1048.35 - 6462.94). Significant positive predictors of costs were injury and age. As there was no difference in reported direct costs (Table 6.15) between the two groups, the difference in total costs is attributed to a difference in work-related costs.

Average predicted NHS costs for non-treated participants were £732.35 (284.35, 1180.94), and £895.3 (566.23, 1225.60) for treated participants. This model focuses only on the NHS-related costs, a category which includes medication, hospitalisation and NHS-provided health services. No difference between two groups was found after adjusting for covariates. Timing of the

follow-up, age, direct involvement in bombings and injury were all significant positive predictors of NHS costs.

Table 6.18 Predictive GLM on NHS costs between the ST users: treated compared to screened and assessed only users

Potentially associated factors	Coefficient
N=138 observations	(95% confidence interval)
Age	0.04*** (0.01, 0.08)
Males relative to females	0.18 (-0.52, 0.05)
White British relative to other ethnic categories	-0.07 (-0.62, 0.23)
Q1. Injured?	1.17*** (0.52, 1.99)
Q2. Thought you might be injured/killed?	-0.48 (-0.73, 0.90)
Q3. Witnessed injury or death?	-0.49 (-0.86, 1.36)
Q7. You personally witnessed effects of the LB?	2.13*** (0.93, 3.27)
Follow-up timing	0.07*** (0.02, 0.12)
Treated vs. Screened and assessed only	0.20 (-0.18, 1.97)
Constant	1.22 (-0.85, 3.33)
Link function	Log
Distributional family	Gamma

* p<0.10; ** p<0.05; *** p<0.01

6.4.3 Discussion and conclusions

The analysis suggests that the treated group reported statistically higher total costs (excluding the ST programme costs) when controlling for exposure and socio-demographic characteristics compared to participants who were not referred to treatment. Costs were up to two and half times higher. Apart from differences in total costs, there is an observable difference in the proportion of contribution of different cost types in the overall cost and amount of services used between the two groups.

For the treated group, work-related costs have the highest contribution to the total cost, followed by the ST programme and health care services. However, for participants who were screened and assessed only, hospitalisation

costs had the largest contribution to the overall costs (50%), followed by work-related costs (37%), the ST programme and health care services. This difference is due to there being more injured and hospitalised participants in the screened and assessed group.

Service use pattern, although always higher for the treated group, is similar between the two groups, with the highest percentage of participants in both groups using health care services, followed by private sector services, medication and voluntary sector services and finally, hospitalisation.

When costs are adjusted for socio-demographic and exposure covariates there is no significant difference in direct costs between the two groups. There is a significant difference between the total costs (that include work-related costs) between the two groups, with the treated group reporting up to three times higher total costs in comparison to screened and assessed only participants.

The two groups differ significantly in reporting work-related costs, in particular productivity loss-related costs, which represent the largest proportion of reported costs. These costs would be probably be even higher if participants did not receive treatment. In support of this assumption, 60% of treated participants reported that treatment helped them return to work or prevented time off work, while 15% reported no difference and 3% reported a negative effect on time off work. If larger costs are an indicator of higher mental health and physical health needs, then the analysis indicates that the treated group consists of individuals who were more severely affected by the LB when compared to the screened and assessed only group. Another potential conclusion is that the ST programme was effective in identifying participants with stronger mental health needs and referring them to treatment.

In regard to differences in the outcome measure in the TSQ follow-up score, the treated group had a significantly lower score and a lower probability of screening positive at the follow-up. However, TSQ follow-up scores, although significantly different, were still below the screening threshold of six symptoms. Nevertheless, the difference in the follow-up TSQ score possibly indicates

higher prevalence of LB-related problems for non-treated participants, even on average two and a half years after the bombings.

Chapter 7 Comparing costs and outcomes of the ST programme

– economic evaluation of the ST programme

“One of the greatest attributes of economic analysis in any field is the ability to work with imperfect data.” Drummond et al. (2005, p. 56)

7.1 Introduction

This chapter presents the cost-effectiveness analysis of the ST programme. It covers the third comparison option: it compares individuals who received treatment early and those who were treated later in the programme. As this chapter will demonstrate, it is a challenging task to conduct a robust economic evaluation given the real-world context in which the ST programme was delivered.

I will begin with a brief recapitulation of the methods used in the economic evaluation, in particular in the context of mental health response and non-experimental study design. Finally, I will present a cost-effectiveness analysis of the ST programme and discuss my choice of methods as well as alternative approaches to economic evaluation in this context, alongside their interpretational and practical challenges.

The guiding idea behind this chapter is to discuss and explore all available avenues and approaches and to demonstrate how the encountered challenges were addressed.

This analysis will demonstrate that each economic evaluation rests on a unique set of assumptions shaped by the individual context of the intervention and therefore needs a specific and tailored approach.

7.2 Methods summary

Economic evaluation is a relatively young yet very useful and increasingly demanded tool for evidence-based decision-making in funding mental health interventions. Available outcome information will determine the type of the

economic evaluation, although the main influence on choice of analysis method is the question to be addressed. Within the context of the ST programme, due to collected information on costs and PTSD, depression and QoL outcomes, available economic evaluation tools were cost-effectiveness and cost-utility analyses.

The rationale for the analysis presented in Chapter 7 was to conduct an economic evaluation of the ST programme in the form of the cost-effectiveness analysis by comparing costs and outcomes of the participants who received treatment early with those who received treatment later. The hypothesis was that the later treatment group could serve as a proxy for individuals on the NHS waiting list, which is a comparison group I was aiming for but for which I was unfortunately not able to obtain data. The choice of comparison groups was guided by the availability of the data. Based on the findings on significant health, social and economic effects of PTSD, my expectation was to find a positive correlation between reported costs and treatment start timing. I assumed that the longer individuals wait for the treatment, the more likely they were to develop chronic PTSD and experience more profound health, social and economic consequences due to PTSD and its comorbid conditions. In regard to the differences in outcome scores between the two groups, I expected the later treatment group to report more severe symptoms and consequently higher scores on both outcome measures, as they were more likely, all things being equal, to develop chronic PTSD.

In regard to the differences likely controlled for by the indicators in the analysis, it is important to highlight that the choice of indicators was dictated by the available data and not the theoretical framework. Therefore, I could only control for socio-demographic characteristics (gender and ethnicity), exposure characteristics, treatment and follow-up timing, treatment type and psychiatric comorbidity. Although the indicators I have included in the analysis have a theoretical backing (the effect of ethnicity and gender on PTSD and service use, the effect of exposure and injury on costs and PTSD rates, and the effect of psychiatric comorbidity in PTSD diagnosis) ideally I would like to have controlled for all other potential factors, observed and unobserved, ensuring

that the only difference between the two groups is the start of the treatment. Unfortunately, this was not possible in this study design and therefore I cannot conclude with certainty that there is a causal relationship between timing of the treatment and differences in costs and outcomes between the two comparator groups. Still, the design allowed controlling for observed indicators, which play an important role as risk factors in PTSD such as gender and ethnicity, trauma exposure characteristics and psychiatric comorbidity.

In order to minimise and adjust for observable biases introduced by the observational study design, I have used multivariate regression to adjust both costs and outcomes for the same group of covariates based on theoretical and statistical criteria. In practice, this translates to running a set of GLM models for prediction of both costs and outcomes. The model protocol is outlined in Table 7.1.

Table 7.1 Costs and effects model protocol

```

** Step A1: GLM model for COSTS**

glm COST i.group $covariates if COST>0, fam(gamma) link(log)
predict yhat1 if e(sample), mu

**Step A2: estimate person-specific COSTS **

gen yhat1c=phat1*yhat1

** Step A3: GLM model for EFFECTS (e.g. BDI score follow up)**

glm BDI i.group $covariates, fam(gamma) link(log)

**Step A4: estimate person-specific EFFECTS **

predict yhat2 if e(sample), mu

**Step B1: obtain mean predicted costs for group 0 and 1,
then subtract to get difference in group mean**

margins COSTS treatment timing =(0 1) atmeans

* *Step B2: obtain mean predicted BDI for group 0 and 1,
then subtract to get difference in group mean**

margins EFFECTS (treatment timing =(0 1) margins

```

I used SPSS 12 and STATA 11 statistical packages to analyse costs and outcomes. I will start the analysis with descriptive analysis of participants' socio-demographic, exposure and clinical characteristics. For costs and outcome categories for each participant group, I will present unadjusted mean values before presenting models and adjusted estimates. I have used three cost categories:

a. *ST programme costs*

b. *direct costs*: aggregate consisting of statutory-provided health care services, hospitalisation, medication, voluntary and private sector-provided services, and

c. *total costs*: aggregate consisting of the ST programme, direct costs and work related costs due to sick leave, unemployment and reduced work hours.

I have adjusted all costs and effects models for the following covariates: age; gender; ethnicity, if the person was injured (Q1); if person thought they would be injured or killed (Q2); if the person saw someone who was injured or killed (Q3); existence of psychiatric comorbid conditions; treatment type; follow-up timing (days since the LB) and total number of treatment sessions.

I will firstly present results of the model evaluation, followed by assessment of the model fit by running a Park test, a link test to check linearity of the response and then checking the distribution of the residuals to test for heteroscedasticity.

I will calculate average mean predicted costs and effects for all treatment and comparator groups, and subtract them to get differences in group means in order to calculate ICERs for each evaluation scenario. In order to explore uncertainties around the cost-effectiveness analysis I have calculated a cost-effectiveness acceptability curve (CEAC) for each evaluation scenario and I have bootstrapped the ICERS. In order to obtain CEACS I have entered predicted costs and effects into the CLT EXCELL model provided by Nixon et al (2005b).

7.3 Participants' and the ST programme outcomes description

Prior to the commencement of the analysis, it is important to set the scene with detailed information on participants, in this case the ST program users. As Table 7.2 shows, there is no difference in exposure, employment, ethnicity or age. However, the early treatment group had 30% more women ($\chi^2=7.03$; $p<0.01$). In both early and later treatment groups around 60% of participants were white British, on average 40 years of age. 90% of the sample were personally involved in the LB, around 40% were injured, and 70% witnessed injury and death and felt they might be injured or killed.

Table 7.2 Participants' socio-demographic characteristics, employment and exposure information

	Earlier treatment group (N=53)		Later treatment group (N=50)		
	N	%	N	%	p
Female	38	71	23	46	0.01
Ethnicity – white British	30	57	34	68	0.47
Employment category					
>500 £ median weekly salary	27	51	24	48	0.25
<500 £ median weekly salary	23	44	21	42	0.42
Student	2	4	2	4	0.43
Retired	1	2	0	0	0.32
Not stated	2	4	2	4	0.65
Exposure					
Q1. Injured?	20	40	16	32	0.68
Q2. Thought you might be injured/killed?	34	64	39	78	0.13
Q3. Witnessed injury or death?	43	81	40	80	0.85
Q4. Family member/ close friend killed?	4	8	2	4	0.44
Q5. Family member/ close friend injured?	2	4	1	2	0.59
Q6. You felt family member or a close friend might be injured/killed?	5	10	2	4	0.28
Q7. Personally witnessed effects of the bombings?	49	93	48	96	0.44
Age (mean)	40.73		40.30		0.74

Follow-up evaluation interviews took place once individuals finished treatment when most of the participants were discharged from the ST programme. Participants in both groups were, on average, screened once, with on average more participants with more than one screener in the later treatment group. There are several possible explanations for on average larger number of screeners for people who were treated later. In the second year of the programme, the number of referrals had dropped and this could have led to those individuals being more likely to be referred for treatment (even if they had milder symptoms) simply because there was more availability of the treatment. Another possible explanation could be that a number of individuals coming later to the treatment had delayed onset PTSD.

Table 7.3 Assessment and treatment information

	Earlier Treatment group (N=53)		Later treatment group (N=50)		p
	M	SD	M	SD	
Number of screeners	0.92	0.43	1.16	0.61	0.03
Referral to the ST programme - N of days since LB	118.03	76.54	314.68	138.13	<0.01
Assessment date – N of days since LB	149.94	66.12	404.21	124.73	<0.01
Treatment start – N of days since LB	182.90	68.26	453.52	112.39	<0.01
Treatment - total number of sessions	15.43	13.85	11.22	8.70	0.07
	N	%	N	%	
Participants who finished treatment	41	77	40	80	0.40
PTSD – DSM IV	36	68	30	60	0.32
PTSD – ICD-10	43	81	35	70	0.13

In both groups, around 80% of participants finished treatment. Around 70% of participants in both groups were diagnosed with PTSD (DSM IV). There was no difference between participants with PTSD ICD-10 or PTSD-DSM IV primary diagnosis between two groups (chi sq DSM-IV=0.95, $P>0.05$; chi sq ICD-10=2.28, $p>0.05$). Although the early treatment group had on average a higher

number of total therapy sessions this difference is not statistically significant at $p=0.05$ criteria ($t=1.84$, $p>0.05$) (table 7.3).

There is a strong positive correlation of 0.70 ($p<0.001$) between referral to treatment, assessment and treatment date and therefore, I have chosen to use treatment start only (expressed as number of days since the LB) in the analysis.

7.4 Cost analysis

I will start with description of the costs and differences between comparator groups based on unadjusted costs and proceed with presenting cost models for each cost category. Due to skewed cost distribution I have used the Mann-Whitney test to test for differences in unadjusted costs between early and later treatment groups. Test results showed statistically significant differences only on work (productivity) costs between two groups (table 7.3, $Z=2.65$, $p<0.02$).

7.4.1 Service use and cost information

Cost estimates in health care are rarely normally distributed and this is true for both early and later treatment groups. Table 7.4 presents unadjusted mean costs for both participant groups per each cost category. I have used the one-sample Kolmogorov-Smirnov test to test the costs distribution. All cost distributions are statistically different from normal distribution at $p>0.05$ level. Two suggested approaches in dealing with issues of skewed costs distributions are log transformations of cost variables (Kilian et al., 2002) or ordinary least square model followed-by bootstrapping.

The Mann-Whitney test showed no difference in average unadjusted reported costs between early and later treatment groups except for costs due to productivity loss (sick leave) and hours reduced (Table 7.4). On average, when looking at unadjusted mean costs, the early treatment group reported three times higher work-related costs; this measure includes all costs due to sick leave, reduced hours and unemployment.

Table 7.4 Average unadjusted costs per cost and participant category

	Early treatment group (N=53)		Later treatment group (N=50)		p
	M	SD	M	SD	
ST screening and assessment	778.42*	280.78	790.02*	266.01	0.83
ST treatment	3489.64*	497.85	2924.68*	322.16	0.97
ST total	4268.07*	493.92	3714.70*	319.35	0.97
NHS health services	820.28*	164.95	957.95*	287.27	0.32
Private sector provided services	435.42*	100.42	285.26*	87.03	0.12
Voluntary sector provided services	122.83*	63.48	89.37*	52.07	0.60
Hospitalisation	455.97*	342.75	552.04*	272.01	0.65
Medication	39.99*	20.48	14.08*	6.13	0.32
NHS costs	1316.10	3005.20	1524.19	3354.12	0.42
Total direct costs	1874.28*	422.23	1898.99*	508.08	0.10
Sick leave	10694.96*	3373.44	2484.12*	926.20	0.00
Hours reduced	549.15*	321.22	38.27*	22.67	0.09
Unemployment	7202.33*	3191.80	3986.66*	1779.28	0.31
Total productivity loss costs	18490.54*	5021.07	6509.31*	2363.74	0.00
Total overall costs	24632.68*	5518.67	12122.79*	2532.54	0.01

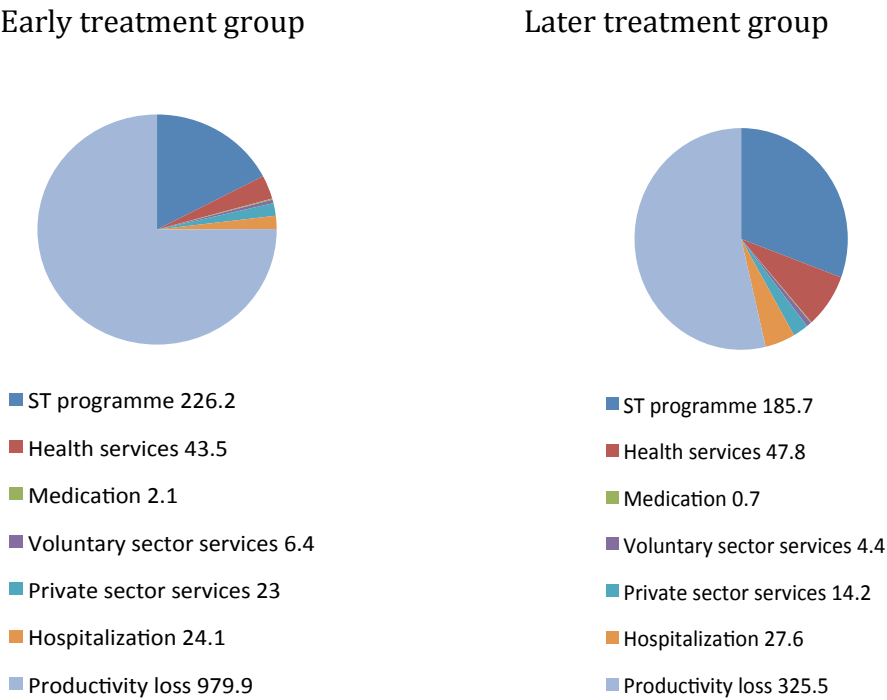
*not normally distributed costs P<0.05

The early treatment group reported more than double overall costs in comparison to the late treatment group. This is an interesting finding as I expected the converse – that the costs would be positively correlated with timing of the treatment. My hypothesis was that the longer it took for participants to reach treatment the higher the costs they would generate through seeking help from other services. Both groups reported similar total direct costs, while ST programme costs associated with the early treatment group are 20% higher.

Although productivity-related costs make the greatest contribution to the total cost in both groups, in the early treatment group productivity loss costs represent 75% of the total costs, while in the later group productivity costs represent 50% of the total costs. Most of the difference in terms of costs derives

from productivity loss-related costs and is not related to service use. One potential interpretation could be that the later treatment group was observed in a period in which they had already overcome some of the mental health problems due to PTSD.

Figure 7.1 Total cost break-down for early and later treatment group in ST programme in £1000



The early and later treatment groups differ in the percentage of contribution of each cost type in overall costs, as shown in Table 7.5 and Figure 7.1. Costs associated with the ST programme are the second largest cost in both groups. The situation is the same for direct costs, with a higher overall proportion of health services and hospitalisation costs in the later treatment group, although the difference was not found to be significant.

The contribution of the voluntary and private sector cost to the overall cost is the same in both groups. When looking at direct costs between early and later treatment groups, reported total direct costs are almost identical.

Table 7.5 Percentage contribution of each service cost to the overall costs per participant group

	Early treatment group (N=53)		Later treatment group (N=50)	
	SUM	%	SUM	%
ST screening and assessment	41256.6	14	39501	24
ST treatment	184951.2	3	146234.4	7
ST total	226207.8	17	185735.4	30
Health services	43475.1	3	47897.7	8
Private sector provided services	23075.18	2	14273.85	2
Voluntary sector provided services	6496.9	-b	4454.7	-b
Hospitalisation	24159	2	27608	5
Medication	2119.46	-b	704.1	-b
Direct costs	99325.7	8	94938.3	16
Productivity loss due to sick leave*	566782.5	43	124208.4	20
Hours reduced	31498.2	2	1933.3	-b
Unemployment	381717.7	29	199324.2	33
Total work costs*	979998.41	75	325465.9	54
Total overall costs *	1305531.9		606139.6	

a All percentages have been rounded to nearest whole number

b Denotes contribution less than 1%

*Denotes statistically significant difference between two groups $P < 0.05$

Figure 7.2 Number of participants who reported costs per cost category

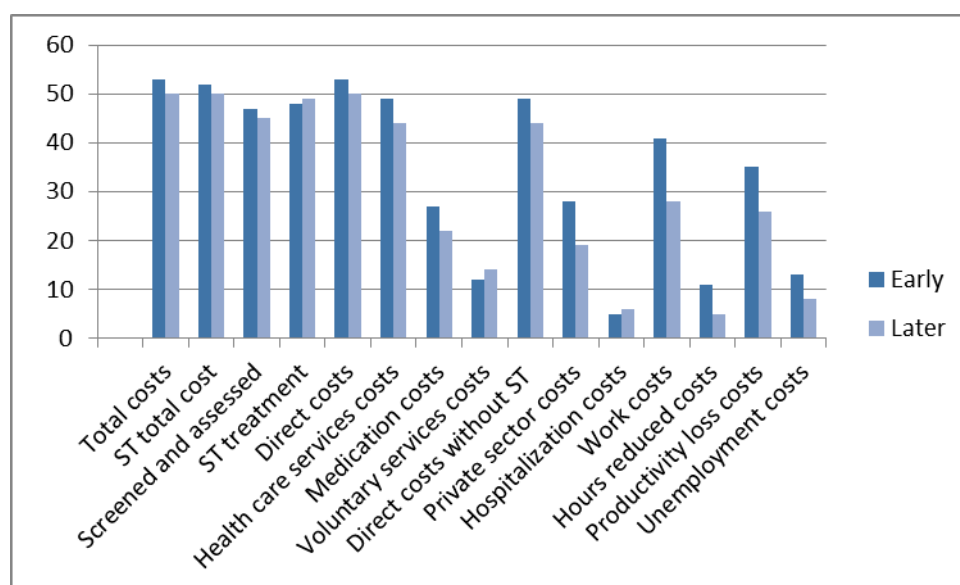


Figure 7.2 illustrates the most frequently-used services for both groups (the ST programme and health care services). Medication, voluntary and private sector services, on the other hand, were less frequently-used: in both groups less than 50% of the participants reported using those services. Figure 7.2 confirms that the largest differences in number of participants per cost category between the early and late group were for private sector and work-related cost categories.

Below is a summary of the details on service use presented in Chapter 4 and in Table 7.6. The most frequently reported services used at least once by participants in both groups were GP services followed by NHS and privately-provided mental health services, and A&E services. The early treatment group used more of both private- and NHS-provided mental health services ($p < 0.05$), while the later treatment group reported using more A&E services ($P < 0.05$).

Painkillers, antidepressants, sleeping tablets and antibiotics were the most commonly reported medications used by the participants in both groups.

Table 7.6 Service use: health, voluntary, private, medication and hospitalisation

	Early treatment group (N=53)		Later treatment group (N=50)		p
	N	%	N	%	
NHS physical health					
GP	44	83	39	78	0.60
Accident and Emergency	14	26	22	44	0.02
Audiologist	1	2	4	8	0.54
Physiotherapist	3	6	3	6	0.43
Ear specialist	1	2	1	2	0.44
Eyes specialist	1	2	1	2	0.59
Neurologist	2	4	0	0	0.32
Surgeon	1	2	1	2	0.28
Other nurse	1	2	2	4	0.36
NHS provided MH services*	25	47	10	20	0.03
Privately provided MH services*	18	34	12	24	0.15
Medication	27	51	22	44	0.25
Hospitalisation	5	9	6	12	0.49
Private sector services	28	53	19	38	0.59
Voluntary sector services	12	22	14	28	0.43

*MH services provided by counsellor, psychiatrist, psychologist

7.4.2 Cost models

In Chapter 5 I explored cost variations by using multivariate analysis, with the aim of establishing the relative contribution of each of the sources of variation, as I was interested in exploring cost drivers for each participant group and cost category. In the cost models presented below, my aim was to predict costs as robustly as possible by controlling for all measured covariates consistently across cost groups. I have employed this approach in the outcome prediction models with the same aim.

In each cost model I have controlled for the following covariates:

- gender (males relative to females),
- ethnicity (white British relative to other ethnic categories),
- Q1. Experiencing injury,
- Q2. You felt like you might be injured or killed?
- Q3. You saw someone who has been injured or killed?

- treatment start date – time elapsed between the LB until the start of the treatment in days
- follow-up timing - time elapsed between the LB until the start of the evaluation study in days
- psychiatric comorbidity
- treatment type (CBT vs. EMDR)

Start of treatment, end of treatment and follow-up periods vary significantly across patients in the study as they reflect the particular time when individuals started and ended treatment, and a point when they were followed-up as a part of the evaluation study (upon finishing the treatment).

Upon the initial analysis I was reluctant to proceed with dividing the ST programme users in two separate groups by using a dummy variable in the analysis. Rather than artificially creating early and late treatment groups based on a very crude measure. I looked instead at the treated participant sample as a whole and investigated the effect of timing of the entry to treatment, follow-up timing, socio-demographic and exposure characteristics. After adjusting for baseline covariates, the only statistically significant difference between the two treatment groups was found for work (productivity) and the ST programme-related costs. For all other cost categories, the analysis showed no differences in adjusted costs among early and later treatment group. GLM models for total, ST programme, direct and productivity loss cost categories are presented below.

a. Total costs

Table 7.7 GLM on total costs

<i>Potentially associated factors</i>	<i>Coefficient</i>
<i>N=101 observations</i>	<i>(95% confidence interval)</i>
Males relative to females	-0.06 (-0.57, 0.54)
White British relative to other ethnic categories	-0.28 (-1.06, 0.06)
Q1. Injured?	0.62 (0.25, 1.59)
Q2. Thought you might be injured/killed?	0.20*(-0.44, 0.86)
Q3. Witnessed injury or death?	-0.39(-1.19, 0.05)

Timing of follow-up	0.02 (-1.49, 0.10)
Treatment start date	-0.93** (-1.77, -0.10)
Psychiatric comorbidity	-0.52 (-0.93, 0.21)
Treatment type	0.26 (0.13, 1.05)
Constant	9.17*** (7.26, 10.63)
Link function	Log
Distributional family	Gamma

* p<0.10; ** p<0.05; *** p<0.01

I tried fitting Gamma, Poisson and Gauss distributions to identity and log links, however none provided for a good model fit. The residual scatter plot gave the best results for Gamma distribution with log link and I have kept it in the model. In the best-fit exploratory model, experiencing injury, ethnicity, timing of the evaluation follow-up and treatment timing were significant predictors of total costs (Appendix E, Table E1). However, in the cost prediction model presented in Table 7.7, when keeping in all covariates irrespective of their significance, only treatment timing remains a significant predictor of the costs, indicating that the early treatment group reported higher overall costs.

b. Direct costs

Table 7.8 GLM on direct costs

<i>Potentially associated factors</i>	<i>Coefficient</i>
<i>N=101 observations</i>	<i>(95% confidence interval)</i>
Males relative to females	0.79** (-0.01, 1.59)
White British relative to other ethnic categories	-0.37 (-1.38, 0.26)
Q1. Injured?	0.64(-0.13, 1.43)
Q2. Thought you might be injured/killed?	-0.38(-1.26, 0.49)
Q3. Witnessed injury or death?	0.20(-0.63, 1.04)
Timing of follow-up	0.05 (-0.01, 0.12)
Treatment start date	-0.71 (-1.8, 0.38)
Psychiatric comorbidity	-1.09***(-1.48, -0.21)
Treatment type	5.14 (4.24, 7.35)

Constant	6.07*** (4.57, 7.07)
Link function	Log
Distributional family	Gamma

* p<0.10; ** p<0.05; *** p<0.01

Direct costs model (Table 7.8) with gamma distribution family and log link function produced a funnel-shaped scatter plot. The results of the Park test suggested that the use of a gamma distribution was more appropriate. This model is very similar to the best-fit model (Appendix E, Table E.3) where gender and injury were significant positive predictors of costs, while psychiatric comorbidity diagnosis was a significant negative predictor of costs.

Average predicted direct costs for the early treatment group were £1965.83 with 95% CI ranging from £720.34 - £3211.09. For the later treatment group, average predicted costs were £965.36 with 95% CI ranging from £372.13-£1557.98.

c. The ST programme costs

Table 7.9 GLM on the ST programme costs

<i>Potentially associated factors</i>	<i>Coefficient</i>
<i>N=101 observations</i>	<i>(95% confidence interval)</i>
Males relative to females	-0.43 (-0.53, 0.10)
White British relative to other ethnic categories	-0.32** (-0.58, -0.06)
Q1. Injured?	0.48*** (0.21, 0.75)
Q2. Thought you might be injured/killed?	0.04 (0.02, -0.30)
Q3. Witnessed injury or death?	-0.06 (-0.63, 1.04)
Treatment start date	-0.46** (-0.77, -0.11)
Psychiatric comorbidity	0.10 (-1.48, 0.21)
Treatment type	0.04 (0.04, 0.05)
Time of follow-up	0.03** (0.00, 0.04)
Constant	7.92*** (7.57, 8.51)
Link function	Log

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

Residuals scatter plots, although showing several negative outliers for larger predicted means and positive outliers for smaller predicted means, presented best results when the model was fitted with gamma distribution and log link. This was confirmed by the Park test. Average predicted ST programme costs for the early treatment group were £4697.83 with 95% CI ranging from £3767.34 - £5626.09. For the later treatment group, average predicted costs were £3277.36 with 95% CI ranging from £2689.13-£3935.98.

d. Productivity loss associated costs

Table 7.10 GLM on productivity loss costs

<i>Potentially associated factors</i>	<i>Logistic regression of reporting work related costs N= 103 observations</i>	<i>GLM of costs per month due to the LB N= 68 observations</i>
	<i>Odds ratio</i>	<i>Coefficient</i>
	<i>(95% confidence interval)</i>	<i>(95% confidence interval)</i>
Males relative to females	0.76(0.25, 2.12)	0.04 (-0.07, 0.08)
White British relative to other ethnic categories	1.43(0.49, 4.19)	-0.47 (-1.50, 0.42)
Q1. Injured?	5.01*** (1.37, 18.36)	0.02 (-1.01, 0.08)
Q2. Thought you might be injured/killed?	1.35(0.99, 4.99)	0.97* (-0.04, 2.19)
Q3. Witnessed injury or death?	0.36(0.09, 1.32)	-0.33 (-1.79, 0.07)
Treatment timing	0.99 (0.91, 1.07)	-0.00*** (-0.01, -0.00)
Timing of the follow-up	0.98(0.88, 1.10)	0.06 (-0.02, 0.13)
Psychiatric comorbidity	0.60(0.18, 1.99)	-0.47 (-1.83, 0.88)
Treatment type	1.64(0.59, 4.52)	0.25 (-0.73, 1.24)
Constant		4.50** (0.30, 8.47)
Link function	-	Log
Distributional family	-	Gamma

Link test p-value	-
Pearson's chi-squared test p-value	0.46
Hosmer-Lemeshow chi-squared test p-value	0.27
Likelihood ratio chi-squared p-value	0.00
Per cent correctly classified	70.02%

* p<0.10; ** p<0.05; *** p<0.01

Average predicted productivity loss costs for the early treatment group were £11463.82 with 95% CI ranging from £3907.93 - £190189.16. For the later treatment group average predicted costs were £3925.69 with 95% CI ranging from £1018.53-£6832.23. The early treatment group reported significantly higher overall costs when work-related costs were included, both for adjusted and unadjusted costs. When controlling for socio-demographic factors, exposure and treatment characteristics, the early treatment group had on average 2.5 times higher costs overall due to exposure to the LB. Table 7.11 presents the average adjusted costs for all cost categories for both early and later treatment groups.

e. Adjusted costs

Table 7.11 Average adjusted costs per cost and participant category

	Early treatment group (N=53)		Later treatment group (N=50)		p
	M	(95% CI)	M	(95% CI)	
ST total	4697.8	3167.3-4826.0	3277.3	3200.1-3835.9	0.03
Direct costs	1965.8	720.2-3211.4	965.3	373.1-1557.2	0.45
Total costs	24530.8	11933.5-37127.4	9606.3	4814.16-14398.4	0.02
Productivity costs	11463.8	3907.9-19019.1	3925.6	1018.5-6832.2	0.00

As discussed earlier, there are various approaches in estimating both costs and effects, each with its own merits and problems. Adjusting costs and outcomes for the same set of covariates seems a sensible approach in

distinguishing between the effect of the intervention and the ‘background noise’ inevitable with an observational study design. Furthermore, using the same set of covariates ensures consistency and allows for comparability of the models. However, as seen from the presented models, costs and effects are significantly associated with different sets of covariates, both between groups and within cost and outcome categories. Therefore, a fixed set of covariates, although theoretically sound in practice, results in poorly fitting models with lower explanatory power and reduced statistical power.

7.5 Outcomes analysis

Three main outcome measures were collected as a part of the ST programme (all outcome measures are described in greater detail in Chapters 3 and 5): BDI, PDS and EQ5D. Each outcome measure can be presented in a different way, each portraying a slightly different perspective. For example, I could compare scores at the end of the treatment for two groups, I could compare differences in scores between end and start of treatment, and I could look at the number of PTSD-free and/or depression-free days for each group. Mirroring the costs models, I ran a GLM for differences between start and end scores for BDI, PDS and EQ5D measures and I have adjusted the models for identical covariates to control for all observed factors that could influence the treatment outcome. In each outcome model I controlled for the following covariates, guided by theoretical underpinning:

- gender (males relative to females)
- ethnicity (white British relative to other ethnic categories)
- Q1. Experiencing injury
- Q2. You felt like you might be injured or killed?
- Q3. You saw someone who has been injured or killed?
- treatment timing – time elapsed since LB in days
- follow-up timing - time elapsed since LB in days
- psychiatric comorbidity
- treatment type (CBT vs. EMDR)
- baseline outcome measure

Table 7.12 BDI, PDS and EQ5D unadjusted scores

	Early treatment (N=53)		Later treatment (N=50)		p
	M	SD	M	SD	
Outcome measure					
BDI assessment (N=101)	23.90	10.78	18.03	11.16	0.01
BDI start (N=101)	25.19	11.57	17.58	11.69	0.00
BDI end (N=101)	11.20	10.18	8.12	9.23	0.11
BDI follow-up (N=83)	12.38	9.84	7.61	9.91	0.02
BDI end-start	-13.35	10.14	-9.54	8.58	0.05
PDS assessment (N=101)	33.13	9.20	25.38	11.32	0.00
PDS start (N=101)	31.83	10.97	25.04	12.91	0.00
PDS end (N=101)	12.54	11.97	9.91	11.20	0.26
PDS follow-up (N=83)	15.67	11.96	9.84	9.84	0.02
PDS end-start	-18.62	12.53	-14.96	11.72	0.19
EQ5D assessment (N=95)	0.59	0.30	0.69	0.23	0.03
EQ5D follow-up (N=103)	0.75	0.25	0.86	0.19	0.19
EQ5D end-start	0.14	0.24	0.17	0.26	0.35

Unadjusted scores for BDI, PDS and EQ5D presented in Table 7.12 suggest that participants in the early treatment group started treatment with higher scores on average for all outcome measures. Differences in the start and end scores between the early and later treatment groups are statistically significant for the BDI ($p < 0.05$) measure but not for PDS and EQ5D measures. Differences on the outcome measures between the early and later treatment groups are presented in Figures 7.2-7.4. BDI scores for both groups indicate moderate depression (Beck, 1961), while scores for PDS indicate moderate to severe PTSD (Foa et al, 1997; McCarthy, 2008)⁵. For BDI and PDS, a higher score indicates worsening in symptoms, while for EQ5D a higher score is connected with improvement in health state. Although there was no significant difference for unadjusted mean scores at the end of the treatment, the early treatment group reported, on average, higher outcome scores. According to the PDS, the mean

⁵ PDS scores range from 0-51 and the cut offs for symptom severity ratings are as follows: 0 no rating, 1-10 mild, 11-20 moderate, 21-35 moderate to severe and >36 severe (Foa et al., 1997). BDI scores range from 0-63, with following score cut offs: 0-9 minimal depression, 10-18 mild depression, 19-29 moderate depression and 30-63 severe depression (Beck et al, 1988).

end score for the early treatment group would be considered to represent moderate PTSD, while for the later treatment group the average score indicates mild PTSD.

There was no statistically significant difference between BDI ($t=0.23$, $df=43$, $p>0.01$) and PDS ($t=-0.41$, $df=43$, $p>0.01$) scores measured at the end of treatment and at treatment follow-up for both early and later treatment groups.

I calculated Cohen's d , indicator of treatment effect size. Cohen's d divides the difference in the group means by their pooled standard deviation and is independent of sample size (Cohen, 1988). Treatment effects up to 0.2-0.3 are considered low, 0.5 is considered to be a medium effect and 0.8 is a large treatment effect (Cohen, 1988). The treatment size effects for BDI are 1.22 ($r=0.52$) for the early treatment group and $d=0.90$ ($r=0.41$) for the later treatment group, both of which are considered large treatment effects (Cohen, 1988). For PDS, the early treatment group treatment size effect is 1.64 ($r=0.62$), while for the later treatment group it is $d=1.14$ ($r=0.49$). The early treatment group had larger treatment effect sizes on both measures.

Figure 7.3 Difference in PDS assessment, start, end and follow-up scores between early and later treatment groups

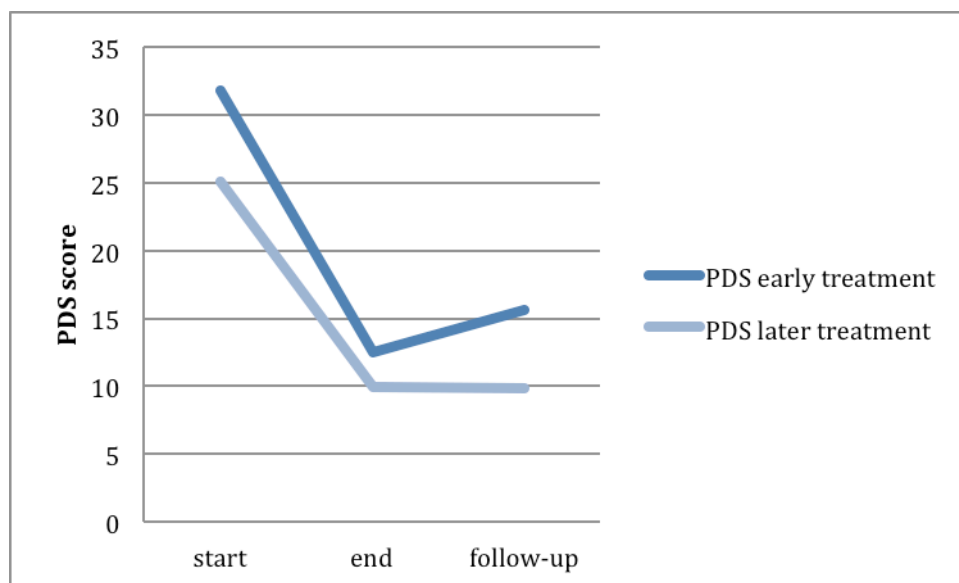


Figure 7.4 Difference in BDI assessment, start, end and follow-up scores between early and later treatment group

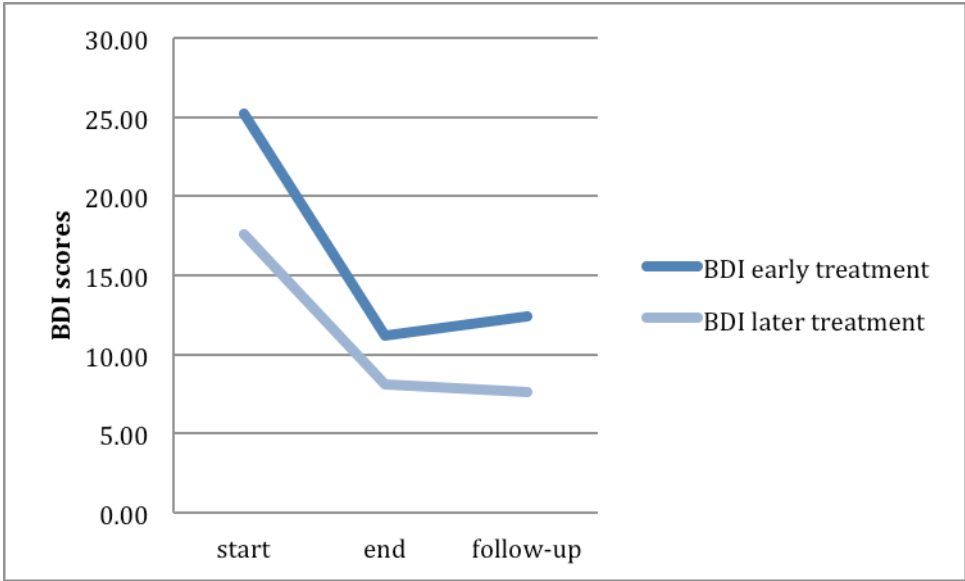
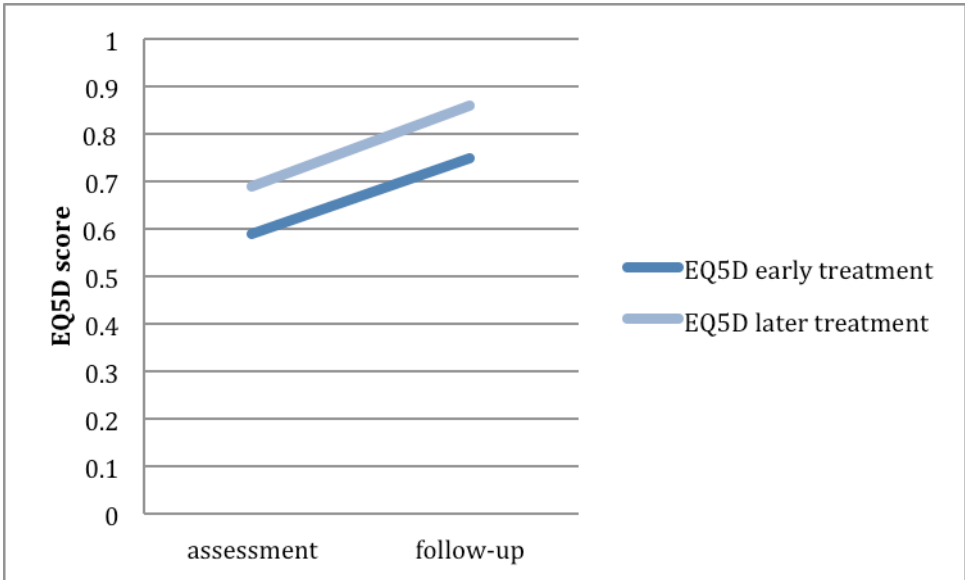


Figure 7.5 Difference in EQ5D assessment and follow-up scores between early and later treatment group



The average outcome measures reported in Table 7.12 again show differences between start, end and follow-up scores, as well as between immediate and delayed treatment groups. Scores for all measures for both groups were normally distributed except PDS post-treatment for the later

treatment group ($Z=1.6$, $p=0.00$) and EQ5D at the end of the treatment for both groups ($Z=2.14$, $p=0.00$; $Z=1.6$, $p=0.01$).

T-test for independent samples confirmed a statistically significant difference between both BDI and PDS scores at the start of the treatment between early and later treatment groups ($t(\text{BDIs})=3.25$, $p<0.01$; $t(\text{PDSs})=2.84$, $p<0.01$). Participants treated early had, on average, higher scores on both measures. At the follow-up stage for unadjusted BDI and PDS scores, there was a statistically significant difference in the Mann-Whitney test for both BDI and PDS between the early and later treatment groups ($Z_{\text{BDI}}=-2.4$, $p=0.02$; $Z_{\text{PDS}}=-2.5$, $p=0.02$).

Another method for assessing treatment outcomes is to look at reliable improvement on the treatment outcome measure and to assess how this result compares with clinically functional and dysfunctional populations for this particular mental health intervention and outcome (Evans et al., 1998). A method that combines both elements was introduced by Jacobson and Truax (1991) and is based on a calculation of reliable change index (RC) that assesses the improvement beyond expected by chance alone and a cut-off score that determines likelihood of person being closer to the mean of a functional trauma-exposed population than to the mean of a population with PTSD.

Reliable change calculation is based on multiplying the standard error of the difference by 1.96 for assessing 95% confidence level for the change between the start and end scores. "Change exceeding 1.96 times SE_{diff} is unlikely to occur more than 5% of the time by unreliability of the measure alone" (Evans et al., 1998, p. 70).

$$SE_{\text{diff}} = SD1 * \sqrt{2} * \sqrt{1-r}$$

$SD1$ is the standard deviation of the baseline observations, and r is the reliability of the measure (Jacobson and Thoreaux, 1991).

Thresholds for the PDS for functional and PTSD populations were calculated from the original validation data provided in Foa et al. (1997), yielding a cut-off of 22 for the early group and 18 for the later treatment group needed

for a clinical change. A fall of at least 9.46 on the PDS for the early treated group and 8.04 for the later treatment group was needed for a reliable change.

Mean BDI scores for functional populations were taken from Seggar, Lambert and Hansen (2002), yielding a cut-off of 13 for the early group, and 11 for the later treatment group. Corresponding thresholds for the reliable change on BDI are 11.99 for the early group and 12.12 for the later treatment group.

Chi-square tests did not show statistically significant change in achieving only clinical or both clinical and statistical change between the early and later treatment groups, as presented in Table 7.13 (Pearson chi (BDIcs)=0.30, $p>0.05$; Pearson chi (PDScs)=0.30, $p>0.05$; Pearson chi (BDIc)=1.82, $p=0.05$; Pearson chi (PDSc)=0.28, $p>0.05$).

Table 7.13 Number of participants who achieved a clinical and statistically significant change on BDI and PDS measure after the treatment

	Early treatment group (N=53)		Later treatment group (N=50)		P
	N	%	N	%	
BDI clinical and statistical change	24	45	20	40	0.48
PDS clinical and statistical change	33	62	31	62	0.29
BDI reliable clinical change	30	56	20	40	0.05
PDS reliable clinical change	39	74	32	64	0.24

7.5.1 BDI

a. Factors associated with achieving clinically significant change in BDI

I ran a logistic binary regression in order to look into factors associated with achieving clinically significant change on end of treatment scores. The model presented in Table 7.14 identified ethnicity and finishing treatment as factors associated with achieving clinically significant change on BDI. White British participants and participants who finished treatment were around three times more likely to achieve clinically significant change in comparison to the rest of the sample. The second part of the analysis is a GLM model that explores factors associated with end of treatment outcome scores.

Table 7.14 Logistic regression analysis of achieving clinically significant change on BDI

Potentially associated factors	OR
N=94 observations	(95% confidence interval)
White British relative to Other ethnic categories	3.52** (1.34, 9.27)
Finished treatment	3.24** (1.03, 13.48)
BDI score at start of the treatment	0.98 (0.94, 1.02)
Treatment timing	1.01 (0.94, 1.10)
Pearson's chi-squared test p-value	0.23
Hosmer-Lemeshow chi-squared test p-value	0.03
Likelihood ratio chi-squared p-value	0.00
Per cent correctly classified	65.65%

b. Factors associated with BDI end score

Table 7.15 GLM model on the BDI end score

Potentially associated factors	coefficient
N=94 observations	(95% confidence interval)
Finished treatment	-8.41*** (-12.03, -4.48)
White British relative to Other ethnic categories	-3.90***(-7.16, -0.63)
BDI score at start of the treatment	0.43*** (0.03, 0.66)
Treatment timing	-0.00 (-0.01, 0.00)
Physical comorbidity	7.39*** (3.03, 11.76)
Constant	10.87*** (4.13, 17.60)
Family	Gauss
Link	Identity
R squared = 0.56	

Average predicted BDI end scores for the early treatment group was 10.69 (9.09-12.28), and 8.62 (7.05-10.29) for the later treatment group.

Factors associated with the lower end BDI score, as shown in Table 7.15 and identified by the GLM model, included finishing treatment and being in the white British ethnicity category. Physical comorbidity and a higher BDI score at the start of the treatment predicted a higher BDI end score.

c. Factors associated in pre and post treatment difference in BDI

Table 7.16 GLM on pre and post treatment difference in BDI score – prediction model

Potentially associated factors	Coefficient
N=93 observations	(95% confidence interval)
Males relative to females	-0.67 (-4.11, 5.05)
White British relative to Other ethnic categories	0.97 (-8.50, 4.12)
Q1. You were injured	1.54 (-2.60, 11.18)
Q2. Thought you might be injured/killed?	-2.07 (-7.06, -2.49)
Q3. Witnessed injury or death?	6.04*** (1.14, 10.04)
Treatment timing	4.16** (-0.57, 8.11)
Follow-up timing	3.72 (-0.2, 6.45)
Psychiatric comorbidity	2.13 (-4.48, 5.2)
Treatment type	-0.40 (-2.24, 4.35)
Constant	-18.43*** (-28.21, -9.66)
Link function	Identity
Distributional family	Gauss

Average predicted pre- and post-treatment difference in BDI score for the early treatment group was -13.78 (-16.10, -10.23), and -9.58 (-12.10, -6.22) for the later treatment group.

If I control for the BDI score at the treatment start there is no difference between the early and later treatment groups in the BDI score difference between the early (-11.55) and later treatment groups (-11.32).

7.5.2 PDS

a. Factors associated with achieving clinically significant change in PDS

Table 7.17 Logistic regression analysis of achieving clinically significant change on PDS

Potentially associated factors	OR
N= 94 observations	(95% confidence interval)
White British relative to Other ethnic categories	7.26** (1.45, 58.45)
Q1. You were injured?	3.19*** (0.28, 6.17)
Finished treatment	32.89*** (6.03, 448.48)
BDI score at start of the treatment	0.96 (0.94, 1.02)
Treatment timing	1.00 (0.99, 1.00)
Link test p-value	-
Pearson's chi-squared test p-value	0.01
Hosmer-Lemeshow chi-squared test p-value	0.05
Likelihood ratio chi-squared p-value	0.00
Per cent correctly classified	70.60%

The model presented in Table 7.17 identified ethnicity, injury and finishing treatment as factors associated with achieving clinically significant change on PDS. Again, people of white British background were around seven times more likely, and those who finished treatment were 32 times more likely to achieve clinically significant change in comparison to the rest of the sample. Interestingly, the model identified injured participants as being three times more likely to achieve clinically significant change on PDS as well.

b. Factors associated with PDS end score

Table 7.18 GLM model on the PDS end score

Potentially associated factors	Coefficient
N=94 observations	(95% confidence interval)
White British relative to Other ethnic categories	-5.80*** (-7.96, -0.15)
Physical comorbidity	10.68*** (4.17, 17.18)
Finished treatment	-11.90*** (-13.03, -0.48)
PDS score at start of the treatment	0.39*** (0.03, 0.56)
Treatment timing	0.00 (-0.01, 0.00)
Constant	13.81*** (5.45, 22.17)
Family	Gauss
Link	Identity
R squared= 0.43	

Average predicted end PDS score for the early treatment group was 11.08 (9.65, 13.47), and 8.47 (8.29, 12.67) for the later treatment group. The model presented in Table 7.18 identifies that participants of white British background and those who finished treatment are associated with lower PDS end scores. Unsurprisingly, physical comorbidity and higher PDS start scores were associated with higher PDS end scores.

The role of the finished treatment coefficient should be taken into account when assessing the significance of other indicators in models examining clinically significant change or improvements on BDI and PDS. Finishing treatment has a strong positive correlation with a person feeling better and this is in turn positively associated with achieving clinically significant change and improvements in the BDA score. Therefore, the inclusion of a finished treatment indicator might undermine the significance of other indicators in the model, such as the start of the treatment or the outcome measure score at the start of the treatment.

c. Factors associated in difference between pre and post treatment PDS scores

Table 7.19 GLM for pre and post treatment difference in PDS score

<i>Potentially associated factors</i>	<i>Coefficient</i>
<i>N=93 observations</i>	<i>(95% confidence interval)</i>
Males relative to females	-0.43 (-6.11, 5.05)
White British relative to Other ethnic categories	-0.67 (-8.50, 4.12)
Q1. You were injured?	4.08 ** (0.60,11.18)
Q2. Thought you might be injured/killed?	-7.07 *** (-16.06, -2.49)
Q3. Witnessed injury or death?	4.04(-2.14, 10.04)
Treatment timing	5.70 ** (0.10, 10.11)
Follow-up timing	2.76 (-1.34, 7.12)
Psychiatric comorbidity	1.13(-4.48, 5.2)
Treatment type	0.40(-2.24, 4.35)
Constant	-20.43 *** (-27.21, -13.66)
Link function	Identity
Distributional family	Gauss

Average predicted pre- and post-treatment differences in the PDS score for the early treatment group was -19.98 (-22.10, -14.23), and -14.73 (-19.10, -12.22) for the later treatment group.

Residuals were nicely dispersed and the Park test approved Gauss distribution. Treatment difference is calculated as the score at the start of the treatment minus the score at the end of the treatment.

On BDI, six participants reported higher scores at the end of the treatment in comparison to the treatment start (three from the early treatment group and two from later treatment). Three of those participants finished treatment while three did not. On PDS, five individuals had a higher score at the end of the treatment (out of which three were from the later treatment group) and out of those, only two finished treatment.

7.5.3 Depression-free and PTSD-free days calculation

There are several difficulties in relation to the calculation of both PTSD-free and depression-free days. The first is the different timing of the data collection for each participant depending on when they entered the ST programme, i.e. when they were assessed, treated and followed-up, which consequently produced a great variation of data for each data collection point. Secondly, there is an issue with the lack of data on both measures for the period from the LB to the assessment point, and this is crucial for calculation of PTSD-free and depression-free days as the LB event is a reference point for the calculation.

There are two ways of addressing this problem as each is built on a set of assumptions, hence caution is required when interpreting the results. One approach is to use multiple imputation that takes into account changes in the scores over time alongside other explanatory variables, such as socio-demographic and exposure characteristics. The imputation model assumes a linear relationship of the predicted values, which is questionable in this case as results from an RCT on interventions for PTSD suggest a potential non-linear relationship between outcome scores and time, with a smaller initial drop in symptoms, followed-by a plateau and a larger drop in scores at 9 months after exposure to the traumatic event (Ehlers et al., 2003). Values obtained by multiple imputation are built on heavy assumptions. which undermines the validity and generalisability of the model.

Another equally challenging approach is to base the calculations of scores for the period between the LB and the ST programme start on data from existing studies. There are numerous issues with this approach, starting with the comparability of the samples, particularly in regard to socio-demographics, exposure, traumatic event type, study time frame and treatment characteristics. Another problem is the assumption about the nature of the relationship between time and changes in the PDS and BDI measures since exposure to the traumatic event, which can easily be explored in the sensitivity analysis.

Although both approaches in estimating depression-free and PTSD-free days have challenges, I have decided to follow the second approach and base the

calculation on the findings from published studies. One of the reasons for this is that this approach offers an insight into the changes in the BDI and PDS scores over time since exposure to the traumatic event. Moreover, the RCT by Ehlers et al. (2003) on effects of early intervention for PTSD provides a valuable insight into the recovery mechanisms after the traumatic event and development of PTSD. The study recruited A&E attendees for injuries after motor vehicle accidents around four weeks after the traumatic event and followed them up after a three week-period of self-monitoring. Participants who scored above 15 on PDS (Foa et al., 1997) were randomly allocated three types of treatment: CBT, a self-help CBT-based booklet and repeated assessments.

The study measured both BDI and PDS scores for individuals who qualified on criteria for PTSD at several time points: at the study assessment point, after self-assessment, at three months (post-treatment) and 9 months (follow-up). Whilst there are differences between the LB and Ehlers study namely in the type of the traumatic event (terrorist attack vs. motor vehicle accident), timeline of the intervention (7 weeks after the accident in comparison to a range of between 8 months and two years after the LB), participant characteristics (the RCT sample was almost exclusively Caucasian, while the LB was mixed, and a third of the RCT sample was blue collar, while the LB study was predominantly white collar and professional), the Ehlers study offers to my knowledge the best available published data on BDI and PDS score changes during exposure to a traumatic event and treatment.

For the calculation of the BDI and PDS scores for the period between the LB and assessment point, I used the percentage increase in each measure as reported by Ehlers and applied it to the LB data. I have allocated Ehlers' data to matching time points in the LB study i.e. 8 weeks, 3 months, 9 months, >9 after the LB. For participants who entered the ST programme more than 9 months after the LB, I used the 9 months rate as this was the only available score estimate.

a. Depression-free days

Table 7.20 GLM on depression-free days

<i>Potentially associated factors</i>	<i>Coefficient</i>
<i>N=94 observations</i>	<i>(95% confidence interval)</i>
Males relative to females	-27.82(-35.83, -9.51)
White British relative to Other ethnic categories	135.03*** (66.1, 225.05)
Q1. Injured?	-48.03 (-61.50, 82.12)
Q2. Thought you might be injured/killed?	-24.08 (-30.80, 44.00)
Q3. Witnessed injury or death?	-27.26(-140.06, 176.49)
Timing of follow-up	4.04(-6.14, 16.04)
Treatment start date	49.00 (18.49, 299.10)
Psychiatric comorbidity	-74.70 (-254.77, 7.11)
CBT	13.13(-185.48, 28.2)
Constant	120.04(-62.24, 174.35)
Link function	Log
Distributional family	Gauss

For the BDI threshold calculation I followed the protocol suggested by Lave et al. (1998). Suggested cut-off scores on BDI were 22 for severe depression and 8 for no depression (Lave et al., 1998). If a participant scored 22 or higher on BDI no depression-free days (DFD) were assumed, while if the score was 8 or below a full DFD was assumed.

In order to calculate depression-free days for scores between 8 and 22, I have expressed these scores in fractions of 14, with a score of 8 equalling 14/14 of a DFD, and a score of 22 equalling 0/14 of a DFD. For example, a score of 10 equals 12/14 of a DFD, i.e. 0.86 DFD. I have calculated the number of DFD days per person by adding the number of DFD for time periods between assessment, treatment start, treatment end and follow-up. For each time period I had a

recording of the BDI score that I have expressed in fractions of 14, as stated above. The number of DFD for each period was calculated as the score expressed in fractions at the start of the period minus the score expressed in fractions for the end of the period, divided by 2 and multiplied by the number of days between the two data collection points.

The Mann-Whitney test for independent samples showed a statistically significant difference in depression-free days between the two treatment groups ($Z=-3.28$, $p<0.01$) with the early treatment group reporting a median of 3.5 depression-free days, while the later treatment group reported 1.65 depression-free days. The unadjusted mean depression-free days for early treatment group is 260.33, while for the later treatment group it was 464.36 days ($Z=-4.09$, $p<0.00$).

Models show residuals are nicely dispersed and the Park test approved the use of Gauss distribution with log link. Average predicted depression-free days for the early treatment group is 265.38 (271.10, 354.23) and 314.58 (201.10, 347.22) for the later treatment group.

If I control for the BDI score at the start of the treatment, a statistically significant difference between the two groups on depression-free days is no longer observed (299 days versus 282 days). As the model in Table 7.19 presents, the only significant predictor of depression-free days is ethnicity, with white British participants reporting significantly more depression-free days in comparison to the rest of the sample. Although the early treatment group on average reported fewer depression-free days in comparison to the later treatment group (265 vs. 314), the difference is not statistically significant.

b. PTSD-free days

In order to calculate the PDS threshold I used scoring suggested by McCarthy (2002) where scores 0-10 are associated with no PTSD, scores between 11 and 35 with moderate PTSD, and scores >36 with severe PTSD. I have used the same calculation protocol as for DFD.

Unadjusted mean PTSD-free days for early treatment group is 359.44, while for later treatment group is 574.45 days ($Z=-3.35$, $p<0.00$).

Table 7.21 GLM on PTSD free days

<i>Potentially associated factors</i>	<i>Coefficient</i>
<i>N=93 observations</i>	<i>(95% confidence interval)</i>
Males relative to females	21.03 (-66.11, 75.05)
White British relative to Other ethnic categories	102.03** (8.50, 196.12)
Q1. Injured?	-98.08 **(-190., 0.18)
Q2. Thought you might be injured/killed?	14.07(-96.06, 126.49)
Q3. Witnessed injury or death?	04(-142.14, 26.04)
Treatment start date	0.70 (-32.77, 90.11)
Follow-up date	0.77**(1.98, 19.0)
Psychiatric comorbidity	149.13***(-185.4, -28.2)
CBT	44.04(-62.24, 74.35)
Constant	126.58 (-97.21, 350.66)
Link function	Identity
Distributional family	Gauss

Residuals are nicely dispersed and the Park test approved the use of Gauss distribution. Average predicted PTSD-free days for the early treatment group is 430.38 (358.10, 539.23) and 511.58 (441.10, 581.22) for the later treatment group.

If I control for the PDS score at the start of the treatment, the statistical difference between the number of PTSD free days between the two groups does not change, with the early treatment group averaging 485 PTSD-free days, in comparison to the later treatment group averaging 469 PTSD-free days.

The GLM model presented in Table 7.20 shows several factors associated with PTSD-free days, such as ethnicity and follow-up date, which are positively associated with PTSD-free days, meaning that again white British participants

and participants followed-up at the later date reported a higher number of PTSD-free days in comparison to the rest of the sample. Injured participants and ones with psychiatric comorbidity, on the other hand, had significantly fewer PTSD-free days in comparison to the rest of the sample.

7.5.4 EQ5D

Table 7.22 GLM on EQ5D difference

<i>Potentially associated factors</i>	<i>Coefficient</i>
<i>N=101 observations</i>	<i>(95% confidence interval)</i>
EQ5D at treatment start	-0.67***(-0.83, -0.51)
Males relative to females	-0.03 (-0.11, 0.05)
White British relative to Other ethnic categories	0.03 (-0.50, 0.12)
Q1. Injured?	-0.08*(-0.17, 0.00)
Q2. Thought you might be injured/killed?	0.07(-0.06, 0.49)
Q3. Witnessed injury or death?	-0.04(-0.14, 0.04)
Timing of follow-up	0.00 (-1.49, 0.10)
Treatment start date	-0.00 (-0.77, 0.11)
Psychiatric comorbidity	-0.13***(-1.48, -0.21)
CBT	0.04(-0.24, 0.35)
Constant	0.43*** (0.21, 0.66)
Link function	Identity
Distributional family	Gauss

Park test approved Gauss distribution.

The average predicted pre- and post-treatment difference in EQ5D score for the early treatment group is 0.17 (0.10-0.23), and 0.16 for the later treatment group (0.10-0.22).

The GLM model presented in Table 7.22 shows two significant factors associated with the EQ5D score difference: the EQ5D score at treatment start and psychiatric comorbidity were both negatively associated with EQ5D score difference, meaning that participants with lower EQ5D at the start of the treatment achieved larger EQ5D score difference i.e. reported a greater

improvement in quality of life, and the same is true for participants with psychiatric comorbidity. However, there was no statistically significant difference in a pre- and post-treatment EQ5D scores between the early and later treatment groups.

From a theoretical point of view, the EQ5D is the most appropriate measure for the analysis, as it introduces information on societal willingness to pay for improvement. However, the decision not to use QALYs to calculate ICERs and CEACs was guided by concerns over the quality of QALY data, which was obtained by converting the SF-12 scores into EQ5D. Initially, the study used the EQ5D measure due it having a short and user-friendly format, however, soon into the evaluation study we realised that this instrument was not discriminating between participants with different needs and scores on BDI and PDS questionnaires and decided to replace it with the SF-12 questionnaire. The algorithm developed by the HERC-enabled transformation of the SF-12 scores back to the EQ5D in order to avoid sample size reduction. Finally, as I was reaching the thesis' word limit, in consultation with my supervisors, I decided only to include data on depression and PTSD outcome measures in the economic evaluation.

7.6 ICER calculations

Table 7.23 Adjusted outcomes and costs for early and later treatment groups based on the multivariate regression **analyses presented in subchapters 7.4 and 7.5**

	Early treatment group (N=53)		Later treatment group (N=50)		
	M	95% CI	M	95% CI	p
Outcome measures (treatment end scores)					
BDI end	10.69	0.4-13.9	8.62	5.7-7.9	0.07
PDS end	11.08	8.98-14.78	8.47	5.3-8.1	0.91
EQ5D fup	0.82	0.75-0.88	0.81	0.75-0.87	0.89
Outcome measures (end-start difference)					
BDIe-s	-13.78	-16.76,-10.63	-9.58	-12.10,-6.22	0.04
PDSe-s	-19.38	-20.68,-12.33	-14.73	-22.26,-14.65	0.04

EQ5De-s	0.17	0.10 – 0.28	0.16	0.06 – 0.23	0.52
Outcome measures (depression and PTSD free days)					
DFD(BDI)	265.38	271.2-354.9	314.58	201.8-347.4	0.67
PTSDFD(PDS)	430.38	430.2-539.4	511.58	417.1-521.3	0.71
Costs					
Total cost	24530.8	11448 - 37086	9606.3	4924 - 14653	0.02
Direct cost	1966.1	712.9 - 3221.1	965.9	352 - 1410	0.45
ST total cost	4697.4	3123 - 3879	3277.4	3222 - 3897	0.03
NHS costs	1503.7	456.0 - 2521.50	735.69	203.4 – 1221.9	0.23
Voluntary sector	526.4	141.8 – 910.3	122.6	51.1 – 193.4	0.53
Private sector	451.77	348.2 - 554.4	287.12	219.3 – 355.6	0.49

After adjusting for the same set of covariates, the only statistically significant change between the early and later treatment groups is for costs associated with the use of the ST programme and for the total cost category, as presented in Table 7.23. The early treatment group has on average 2.5 times higher costs in comparison to the later treated group when adjusting for participant, exposure and treatment related factors. Although other adjusted average group costs are not statistically different, for all categories apart from the ST programme costs early treated participants reported higher average costs. There was no statistical difference between adjusted end treatment outcome scores, although again, the early treatment group reported on average higher BDI and PDS end scores indicating more symptoms. There was no difference in follow-up EQ5D scores between groups, or in difference between score at start and treatment follow-up. Both treatment groups achieved large treatment effects.

Although there was no statistically significant difference between the early and later treatment groups between start and end treatment scores, the early treatment group reported, on average, larger adjusted score differences for both BDI and PDS measures. This is reflected in reliable and clinically significant changes calculations as well, and is due to the early treatment group reporting higher average treatment start scores and therefore more ‘leverage’ for change.

In both groups, around 40% of participants achieved both clinically and statistically significant change on BDI, and 60% of participants achieved the same on PDS. On the other hand, reliable clinical improvement was achieved by a larger number of participants in the early treatment group, 56% for BDI and 74% for PDS, in comparison to 40% on BDI and 65% on PDS for later treatment group.

The early treatment group had, on average, lower number of both PTSD-free and depression-free days. Although the difference was not statistically significant it is numerically quite big: the later group averaged 50 depression-free and 81 PTSD-free days more than the early treatment group. Looking at total cost, including societal costs, it costs £304 to achieve an additional depression-free day and £184 for an additional PTSD-free day for participants treated early in comparison to those treated later. When only the ST programme costs are considered, there is a very small numerical difference between the groups that is going in the opposite direction – to achieve additional depression-free days for the later treatment group in comparison to earlier costs £3, while an additional PTSD-free day costs £1.8 more.

Table 7.24 ICER calculations

ICER	Total costs 95% CI
BDI end-start	4639.4 (3670, 5608)
PDS end-start	5725.6 (2281, 9619)

I have calculated ICER as the difference between costs of the early treatment group minus the later treatment group, divided by the difference between early and later treatment groups on outcome measure.

ICER= (Cost earlier treatment group - Cost later treatment group)/(Outcome earlier treatment group - Outcome later treatment group)

ICER calculations translate adjusted cost and outcomes reported in Table 7.24 in the ratios reporting additional cost and effect of treating people early rather than later. As suggested by Fernandez et al. (2005) citing Briggs & Fenn

(1998) I have sampled with replacement cost/effect pairs based on GLM cost and outcome models for both comparator groups, and calculated mean bootstrapped estimates for costs and effects. It was important to estimate cost/effectiveness pairs in order to preserve covariance or pair-specific correlations between them and achieve more robust predictions (Gray et al., 2007). Following on from this, I have calculated 1000 bootstrap replications of the ICER, and plotted bootstrapped estimates in the cost-effectiveness plane to present confidence surfaces for the ICER. I have based the ICER calculation on differences between start and end scores for BDI and PDS measures, as the models suggested significant differences between early and later treatment groups in treatment gains for both outcome measures. I have used the same perspective for both costs and outcomes.

The X-axis on Figures 7.6 and 7.7 shows differences between the groups in the outcome measures (BDI, PDS, EQ5D). These are calculated as difference on the start and end scores for the early group minus the difference between start and end scores for the later treatment group. The Y-axis depicts the difference in costs between early and later treatment groups (i.e. cost early treatment group minus cost later treatment group). Looking at the scatterplots for differences on the BDI measure for total costs, the majority of the bootstrapped estimates are placed in the north-west quadrant of the cost-effectiveness plane, indicating that treating participants early is both costlier and more effective (Figure 7.6).

Figure 7.6 Scatterplot of differences on BDI measure for total costs between early and later treatment groups

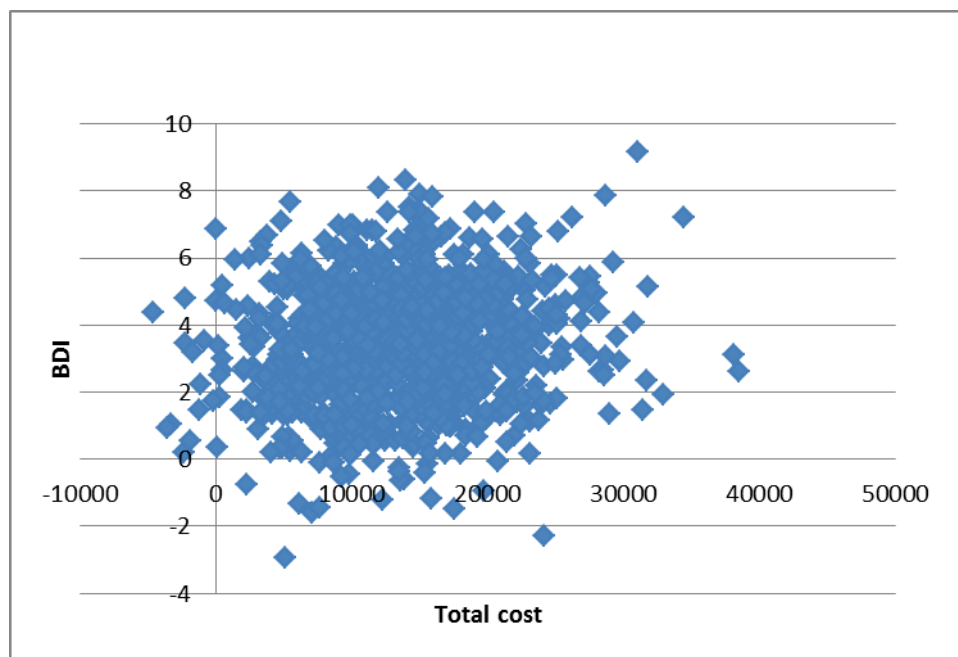
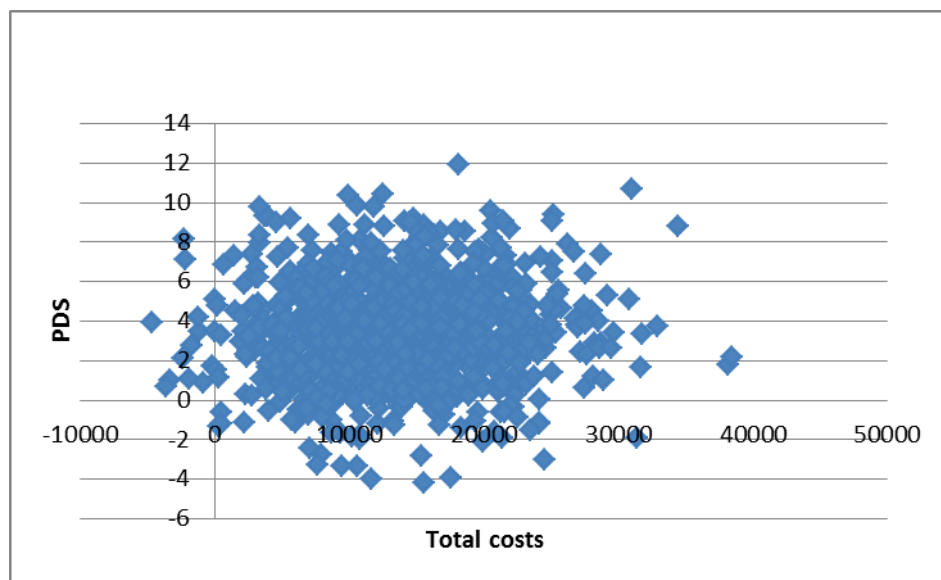


Figure 7.7 Scatterplot of difference on PDS measure for total costs between early and later treatment groups



A potential conclusion from the ICER calculation is that it is both costlier and more effective to treat participants early when overall societal costs are taken into account, and by looking at the difference between the start and end outcome score. However, when looking at the difference in the outcome

measure at the end of the treatment, there is no statistically significant difference between the groups and the conclusion is that it is less expensive to treat participants later. Another possible interpretation of the results could be that although there is no difference in the outcome measures at the end of treatment between the early and later treatment groups, by treating individuals early we are avoiding large societal costs due to productivity loss becoming even larger.

The cost-effectiveness acceptability curve (CEAC) helps in deciding whether additional units of improvement on an outcome measure justifies the associated cost. The CEAC shows the probability that an intervention is cost-effective compared with the alternative, given the observed data, and for a range of values a decision-maker is willing to pay (Fenwick & Byford, 2005).

Figures 7.8 and 7.9 present CEACs curves for the total cost category. WTP thresholds have been chosen purely as an example; they are not based on any theoretical or practical underpinning. The CEACs show that willingness to pay (WTP) £5000 per unit of improvement probability of cost-effectiveness of the intervention does not exceed 50% for PDS and 60% for BDI.

Figure 7.8 CEAC for PDS score difference and total costs

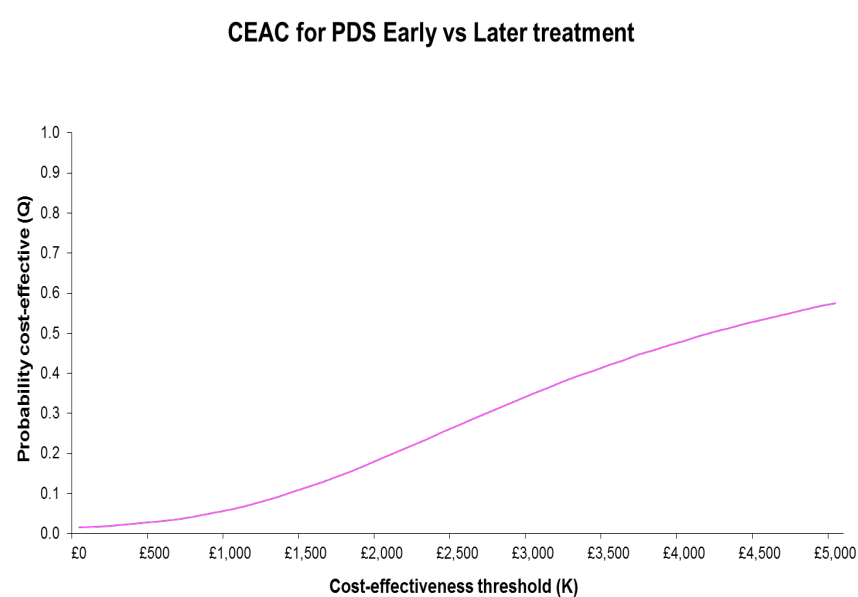


Figure 7.9 CEAC for BDI score difference and total costs

CEAC for BDI Early vs Later treatment

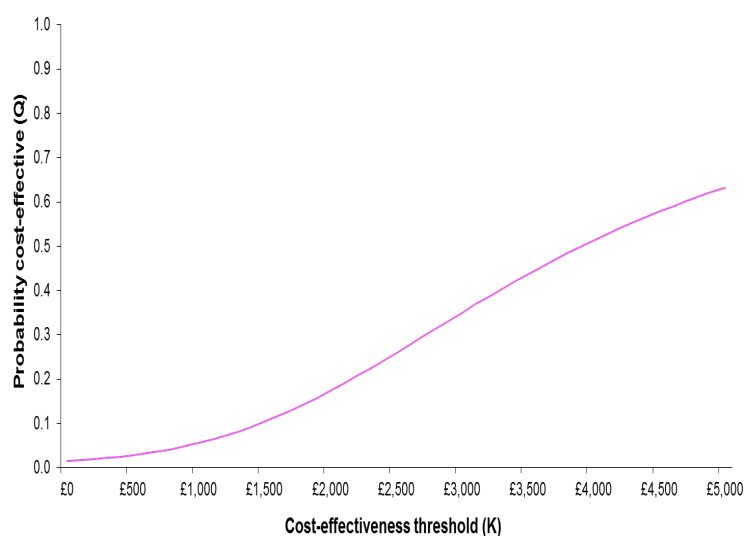


Table 7.25 Cost per clinically significant change

	Early treatment group (N=53)		Later treatment group (N=50)	
	BDI	PDS	BDI	PDS
Costs				
Total cost	24530.8	30696.8	9606.3	14181.3
Direct cost	1966.1	2460.3	965.9	1425.9
ST total cost	3769.4	4716.8	3917.4	5783.1
NHS cost	1503.7	1881.67	735.7	1086.1

The overall total cost for a clinically significant change (including costs to society) is higher for the early treatment group, around £24 500 for BDI and £30 000 for PDS (Table 7.25). The total cost per clinically significant change is almost double for the early treatment group in comparison to the later treatment group. A similar pattern is found for direct and NHS costs. However, when looking specifically at the ST programme costs, the cost per clinically significant change is almost identical for both groups. When looking at treatment cost only, the difference between groups is minimal, with a higher cost per unit PDS change for both groups.

7.7 Discussion and conclusion

Individuals treated within the first year of the ST programme reported overall higher costs (up to 2.5 times on average) than individuals treated later in the programme.

The general linear model confirmed a statistically significant difference between early and later treatment groups in total cost when controlling for age, gender, ethnicity and psychiatric comorbidity. The difference in costs between the two groups is driven by productivity loss-related costs, i.e. when the total cost variable is broken down into cost categories, early and later treatment groups statistically differ only in productivity loss costs. The general linear model shows that when controlling for treatment, exposure and socio-demographic characteristics, the early treatment group reported, on average, higher productivity loss-related costs in comparison to the later treatment group.

For participants who received treatment early, productivity loss costs accounted for up to 75% of all reported costs, while for participants who received treatment more than 8 months after the LB the contribution of productivity loss costs was 50%. For the early treatment group, 60% of costs are due to productivity loss, while in the late treatment group unemployment costs account for 60% of work costs. Participants who received treatment later reported a small rise (18%) in unemployment costs when compared to the early treatment participants. The GLM model on work costs highlighted treatment timing as the only significant predictor. Finally, a possible explanation for the higher observed costs in the early treatment group is that people were allocated early or later to treatment purely by chance or some systematic or unsystematic factor that has not been observed in the course of the evaluation.

The increased costs in the early treatment group are an important and unexpected finding as my hypothesis predicted the exact opposite finding. A possible reason for this could lie in a couple of observed and possibly unobserved factors. In order to investigate why the early treatment group

reported higher productivity costs, I have explored the impact of other variables such as cost categories and participants' characteristics. The early treatment group reported more hospitalisations and injuries; eight out of nine participants who reported injuries and hospitalisations were in this group, and these turned out to be the main drivers behind high productivity costs. This comes as no surprise as the ST programme obtained information on participants through hospital and A&E injured and wounded lists quite early in the programme. The correlation between treatment timing and cost collection date is positive and statistically significant ($r=0.504$, $p=0.001$). The reason for this lies in the timing of the evaluation data collection, which took place upon participants' completion of the treatment in the ST programme.

In terms of treatment effectiveness, results demonstrate no significant difference between early and later treatment groups on all outcome measures while controlling for other factors. However, individuals who received treatment earlier in the programme reported, on average, higher start and final scores on both BDI and PDS measures, indicating more symptoms at the start of the treatment and worse treatment outcome. However, they have also achieved a more substantial improvement in outcome scores in comparison to the later treatment group. The pattern of more severe cases achieving on average a larger treatment improvement has been reported by Gyani et al. (2013) in a study looking at lessons from the first year of IAPT programme's implementation. Predictors of achieving a clinically significant change on both outcome measures, as defined by Jacobson et al. (1984), were being white British and completing the treatment.

The quality of economic evaluation of the ST programme depends on appropriateness of the comparator group. There are a couple of concerns and pending questions around the choice of the comparator group in this analysis, such as whether participants who started treatment more than 300 days after the LB are a valid proxy for the NHS PTSD treatment as usual users. Theoretically, all being equal, starting treatment later seems to be a valid proxy for people on the NHS PTSD treatment waiting list. However, there is a valid question as to whether participants who started treatment early are different

from participants who started treatment later in characteristics other than treatment start date. Therefore, it is important to understand the reasons why individuals received treatment later, whether it is possible to control for those factors and whether they were measured in the first place. It is difficult to say the reason behind late entry to the ST programme, as it was not recorded. It is uncertain whether people who entered treatment later did so intentionally as they were coping well on their own and at some point decided to seek help, or because this is caused by late onset PTSD, lack of knowledge about the programme, treatment avoidance or receipt of alternative treatment elsewhere.

A descriptive analysis identified differences between participants' characteristics among the two groups – the early treatment group had significantly more women, while the later treatment group had on average a higher number of individuals who were screened more than once. Both factors could contribute to the fact that at the start of the treatment the early treatment group had on average significantly higher adjusted and unadjusted PTSD and depression scores, which could be explained by the fact that the effect of natural recovery was not yet fully established in the early treatment group. Spontaneous recovery with time is well documented, as shown in Ehlers' study (2003). It is noticeable that after a traumatic event, the average scores for the exposed population spontaneously drop to a certain level without treatment. In Ehlers' study, the spontaneous recovery curve had a reversed sigmoid shape, and in addition the literature points out that the bulk of natural recovery occurs within first 6-12 months after the trauma (Helzer et al., 1987; Kessler et al., 1995) and could potentially provide an explanation for the lower average scores of individuals treated later.

Interestingly, although there was no significant difference in the outcome scores at the end of the treatment between the groups, the difference in scores appeared again at the follow-up stage. However, this effect could be due to a reduced follow-up sample caused by missing data on PDS and BDI. A number of participants did not want to go through PDS and BDI at the interview session due to the length of the questionnaire. They agreed to (e)mail it back instead, which then rarely happened. This could be due to the content of the questionnaires,

which reminded participants of the traumatic event and may potentially have been re-traumatising. A similar problem was encountered in the data collection process as therapists reported participants often refused to go through BDI and PDS measures prior to the start of each therapy session, which resulted in limited treatment progress monitoring and consequently the focus on fewer data collection points (assessment, treatment start and treatment end). The early treatment group achieved larger treatment gains. One explanation for larger treatment gains with the early treatment group could lie in the natural recovery process. I calculated the correlation between the extent of improvement on BDI and PDS outcome measures and the time elapsed between the LB and the start of treatment. Both correlations were small and positive but not statistically significant for PDS $r(103) = 0.16$ $p=0.09$, and significant at 95% for the BDI, $r(103) = 0.19$ $p=0.05$.

Differences between participants in early and later treatment groups could potentially be explained by the structure and set-up of the ST programme. As the programme's aim was to screen people for mental health problems and refer them for treatment, the differences among early and later groups could be explained by the ST programme being effective in identifying participants with greater mental health needs and treating them early. Despite this, it is difficult to control for all the factors behind the programme's referral system and for pathways into the programme as they include a wide array of variables, from effectiveness of the referral pathways into the programme (timing of receipt of the affected individuals' details, effectiveness of standard referral pathways into treatment such as GPs or self-referral, and effectiveness of the awareness-raising media campaign), to individual decisions to accept and respond to screeners, assessment and treatment.

A large number (60%) of the referrals to the ST programme came through hospital and police witness lists. Around 60% (500) of total referrals to the programme came in the first six months after the LB, at a time when hospitals and Metropolitan police released contact details of the affected individuals. However, only 50% of people referred to the programme at that stage were in the end referred to treatment. This is probably due to many of those referred

early already showing signs of spontaneous recovery, so it was not appropriate to refer them for treatment. In the second year of the ST programme, the total number of referrals dropped significantly, but most of them were referred to treatment. This could have been a consequence of individuals with milder symptoms being referred to treatment rather than into monitoring (as it was the practice in the first year) when there were many referrals. Alternatively, individuals coming later to the treatment could have delayed onset PTSD. Referral, assessment and treatment timings were all positively correlated. Also, the analysis showed a couple of outliers without a particular pattern due to a small number of individuals having larger gaps between referral to the programme, assessment and treatment timing.

It is unclear whether the ST programme was effective in recruiting individuals with high symptomatology early in the programme, while individuals who came later were less affected by mental ill health due PTSD, depression and travel phobia, which would indicate a self-selection in the sample composition. Moreover, the difference between outcome scores for the two groups could be a consequence of the natural recovery.

One of the potential conclusions of the cost-effectiveness analysis could be that it is more cost-effective to delay screening and treat participants later. However, this conclusion is only valid if the only difference between the two groups was the start of the treatment (early vs. late).

All the discussed differences between early and later treatment groups point out that early and later treatment groups differ in other characteristics rather just in terms of the start of the treatment. There is a valid question as to whether the participants who received treatment later can serve as a valid comparator in the cost-effectiveness analysis, if they could be compared fairly and in a way that informs decision makers.

Alternative comparator groups for evaluating the ST programme could include individuals involved in a similar traumatic event who have received treatment as a part of the mental health response. I looked into comparisons with the 9/11 sample and the people involved in the Madrid bombings.

However, there are numerous difficulties associated with this route, stemming from differences in structure, provision and delivery of mental health response programmes, to discrepancies in reporting and recording of mental health response outcomes and costs. For example, the mental health response after 9/11 did not include a single intervention. Due to the scale of the event, health system funding and mental health delivery factors, it consisted of a multitude of small and often isolated and in general short-term interventions that differed in the type of treatment provided and their target audiences. Therefore, to directly compare those interventions to the ST programme would be difficult at the very least.

The Madrid mental health response was similar to the one provided in London in terms of the type of treatment, but their response did not include systematic screening and follow-up (Buesa et al., 2006). Furthermore, there are few publications on outcomes of the response and no information on costs associated with the response, which again made comparison difficult.

Another potential source for a comparator group was the intervention delivered in Northern Ireland in response to terrorist events during the 'troubles'. An intervention was well documented and evaluated with an RCT that compared immediate cognitive therapy with a 12-week wait (Duffy et al., 2007). However, comparison with the LB intervention is difficult due to differences in the treatment provided – cognitive therapy in Ireland and trauma-focused CBT in the ST programme. Another problem lies in the unavailability of cost information, as the study did not report treatment, health services or societal costs. Another prospective candidate was intervention following the Omagh bombings (Gillespie et al., 2002), however this study reported only on treatment effects.

My hypothesis was that the ST programme costs would be offset by the long-term PTSD costs averted, and that the sooner the treatment was offered the lower the costs to the individuals and society would be. However, one cannot exclude the other possibility of screening potentially interfering with natural coping mechanism and re-traumatising individuals by reminding them of the

traumatic event, or pathologising their experience by suggesting people should feel the consequences of the traumatic event even months or years afterwards. However, in my view, the research methods available in this study will not allow us to reach a definite answer.

Chapter 8 Screening for PTSD – benefits and barriers

8.1 Introduction

Treating mental health disorders has multiple benefits both to individuals, in terms of reduced suffering and enhanced quality of life, and to society, in terms of increased employment and savings to health care costs (Layard et al., 2007; Knapp, 2003). There are other benefits to the Exchequer, including savings on incapacity benefits and higher tax receipts. It has been estimated that, due to the loss of output, the cost of depression and anxiety is £17 billion per year in the UK, while the cost of providing evidence-based treatments is £0.6 billion per year (Layard et al., 2007). These costs create an urgency to finding means of treating such disorders.

Taking into account these and other considerations, in 2006 the Government introduced the Improving Access to Psychological Treatment (IAPT) programme, with the aim of supporting the implementation of guidelines from the National Institute for Clinical Excellence (NICE) for depression and anxiety disorders. The allocated funding of £173 million was intended to enable the then 34 Primary Care Trusts to implement IAPT services. The objective was to produce an additional 3600 trained therapists and to enable 900,000 people to access treatment (IAPT, 2008).

One of the disorders covered by the IAPT programme was posttraumatic stress disorder (PTSD). As argued in earlier chapters, PTSD is a prevalent disorder with significant health, social and economic consequences, however, there are only limited economic data on its direct and indirect costs or on the costs of its treatment. General mental health or depression studies are usually used as proxies, with the consequent risk of misrepresenting – and probably underestimating – the relevant costs.

PTSD is treatable using high-intensity interventions, such as Eye Movement Desensitization and Reprocessing and Trauma Focused Cognitive Behaviour Therapy, but there is as yet no evidence base supporting low-intensity interventions. Within the IAPT programme, patients diagnosed with PTSD are

expected to be immediately referred for high intensity treatment. UK treatment guidelines produced by the National Institute for Clinical Excellence (NICE, 2005) recommend trauma-focused cognitive-behavioural therapy as one of the first-line treatments.

The assumption that individuals with PTSD will be referred in this way can be questioned, however. There seems to be a lack of recognition of the nature, seriousness, and chronic nature of the disorder, both among sufferers themselves (Kessler, 2000) and among UK general practitioners (Munro et al., 2003; Duxbury, 2006) who, alongside self-referral, are the main gateway to the IAPT programme. This finding was confirmed by the evaluation of the ST programme as only 3% of the referrals to the study came from GPs. Surveys of professionals' awareness of the NICE guidelines for PTSD and, indeed, of the existence of PTSD in practice patients, have concluded that there is a failure to detect cases in both primary and secondary care. Ehlers' (2006) GP survey revealed that the majority of patients with PTSD did not receive or were not referred for psychological treatment, but were instead prescribed medication, usually SSRIs, contrary to the NICE guidelines. The impact of such untreated or inappropriately-treated PTSD on the individuals and their families – and the associated economic costs – is unknown, as there has been no research.

The difficulties for people with PTSD are likely to be exacerbated by factors associated with social exclusion, despite the fact that it is a key policy objective to address this issue. Adults with mental health problems, black and minority ethnic groups and young men, have been found to be among the most excluded groups in society (Social Exclusion Unit, 2004). The stigma of mental health leads to isolation and delays in seeking help. Data from the U.S. (Wang et al., 2005) suggest that it is on average 12 years before a person suffering from PTSD receives *any* treatment for it, evidence-based or not. It is possible that social exclusion may hinder people from accessing IAPT; and the programme may need to be adapted to take this into account.

Due to the high prevalence of PTSD and its significant impact on individuals, their families, the health system and society as a whole, screening is

suggested by numerous authors for the early detection and prevention of chronic PTSD (Liebschutz et al., 2007; Kimerling et al., 2006; Ouimette et al., 2007; Van Dam et al., 2013; Lang and Stein, 2005; Foa et al., 2008; Breslau et al., 2003; Silove et al., 2009; Ivanov et al., 2012). Indeed, screening, particularly after disasters, is recommended by the NICE guidelines, but it has never been implemented within the primary care sector.

Brief valid screening instruments exist to enable GPs to detect people with likely PTSD and refer them for assessment and treatment. However, there is insufficient evidence as to whether screening at the primary care level is a valid and cost-effective pathway into treatment. The most commonly identified barriers to screening for PTSD in primary care are low awareness of the disorder among GPs, insufficient information on available screening tools, and GP concerns about doing harm and re-traumatising their patients (BPS, 2012).

The main objective of this chapter is to consider the benefits from – and barriers to – introducing screening for PTSD at the level of general practice. This should then make it possible to address key questions about ensuring the successful implementation of the IAPT programme. The effects of screening in primary care will be addressed from the perspective of all potential stakeholders likely to be involved in establishing, implementing and funding a screening policy. Some qualitative research offers an important contribution to understanding the views and perspectives of key stakeholders on the benefits and practical implications of implementing a screening policy within the IAPT programme.

8.2 Methods summary

A small qualitative study was designed to explore the benefits and barriers of implementing screening for PTSD policy within primary care. Some potential stakeholders involved in policy development, planning, implementation and funding were invited to take part in short (30-40 minute) semi-structured face-to-face or telephone interviews. These interviews were conducted between October 2009 and June 2011. The questions, set out in Appendix C and

summarised in Table 7.1, explored the perspectives of each stakeholder, with the aim of providing a comprehensive view of the benefits and practicalities of introducing such policy. I have used directed qualitative content analysis (Hsieh & Shannon, 2005). I started with a couple of themes identified in the Literature Review and added new themes as they emerged in the analysis. Validity of the emerging themes was tested by triangulation with data identified in the Literature Review, and exploration of participants' underlying views on the emerging themes and discussion of the themes. In total I have identified 8 themes in the interviews:

- PTSD prevalence and presentation,
- Screening for PTSD as a concept,
- General population screening vs. targeted screening,
- Screening setting,
- Screening protocol,
- PTSD in the context of the IAPT programme,
- GP education and training,
- Screening in the context of the IAPT programme.

8.3 Improving Access to Psychological Therapies (IAPT) Programme

The IAPT programme is an example of the direct translation of policy recommendations into practice (Clark, 2011). Its foundations lie in a series of NICE guidelines with recommendations for effective treatments for depression and anxiety disorders, along with an economic case provided by a wide academic and clinical community, most notably by Layard (2006) and Layard et al. (2007). Layard and colleagues argued that the costs of treatment and prevention of depression and anxiety disorders would be offset by reducing or, in some cases, preventing the large costs associated with lost productivity and time off work,

alongside medical and societal costs arising from the consequences of chronic disorders and their associated comorbidities. This, in itself, constitutes an interesting and, until recently, rare example of where health economics has directly influenced the adoption of a prevention-oriented policy.

The programme, started in late 2008, is now in its last stage, outlined in two policy documents: *No Health Without Mental Health* (DH, 2011a), and *Talking Therapies: Four Year Plan of Action* (DH, 2011b). The programme plans to expand from providing solely adult services to offering elderly and young people services during the final phase of the roll-out, from 2011 to 2015. Special attention is also given to chronic physical health problems, medically unexplained symptoms that often present alongside depression, and targeting people with severe mental illness (DH, 2011).

The main principle underpinning the programme, as outlined in the *Implementation Plan* (DH, 2008), is the introduction and implementation of a stepped care approach, which offers appropriate evidence-based treatment to a range of anxiety disorders in a “most effective and least resource intensive” way (Davison, 2000, p. 583). The stepped-care treatment approach offers a flexible therapy system in which individuals can be easily stepped-up or down in terms of treatment intensity depending on their diagnosis and needs. Low-intensity interventions, such as computerised CBT, guided self-help, behavioural activation or psycho-educational groups (NICE, 2009) are recommended for mild and moderate depression and some anxiety disorders such as panic disorder, GAD, OCD. For moderate to severe depression and PTSD, the NICE guidelines and stepped-care approach are recommended solely for high-intensity treatment, which consists of face-to-face CBT and or EMDR.

Another distinctive feature of the programme, introduced to improve access, is self-referral, alongside the standard GP point of entry. In order to facilitate a pathway to recovery, some IAPT services are supported by employment advisers.

Another important aspect of the programme is monitoring a client’s progress, as this enables evaluating the outcomes and progress of the treatment.

Therefore, a session-by-session clinical outcome monitoring system is introduced by employing the following measures: PHQ-9 (Kroenke et al., 2001) for depression, GAD-7 (Spitzer et al., 2006) for anxiety disorders and a measure for a specific anxiety disorder like PTSD, OCD, social or travel phobia (Richards & Suckling, 2009). All collected data is stored in the IAPT minimum dataset (DH, 2011), an electronic dataset available for therapists and funding bodies to monitor patient progress and for evaluation purposes.

Before a national roll-out, the programme was piloted in two demonstration sites based in PCTs within Newham and Doncaster. The sites differed in their approach and the audience they attracted. The Newham site focused predominantly on high-intensity CBT, following the stepped-care model where appropriate, which included low-intensity treatments such as computerised CBT, guided self-help, and psycho-educational groups (Clark et al., 2009) and attracted a mixed ethnic community. In contrast, the Doncaster site focused on low-intensity therapies, with a focus on guided self-help; by adopting this approach, however, individuals with PTSD were excluded, as they require high-intensity treatment. This allowed the site to manage a large number of cases.

In total, both demonstration sites saw over 3,500 people in the first year. Both sites featured a session-by-session clinical outcome monitoring system as described previously and introduced self-referral, with the aim of increasing equity of access, especially in the case of mixed ethnic communities. The evaluation of the demonstration sites was positive in terms of the number of people seen and the outcome monitoring, and high-level of data completeness demonstrated large treatment effect sizes, which were maintained, although follow-up data completeness was significantly lower than at post-treatment (Clark, 2011; Richards & Borglin, 2011).

At the end of the pilot phase, the programme was rolled out nationally in three waves of funding, the last one funded until 2015 when the programme was due to reach its initial goal of increasing the availability of evidence-based therapies for depression and anxiety disorders throughout England.

By 2011, the UK Government had invested £309 million in total to train up to 3,660 psychological therapists, 60% providing high-intensity treatment and 40% providing low-intensity treatment (Clark, 2011). The projected savings to the public sector due to the roll-out of the IAPT programme are over £700 million, for £400 million invested (DH, 2011). It is expected that, as a result of the programme, 50% of the individuals seen will recover and around 25,000 will move to employment from sick pay and state benefits (Clark, 2011). In 2011, the IAPT programme was present in around 95% of PCTs, although there was a substantial variation in service provision between PCTs. Services were seeing 310,000 people each year and it was hoped to increase this number to 900,000 by 2015 (Clark, 2011).

In the next phase ending in 2015, the government pledged to spend another £400 million. By the end of the project, it is projected that 3.2 million people will have accessed the IAPT programme, 2.6 million will have completed a course of therapy treatment, of which up to 1.3 million will have moved to recovery and 75,000 will have returned to employment or education (DH, 2011).

The evaluation of the IAPT programme highlighted some implementation difficulties. These included under-representation of people aged over 65 years and individuals from black and minority ethnic groups, attributed partially to the slow introduction of the self-referral pathway. It was also found that there was under-representation of patients with obsessive-compulsive disorder (OCD), panic disorder, social phobia and agoraphobia and – most importantly for this study – PTSD. According to prevalence rates reported in the most recent Adult Psychiatric Morbidity Survey (McManus et al., 2007), it was expected that one third of patients would present with these diagnoses, including 8% with PTSD. Yet records show that less than 10% of patients actually presented with those diagnoses.

The problem of under-representation of PTSD patients was of a particular interest to this study. A part of the explanation could lie in the specific characteristics of PTSD as a diagnosis, such as avoidance of any stimuli that remind a person of their trauma or bring out the traumatic memory. This is a

frequent coping mechanism for people suffering from PTSD, which makes them less likely to report any concerns to their GP. Moreover, people affected by PTSD are more likely to present with physical health issues or issues which are comorbid to PTSD, such as alcoholism or depression (Marciniak, 2004).

Another problem lies in a low recognition among GPs both of PTSD and of the available evidence-based treatments recommended by NICE guidelines (Ehlers, 2009). This is of a particular concern due to the key role of the GP as a gatekeeper to treatment, which is still a dominant pathway into treatment (even though the IAPT encourages self-referral). This concern was reflected in the *Commissioning Talking Therapies 2011/2012 Toolkit* (DH, 2011 c), a document published by DH that clearly outlined arguments of investing in evidence-based treatments for depression and anxiety disorders.

For all these reasons, exploring the pathways into treatment for people with PTSD seemed an important topic to be explored, particularly in the context of the IAPT programme. However, due to lack of funding, the study was not undertaken as originally planned and had to be replaced by a small qualitative study examining the benefits and barriers to screening for PTSD. The study methodology and findings are presented in the next section.

8.4 Screening for PTSD: Benefits and Barriers – qualitative study findings

8.4.1 PTSD prevalence and presentation

Most of the GPs interviewed reported that they do not see PTSD cases very often, although the prevalence of PTSD was higher in those GP settings that see many refugees and asylum seekers; one suggested two to three times a year.

The GPs in general acknowledged that PTSD is under-diagnosed in general practice, some suggesting that this was due to being disguised by co-morbidity or to low recognition of the disorder by GPs:

PTSD is incredibly under diagnosed, really under diagnosed. (GP 3)

I do think that there is something distinctly and discretely different about PTSD in comparison to other anxiety disorders. It is often masked in presentation. (GP 4)

It is not really a condition high in the mind of a GP unless it is very obvious, such as person is very distressed. (GP 5)

Two GPs expressed scepticism about PTSD as a diagnostic category and a concern about the over-medicalisation of a normal mechanism for coping with trauma:

I have problems with a label like PTSD – I prefer to see it as a psychological distress, rather than saying this is the case of PTSD and it must be treated in following way. (GP 6)

My worry is about PTSD as a diagnosis, looking at Sommerfield's scepticism about PTSD as an entity. I think I share some of that, it is rather reductionist seeing people as a tick-box of things they have or haven't got. Make them fill-in a tick-box might make them not come back. What they need is to share a story, develop a relationship." (GP 7)

With regard to PTSD presentation, the GPs reported various cases of complex and single-incident traumas, and different presentations varying from psychological to physical symptoms:

The commonest way would be people coming in with anxiety, depression, mixed picture, who tell us about particular incident that trigger different feelings. (GP 7)

Access to services by high-risk groups, such as veterans, refugees and asylum seekers were discussed, along with differentiation between single-incident and multiple trauma exposure:

Refugees and asylum seekers – I would almost assume they have PTSD if they have been through situations like that. Difficult because they often don't speak English and are often transient, difficult to organise treatment

for them, they might come to the practice one to two times and then they are off somewhere else. (GP 1)

Veterans access the services on average ten years later. We often see people who are abused in childhood for whom this is the first time they accessed the services. Two reasons – stigma and people avoid thinking or talking about it. Single incident people come up sooner, multiple traumas access the services later. (CL 1)

8.4.2 Screening for PTSD as a concept

All interviewed clinicians agreed that screening for PTSD was an interesting proposition and ‘worth trying’ despite practical difficulties: in their view, screening was a good way to reach individuals who would not otherwise access services, due to the low detection of the disorder by GPs, and also served to obtain information on the prevalence of PTSD and complex PTSD.

[Screening will help in] having a clearer idea about prevalence of PTSD alongside a clearer idea on prevalence of complex trauma cases. (CL 2)

Most people who suffer from these types of disorders don’t come to the services – they suffer and very little attempt is made to find them and offer them treatment. (CL 1)

Good incentive to get people in the treatment early, because the consequences are not just for the patient and the family, but a burden to the health system as a whole. (PD 2)

Furthermore, screening would enable professionals to distinguish people suffering from PTSD from those suffering other co-morbid conditions arising from exposure to traumatic events and ensure appropriate treatment is provided:

I suspect a lot of PTSD patients are lumped in with depression and get antidepressants. (GP 5)

In contrast, most of the GPs expressed a more conservative approach towards screening. They argued the need for robust evidence on the effectiveness on benefits of screening:

I think 'screening' is probably not the right word to use. 'Case finding' rather than 'screening' is more appropriate. (GP 3)

There needs to be hard evidence to support this. (GP 1, GP 2, GP 5)

One GP actively opposed the concept of screening, along with a proactive outreach for PTSD cases within the general population, with the aim of providing evidence-based treatment. He expressed a particular concern in regard to "over-medicalisation of the normal human behaviour."

My default assumption is that screening will create more cases, you might be perversely doing harm. Let people come to their GP. Why should avoidance be a pathological response, maybe it is a natural coping response?....I am sure it is a good treatment but it is not a magical solution – you will be cured if only I can persuade you to have six sessions of CBT – it does not justify me to go out there and case find and offer treatment. (GP 1, GP 4)

Some GPs drew a parallel with screening for depression, expressing scepticism about screening for a disorder with an even lower prevalence rate:

Screening for depression, which is much more common, it is still not effective. (GP 6)

You would get a poor return if you try this kind of approach with PTSD. (GP 6)

8.4.3 General population screening vs. targeted screening

On the issue of general population ('blanket') screening vs. targeted ('high risk population') screening, GPs were generally in favour of the latter:

Certainly, if you can correctly identify who is high risk, then it would be more appropriate to screen within that high risk group. (GP 3)

For certain groups of people, we should automatically be asking about the possibility of PTSD, for instance people with alcohol presentations. Do you screen the population, only high risk groups, everyone whom casualty department, as a part of your patient medical? (GP 4)

The rule of thumb generally is that screening is often done in high risk groups, rather than blanket screening. People need to think who are the higher risk group who would benefit from intervention. (GP 3)

In contrast, one clinician pointed out that the advantage of screening the general population lies in “reaching a completely different group not otherwise identified as having treatable problems”. (CL 2)

A number of factors were identified as necessary for the successful implementation and delivery of PTSD screening, including sufficient resources for screening and referral training, good liaison with specialist services, a clear referral pathway and a well-integrated assessment and treatment mechanism:

It would not be acceptable to screen people and not provide them with feedback and move them on to the treatment. It is important to ensure resources are there to deal with any morbidity discovered within the process. (CL 2)

Work closely with services, with a clear message that if people did screen positive, there was a service they could get help from, and to very much encourage that pathway. (PD 2)

Another question is how practical this would be. It would need to be a very simple scheme or focused on particular populations. (GP 1)

In addition, the issues of specificity, sensitivity, and the potential to administer the screening questionnaires in multiple languages for non-English speaking groups were regarded as essential elements of any screening exercise.

Furthermore, a question was raised about the referral of identified cases and the capacity of the health system to provide treatment:

You need to have a very clear pathway on what to do if you get a positive screen. The worst thing you could do is to set-up screening and if people screened positive, not much is going to happen. (PD 2)

One recommendation from both GPs and policy developers was to combine screening for PTSD with screening for depression (either via a short additional questionnaire or as an additional item on the PTSD screen). Several GPs suggested that individuals with conditions co-morbid with PTSD or in a high-risk group for PTSD should be checked for symptoms of PTSD:

If we are already handing out the PHQ9, we might also do a simple screen for PTSD, as long as it is simple to do. (GP 1)

For anyone who gets a new diagnosis of depression and anxiety (there) should be an automatic question about PTSD. A similar screen could be [developed] for people with alcohol or domestic violence problems. In other words, pick-up groups who are already presenting in one way or another as having a functional problem and then look to screen more selectively for PTSD. (GP 4)

If it is a part of the questionnaire, which is a diagnostic screen such as PHQ9, it could be genuinely helpful if it was used as a diagnostic screen, if it was used to help GPs make a [diagnosis] perhaps they would not be competent in making otherwise. But I would be thrown re: how to pick a group of people to focus on. (GP 8, GP 5)

What you would like to have for PTSD is some trigger on the generic tool that could take you to a place where you could use your specific screening tool... If you could get one tool for common mental health and PTSD problems, one size fits all for the whole population, with sensitivity within that to drill-down to people with people who trigger the risk factors around your area. (PD 3)

Some respondents raised the question of appropriateness of screening for PTSD, in comparison to other mental health conditions.

If we are not doing it for any other aspects of primary care mental health, why should we do it for PTSD? (GP 6)

A number of arguments were made for general PTSD screening, including the fact that it is poorly recognised in general practice, that there could be long delays in getting treatment and that ‘avoidance is a part of the symptoms’. It was felt that there were effective treatments and validated screening measures, so it made sense to use these. But some felt that screening was most appropriate where there were other triggers, such as major events in a person’s life.

8.4.4 Screening setting

Aside from the GP setting, other potential screening settings identified by participants were A&E departments (for people involved in accidents) or intensive care units, as these are “a specific setting where you are likely to pick-up a large number of people who have been traumatised”. (CL 2)

Those participants who were in favour of screening generally agreed that the GP surgery was the most suitable setting. IAPT services could then see those who had been screened as well as self-referred individuals, provide assessment and if necessary refer for treatment, as suggested by one of the interviewees.

The (GP practice) [is] the only setting where people go routinely. It can be a good place to screen, just like for many other conditions like cervical cancer. An alternative could be the IAPT, but then, of course, people need to get to IAPT in the first place, so you would miss a lot of people if you start at IAPT. (GP 5)

One GP suggested focusing on the practices with a higher incidence of factors associated with the onset of PTSD.

8.4.5 Screening protocol

When discussing the screening protocol, it was widely felt that it would need to be short, simple and easily understood, with a simple response scale, as well as

the usual characteristics of sensitivity and specificity. However, a few GPs questioned practical aspects of implementing such a policy and the feasibility of such practice across the country, as it would have the effect of “increasing the volume of work in the practice” (GP 4). One potential solution was to make possible self-referral to IAPT services, “already explored as a part of proactive targeting for depression that will prevent burdening the GP practice” (PD 2).

Piloting such a scheme was seen to be important to determine the feasibility of screening, to gain an insight into the process of screening and the complexity of cases, to investigate screening as a pathway into treatment and to explore all practical issues along the way.

8.4.6 PTSD in the context of the IAPT programme

In general, the GPs perceived IAPT positively and expressed a willingness to refer to the IAPT:

IAPT – one of the good things is that there are more people to deliver CBT and identify people with PTSD. (GP 3)

A number of those interviewed discussed aspects of the IAPT programme. A key theme was under-representation of individuals with anxiety disorders and PTSD within the programme, found to be much lower than the prevalence of the disorder within the general population:

One would expect, based on the epidemiology, that around about a third of people in the IAPT services should have one of the anxiety disorders, other than GAD, PTSD, panic disorder, social phobia, OCD. Actually, there was only 8.5%. So there is quite a serious overrepresentation of depression, relative to anxiety disorders. (CL 3)

Several potential causes were identified, including complications with the database and the allocation of a provisional diagnosis:

Quite a lot of people were recorded as having mixed anxiety and depression. But a fair number of them may actually have had PTSD so the figure might be a bit higher. A lot of people with PTSD are also depressed

and clinicians tend to think that mixed diagnosis of anxiety and PTSD – restricted for people who fit neither group. (CL 3)

Furthermore, it was said that both recovery rates and the number of treatment sessions were not calculated correctly in the initial IAPT report.

Clinicians also noted problems in correctly identifying people with PTSD problems, arising perhaps from the sense of stigma around a PTSD diagnosis. Another identified issue was a referral bias of some GPs with a big interest in mental health.

One commissioner discussed potential system problems in the early stages of the IAPT programme, such as the inadequate training of IAPT therapists, the GP referral pathway and around commissioning:

There are lots of system problems not just about recognition but about training therapists, and making sure that commissioners are enabling that work goes to the right place, in the right time etc. (PD 3)

Another important finding was that the IAPT programme was picking up a higher number of complex PTSD cases than expected. As this was in the early phase, the programme was not geared to treating complex cases and providing high-intensity treatment and such cases were consequently referred to specialised mental health services:

IAPT doesn't treat complex cases. It is designed to treat low intensity and actually struggles to find cases. A lot of individuals with chronic and complex problems are coming through and IAPT isn't designed to deal with this. As a consequence, this increases pressure on other MH services and impacts on other services, which are under resourced. Resources need to be allocated accordingly. (CL 1)

(High-intensity treatment) should be part of the core IAPT service, but I am acknowledging it is not happening now. (PD 3)

One clinician pointed out that this problem may stem from the fact that mental health services were not involved in planning the IAPT. He concluded that the

IAPT programme only made sense if the resources were available because of the number of complex cases.

8.4.7 GP education and training

All those interviewed felt there was a need for improved GP education on the available treatment for people with PTSD. Many of the GPs interviewed agreed that the role of a GP should be to recognise and detect the symptoms and make a referral, rather than making a diagnosis:

You are right about increasing awareness for GPs, but there is no point of having an incredibly complicated educational programme, it is just one of the diagnoses a GP has to consider. It is probably unreasonable for a GP to make a firm PTSD diagnosis. He/she can raise the question and make a referral to community mental health team or to IAPT. (GP 3)

Awareness can increase sensitivity of practitioners, education of practitioners and the population and is a relatively efficient tool to use in a primary care setting. And is probably a more implementable nationwide, rather than a blanket whole population screening. (GP 4)

The best channels of awareness-raising and education about PTSD, GPs suggested, were online resources such as BMJ Learning, EAMIS, patient.co.uk, and numerous national portals focusing on general practice training in mental health. User-friendly, readily-available educational materials in the form of patient leaflets or information sheets that can be printed out, along with podcasts, were seen as particularly helpful:

If there was a written piece on mental health and PTSD associated with a patient leaflet, even better. We are all getting used to clicking-in and finding patient leaflets and giving patients information to back-up information given out in the session. (GP 8)

As discussed with the IAPT director, mental health training for GPs was not obligatory at the time of the interviews. Consequently, training in that area falls to GPs having a personal interest – and there are no additional incentives or sanctions to nudge GPs into mental health education. However, with the current

changes in the NHS and commissioning being passed from PCTs to GP consortia, this is likely to change:

GPs are very variable. There are some GPs that are more trained and knowledgeable in mental health and others who are not interested, which is a bit worrying considering this is around a third of their work. (PD 2)

By and large, GPs still don't do mental health very well, let alone common mental health. Their responsibilities around commissioning will come with greater responsibilities that will require training across GPs. (PD 3)

It will take some cultural change and leadership to make a new step. I am optimistic as a good handful of first wave GP commissioning consortia have expressed that their particular area of interest is IAPT and services we got. We have some champions coming forward, and that is much more powerful to hear from another GP consortium first than from some policy suit. (PD 3)

Lastly, issues of policy development, process and implementation were discussed. Clinicians, GPs and commissioners agreed about the importance of evidence in policy making, along with the availability of guidelines:

Having NICE guidelines and a clear message on available evidence does make a very big difference. Commissioners won't know the details and they are guided by that sort of thing. (PD 2)

Participants also agreed on the paramount role of developing an *economic* argument for policy funding and implementation:

Economic argument changed it.... the most testing moment in the whole policy development. (PD 1)

Layard built on the body of work that existed, putting an economic twist and presented it to the Chancellor. Interesting how policy is being made, not enough saying all these people are suffering – you need to make an economic case. (GP 5)

One interviewee who was involved in the development and implementation of early treatment of psychosis highlighted some key elements of policy development and change process:

Right timing, channelling out dissatisfaction with services, a strong network which is responsive and inclusive of all important stakeholders (academics, policy makers, health economists, health care users).

Another important thing – it is not sufficient just to complain. It is important to have a pathway audit along making a strong economic case to support the process. (PD 1)

Due to the pending NHS reform around commissioning of services, there was a lot of uncertainty about changes in the policy making process. One mental health commissioner noted:

It would be that sort of thing the GP consortium would be interested in. In the old days, it would be discussed by the Primary Care Trust, it may go to professional executive commissioning within the PCT and clinical pathways group. You have to ensure that GPs are involved and linked in with commissioning groups. (PD 2)

8.4.8 Screening in the context of IAPT programme

At the time of the interviews, the IAPT lead person acknowledged that there would be sufficient flexibility and resources within IAPT services to accommodate a pilot, and it would bring beneficial insights into the reasons behind the low referral rate of PTSD to the IAPT services:

We have huge targets for the numbers of people we can see, which we need to meet. In principle, the numbers of PTSD are not that huge, this is the group we should be seeing and that is why we need a pilot. (PD 2)

8.4.9 Satisfaction with the ST programme

The presented information is cited from the Evaluation study report by Brewin et al (2009) and it was collected as a part of the Evaluation study. The vast

majority of the 230 respondents interviewed (90%) had no objection to being contacted by the programme. There was a small preference in favour of being initially contacted by letter rather than by telephone. Moreover, 25% of those who finished treatment said it was unlikely that they would have asked for help if they had not been approached by the programme. Of those who were screened or assessed but not offered treatment, around 70% were satisfied with the programme. Reported levels of satisfaction were higher, 80%, in those who were actually treated within the programme.

8.5 Conclusion and recommendations

This chapter has discussed arguments for and against screening for PTSD from both an empirical and practical perspective. It has been shown that despite numerous potential benefits, there are also practical and theoretical problems in introducing screening, including the opportunity cost of implementation of such a policy. Before proceeding to the final conclusions about the screening programme, it is important to compare these findings against the UK National Screening Committee's Criteria NSCC) to establish if they are met. The summary of the guidelines is presented in Chapter 2, Table 2.1.

In my view, the National Screening Committee's Criteria are met with regards to the condition and treatment. As outlined in Chapter 2, PTSD is a prevalent disorder with quantifiable health, social and economic impact on individuals, their families and society as a whole. The impact of PTSD and the benefits of timely provision of evidence-based treatment, both health and economic, have been recognised by the government, which funded the IAPT programme. The IAPT programme ensures availability of optimal clinical management of the condition and patient management and the provision of the best evidence-based treatment throughout the country. Furthermore, evidence supports provision of the early treatment for PTSD. However, the evidence is not so clear with regard to the screening test and the screening programme itself. The NSCC asks for a simple, safe and valid instrument that is acceptable to the population with suitable cut-off level defined and agreed. The TSQ ticks most of

the boxes and has been used in several UK screening studies already. It has good psychometric properties, a short, user-friendly format and agreed a well-documented cut-off level of six or above for the UK-based population. However, as the TSQ is covering DSM-IV and ICD-10 criteria, its diagnostic properties need to be further tested in order to reflect the changes introduced in the DSM-V and ICD-11 diagnostic manuals. Therefore, it could be argued that its diagnostic properties could be affected with the diagnostic changes and its performance needs to be further tested and documented.

With regards to the screening programme itself, the evidence is scarce for most of the criteria. To my knowledge, there are so far no RCTs supporting screening for PTSD in reducing morbidity and mortality in the general population. Existing evidence on screening for PTSD in military contexts and in hospital settings targeting victims of violent crime did not perform well as expected, resulting in low response rates and high costs of treatment (Bisson et al., 2010, Rona et al., 2004). In contrast, evaluation of the mental health response to the LB screened 65% of individuals who came into contact with the programme, out of which 30.5% were consequently referred to treatment.

Evidence on screening being clinically, socially and ethically acceptable to both health professionals and to the public is divided, and the results of the qualitative study attest to that. An interesting finding from the evaluation study pointed out that screening was perceived positively by majority of people followed-up in the evaluation study, who had no objections to being contacted. Participants reported screening was “an opportunity to check how they were doing” and it was “comforting to know there was available help should they need it”. Importantly, for the 20% of participants who received treatment within the programme, screening served as a pathway into treatment. Evidence that screening benefits outweigh the potential harm from screening is not fully established, and there are numerous arguments for and against, involved in a debate around screening and PTSD as a diagnosis, as reflected by the qualitative study findings. Finally, opportunity cost involved in the screening should be considered.

Following that, there should be capacity within the health system to accommodate all identified individuals who screened positive on the test and an agreed policy on how to address their needs. This should be ensured by available capacities within the IAPT programme, which receives relatively low numbers of PTSD cases based on their calculations from the UK national psychiatric morbidity rates for PTSD.

On another note: not all screening contexts work equally well for PTSD. For example, while victims of the terrorist attacks might expect help and response from the health services, the situation might be different in the context of refugees/asylum seekers/illegal migrants or as accident and emergency services users (Bisson et al, 2009). Possible stigmatisation, or legal issues around their status might prove to be an obstacle in screening for PTSD in this context.

Furthermore, the possibility of further traumatising or victimisation and interference with the recovery process need to be taken into account. However, these are difficult to measure and require a dedicated longitudinal study.

The short qualitative study reported here has not made it possible to provide any definitive answers with regard to the introduction of a screening policy. What it has done is to highlight different views and perspectives. A number of participants identified benefits, which would accrue from introducing a pilot screening study in one or two GP practices, in particular ones whose main target population are refugees or asylum seekers. This would elicit valuable information on key elements of the screening process, the prevalence of PTSD cases in the population, the type of cases, and pathways into treatment; and shed light on the low number of PTSD referrals to IAPT services. In my opinion, it would be possible to implement a pilot study in the existing capacity within the NHS introduced by the IAPT programme, particularly when lower than expected rates of PTSD into the programme have been reported. The qualitative study identified and described a scenario for a screening pilot that would be implementable in general practice, which is discussed in greater detail in

Chapter 9. The pilot would enable researchers to collect data on the costs and effects of screening and analyse the costs and benefits of such an intervention, thereby allowing policy makers to make informed decisions grounded in evidence. Furthermore, such evidence would provide an insight into the low referral rates of individuals with PTSD to the IAPT programme, and perhaps improve access to the best evidence-based treatment currently funded by the DH. Importantly, if appropriately designed, data collected by a pilot would enable researchers to undertake a cost-effectiveness analysis of the introduction of such a policy.

Most of the interviewed clinicians agreed that running a pilot PTSD screening in primary care could be a helpful way forward. However, some of the interviewed participants (mostly GPs) highlighted possible negative outcomes such as re-traumatisation and interfering with the process of natural recovery. Alternative proposals to screening suggested by all participants in the study focused on GP awareness-raising around PTSD and its symptoms, screening at A&E and intensive care units, or the inclusion of PTSD into screening for depression protocol. In the context of availability of the best-evidence based treatment through the IAPT services and the evidence on low rate of recognition of PTSD by the GPs, awareness-raising was identified as a good alternative to screening in primary care. Participants highlighted the importance of educating GPs to recognise the symptoms and make a referral rather than make a diagnosis themselves.

When discussing these findings, it is important to highlight their limitations. First, the findings from the qualitative study are affected by the small purposive sample of interviewed participants, and although the sample aimed to include all the important stakeholders in the decision-making process of introducing PTSD screening policy, it omitted to include the views of the service users themselves. Instead I have included findings from the Evaluation study, which looked at satisfaction with screening. Secondly, it is difficult to know how representative the comments of the different participants in the qualitative study were and, indeed, if saturation of themes was achieved. A relatively small number of participants involved in the study affects

generalisability of the findings. Furthermore, representativeness of the comments collected on such a small sample is a concern. However, the participants' sample was varied and reflected stakeholders likely involved in the decision-making, policy implementation and funding behind introduction of the PTSD screening. Furthermore, the findings highlighted a range of the opinions in regards to the screening and reflected the current debate in the field, which possibly points out that although small, the sample reflected the main discourses in the field, arguing both pro- and against screening, from the various stakeholders' perspectives. The main screening scenario was examined in the interviews; its strengths and weaknesses were discussed alongside implication of its use in the general practice setting.

The generalisation of the study findings needs to be carefully assessed, as the number of the participants was small. This is particularly true for clinical research and policy development, funding and implementation subcategories where only three participants were interviewed from different backgrounds, so there is a possibility that the saturation of the theme was not achieved. However, I believe saturation of the themes was likely to have been reached in the GP participant category as the number of new themes and codes did not emerge after the first six interviews.

Another important limitation of the study that has quite likely affected the overall saturation of themes is the failure to include PTSD sufferers, the general public and screening experts in particular. PTSD sufferers were not contacted as the evaluation study already collected data on the screening satisfaction from the perspective of the programme users and the views on the screening protocol from the participants who did not use the programme, the findings for which are presented as a part of the qualitative study in Section 8.4. Looking at the study retrospectively, the study would have benefitted from the involvement of the general public and the screening experts. This omission affects the representativeness of the findings as not all the aspects of the decision making process were discussed.

Chapter 9 Conclusion and recommendations

9.1 Introduction

The aim of the thesis was to assess the health, social, and economic impact of PTSD by focusing on the individuals exposed to the London bombings (LB). While both academic and non-academic literature highlighted significant burdens of the disorder on individuals, their families and society, there is a lack of empirical data in relation to its economic impact on individuals, the health system and wider society, and in particular a lack of economic evaluations of PTSD interventions (NICE, 2005). This study aimed to fill some of the gaps in the evidence by measuring the health and economic impact on individuals and society as a whole, and by applying a cost-effectiveness analysis to evaluate the mental health response to the LB.

The study aimed to answer questions such as what it meant for individuals to have been involved in the LB, both from a health and an economic perspective, what services they used, how participants' characteristics, patterns of exposure and service use related to reported costs, and which factors were associated with being diagnosed with PTSD. The application of economic evaluation tools allowed closer investigation of the costs and outcomes of the ST programme. Finally, a qualitative study explored the benefits of and barriers to PTSD screening in a primary care context.

The aim of this chapter is to bring together themes explored in the empirical chapters, provide a summary of findings, discuss the study's limitations and strengths in order to inform future research, and draw out some implications for practice and policy.

9.2 Thesis summary and discussion

This section will present the methods used and discuss the main findings of the study. For each section I will first present a summary of findings followed by a discussion of the main points and results.

9.2.1 Costs of involvement in the LB

The total estimated costs reported by a sample of 230 individuals involved in the LB were £2,389,520.45 at 2007/08 prices. This translates to an average of £4,362.45 for service use costs and £60,266.62 for indirect costs per person. Indirect costs represented 58% of the total reported costs. Among indirect costs the most frequently reported ones were related to productivity, i.e. are associated with sick leave. Costs due to unemployment accounted for almost 40% of the productivity costs. In the direct (service use) cost category the most costly services, when looking at totals, were hospitalisation (38%) and treatment costs (32%). Health services were the most frequently-used services after assessment and screening, with around 63% of participants reporting using one of the associated NHS services. Participants who received treatment within the ST programme reported the highest percentage of usage for all cost categories. The GP, A&E and the NHS mental health services were the most frequently used for all participants' groups. These results show that the burden of exposure to terrorist attack lies in providing statutory sector health services in a form of hospital treatments, general health services provision through A&E services and general practice. In the aftermath of terrorist attacks, health service use was mostly focused on treating the injured and the type of service used depended on the type of injuries. Higher private sector service use was evident for participants who did not use the ST programme because they did not know about it. Participants accessed services in the non-statutory and private sector mainly for their mental health needs. Findings on the use of general practice services and mental health services (provided by both the statutory and private sectors) point out where capacity should be available in the aftermath of similar traumatic events.

In this particular sample, twenty-one out of fifty types of medication used by participants were mental health-related medications. Other reported medications covered physical health problems, mostly related to the injuries received during the London bombings. This is an interesting finding, particularly in the context of medication not being recommended by the best-evidence based practice in the UK as the first choice of treatment for PTSD. Still, 38% of

participants reported using at least one type of mental health-related medication either for relaxation, sleeping, anxiety or managing panic attacks. These results indicate the underlying mental health needs among the participants.

Costs were higher for individuals who were assessed earlier in the programme, individuals with PTSD ICD-10 diagnosis and participants who saw someone being injured or killed. In Section 9.2.4, I will address in greater detail findings on higher costs reported earlier in the programme. Findings pointing out higher costs for participants with PTSD diagnosis in comparison to the rest of the sample were expected, and are in line with findings from the literature on the burden associated with PTSD discussed in Chapter 2. Injury and witnessing death are both risk factors for PTSD and their role as cost predictors is not a surprise. In fact, inclusion of these two factors in the model possibly 'diluted' the effect of PTSD variable on cost.

For comparison, Ferry et al. (2009) reported £172.8 million in 2008 as the total economic burden (direct and indirect costs) for individuals with PTSD in Northern Ireland (NI), of which an estimated £46.7 million was attributed to the conflict in NI. Translated to the average cost per person, the NI study reported an average direct cost of £16,616 and £22,268 for indirect costs per person, which is around four times higher for both cost categories when compared to the costs from the LB study. When interpreting and comparing results from the two studies, it is important to take into account differences between study populations and designs; one is looking at the prevalence and costs of PTSD at the general population level, while the other is focusing on a particular sample of individuals involved in a terrorist attack in a major urban area. Both studies point out the high burden of PTSD, although it is likely that the LB study underestimated the economic burden of PTSD by not using any objective records of service use or productivity loss, by not measuring the effects of PTSD on formal carers such as family and friends, and by relying on participant recall of services used between six months and two years after the LB.

The costs due to exposure to the LB and PTSD are likely to be conservative estimates, as the study did not measure costs of presenteeism, costs

to caregivers/families, and effects on quality of life and effects on social and family life of participants. Furthermore, the study relied on participants' recollection for events up to two years prior to the time of data collection, which could have affected the accuracy of reported data. Another important point is that the presented costs represent the economic burden of being exposed to the LB and due to developing PTSD, rather than costs due to PTSD exclusively.

Both studies report a high proportion of indirect costs in the total estimated cost; 81% in the NI study and 58% in the LB study. High indirect costs due to reduced or lost productivity are typical of mental health disorders and they "either match or outweigh direct costs for all mental health areas" (WHO, 2003, p. 17). Productivity loss-related costs for the LB sub-sample are characterised by high costs of unemployment and a large proportion of participants reporting taking sick-leave due to the effects of the LB. Higher productivity loss costs were associated with the female gender, although gender was not a significant predictor of the PTSD ICD-10 diagnosis.

Participants who received treatment under the ST programme reported the highest costs and the highest frequency of service use for all the service categories. This finding indicates that this group had the greatest needs. Moreover, this finding possibly suggests that the ST programme screening protocol was effective in identifying and triaging people with mental health needs and then referring them to treatment. However, without an appropriate comparison group this interpretation is speculative and remains unproven.

Analysis of cost variations provides an insight into how participants differ in their costs and service use. This information is particularly useful for service providers and planners as it will inform them about specific needs as well as about service use pattern in the context of exposure to the LB.

The analysis showed that groups such as women, participants of an older age and participants from minority ethnic groups were more likely to report costs or to use services associated with exposure to the LB in comparison to the rest of the sample. Women were twice as likely to report service use costs when compared to men. Women were more likely to report private sector and

medication costs, service use costs (without the ST programme costs), and costs due to productivity loss. Unsurprisingly, injury was a significant predictor of use of services provided by the NHS, private and voluntary sectors, and of use of medication.

These findings are not surprising and are in line with the literature on risk factors for PTSD and service use in the context of PTSD discussed in Chapter 2. Minority ethnic status, being a woman and older age all contribute to vulnerability after trauma exposure and increase the odds of service use and associated costs. This is an important finding that calls for a specific attention to the needs of these particular groups and should inform planning and provision of mental health response and services.

The study has identified two well-known PTSD risk factors - witnessing death or injury and feeling one will die or sustain injury as predictors of PTSD ICD-10 diagnosis. Participants who reported those factors were four to five times more likely to have a primary diagnosis of PTSD–ICD 10 in comparison to other participants.

The study results confirmed my hypothesis on positive correlation between PTSD ICD-10 diagnosis and reporting high costs. Not surprisingly, two well-known predictors of PTSD, witnessing death and injury, were identified as predictors of PTSD ICD-10 diagnosis. Lastly, early assessment was another predictor of high costs. This result could be explained by the differences between early and later treatment groups, which I will discuss in greater detail in Section 9.2.4, rather than an association between the timing of the assessment and reporting costs.

9.2.3 Comparing costs and outcomes of the ST programme

In Chapter 6, I was not able to conduct an economic evaluation due to the limited data on programme users and non-users. Instead I have explored and compared costs and outcomes for programme users and people who did not use it, and between people who received treatment and participants who were only screened and assessed, in order to have a better understanding of the screening process and its outcomes.

Service use patterns were similar between all participant sub-groups. The highest percentage of participants in all groups reported using health care services, followed by private sector services, medication and voluntary sector services and finally hospitalisation.

The treated group had a significantly lower screening score and lower probability of screening positive at follow-up in comparison to participants who did not receive treatment. There was no statistically significant difference in adjusted follow-up TSQ scores between the ST programme users and participants who did not use it. This means that participants who were treated maintained their treatment gains, and the screened only and assessed but not treated participants along participants who did not use the ST programme remained under the positive screening threshold. In terms of costs, the programme users reported significantly higher average direct and total costs in comparison to programme non-users.

As the group of participants who did not use the programme consisted of people who knew of the programme but decided not to use it, and others who did not know about the ST programme, it was interesting to compare their outcomes and costs. Participants who did not know about the programme reported four times higher average total costs due to high productivity loss. Although they reported numerically larger direct costs, the difference was not significant from participants who did not need the programme.

50% of participants who did not know of the ST programme reported using private sector services, in comparison to only 12% of participants who did not need the programme. Although participants who did not know of the ST programme screened below the TSQ threshold at the evaluation follow-up, they cited heightened awareness and alertness to potential dangers, and being upset by reminders of the LB event as their main concerns, even after significant time had elapsed since the LB. These findings potentially suggest that this sub-group of participants would have benefited from the use of ST programme services, as their use of private sector services indicates their needs. This finding points out that the wide outreach strategy is an important aspect of mental health response

after terrorist events. Moreover, this finding indicates how difficult it is to reach the targeted population of individuals affected by the traumatic event even when using an elaborate and long-term outreach relying on regular information channels such as GPs and the media.

Comparison between participants who received treatment and those who were screened and assessed only also highlighted some interesting findings. Participants who received treatment were more severely affected by the bombings in comparison to the individuals who were assessed and screened only. Apart from screening positive on TSQ and reporting high scores on BDI and PDS measures, they reported statistically higher costs. This finding suggests that the ST programme was successful in identifying people in need of treatment.

Both participant groups reported similar service use patterns. They reported health services as the most heavily-used service category followed by private sector services, medication, voluntary sector services and finally hospitalisation. The productivity loss-related costs were the dominant cost category reported by people who received treatment, while for the screened and assessed-only participants the dominant cost category was hospitalisation.

The treated group reported a significantly smaller score on the screener and lower probability of screening positive at follow-up, in comparison to participants who did not receive treatment. This finding suggests effectiveness of treatment, and supports the benefits of longer-term screening and assessment alongside the availability of evidence-based treatment.

Finally, the analysis pointed out ethnicity as a significant predictor of worse outcomes for all participant groups. Non-white British respondents had, in general, significantly higher predicted TSQ end scores across all the ST programme user groups. As highlighted by Brewin et al (2009), these findings suggest a careful consideration of the use of the TSQ with the members of black and minority ethnic groups.

Results presented in this section need to be interpreted with caution due to several issues including small sample sizes, in particular for participants who were screened and assessed only, and convenience sampling. Different outcome

measures for different participant groups complicated further group comparison and data analysis and required transformation of the PDS scale into TSQ for treated participants. This could possibly have affected the psychometric properties of the scales, particularly in regard to their reliability.

9.2.4 Cost-effectiveness of the ST programme

The cost-effectiveness analysis of the ST programme is the most interesting empirical chapter and in my view, represents the highlight of the thesis. It presents an innovative approach to conducting the economic evaluation of a mental health intervention delivered within the ST programme. Economic evaluations in the observational study context are quite a rare occurrence, possibly due to the many difficulties and methodological challenges introduced by observational study design. This analysis was challenged by a number of factors ranging from study design, issues with comparator groups, and missing data. The observational study design possibly led to self-selection of different groups, which in turn renders comparison difficult and ultimately raises questions in regards to representativeness and generalisability of the findings. However, one of the major advantages of observational study design is high ecological validity, as the evaluation in this context, in comparison to the experimental study design, has the valuable opportunity to capture, can be generalised and reflects real life conditions.

In the cost-effectiveness analysis, I compared participants who received treatment early (<1 year) with ones who received treatment more than a year after exposure to the LB (later treatment group) – which I used as a proxy for the people on the NHS waitlist for evidence-based treatment for PTSD.

Interestingly, participants who were treated early reported higher total costs in comparison to the participants treated later. This was a surprising finding, as I had expected exactly the opposite – participants who were treated later in the programme to report higher costs. My hypothesis was that by treating participants early, large societal costs could be avoided by preventing health service use costs and productivity loss becoming even greater.

Although the groups differed statistically in reported costs, in both groups productivity loss were the highest reported costs. I compared the early and late treatment groups on several aspects of PTSD and depression outcome measures: the end score, the difference between start and end scores, the number of depression-free and PTSD-free days, and the percentage of people achieving clinically significant change. While controlling for other factors I found no difference between the two groups on outcome measures, except the start-end score difference on PDS and BDI scales, with the early treatment group achieving greater treatment improvement. Differences in start and end of treatment outcome scores between early and later and outcomes could be attributed to the effect of natural recovery, which usually takes place between 6-12 months after trauma exposure.

Both groups achieved large treatment effects on both measures that were maintained at the point of evaluation follow up. In the early treatment group, 56% of participants achieved a reliable clinical improvement on the BDI and 74% on the PDS, in comparison to 40% on the BDI and 65% on the PDS for the later treatment group. For both groups, around 40% of participants on the BDI and 60% of participants on the PDS achieved both clinically and statistically significant change. Due to the absence of control waiting-list group it is difficult to say with certainty if these effects are due to treatment or natural recovery. However, the results show that there is no significant difference between the early and later treatment groups in treatment outcomes, which is inconsistent with the idea that improvement could be accounted for by natural recovery.

Ethnicity and completing treatment were the only significant predictors of achieving a clinically significant change, however this contribution of other factors could have been undermined by inclusion of the finished treatment variable in the model, which is a clear predictor of clinical improvement.

Looking at the results of the cost-effectiveness analysis without taking into account the differences between the early and later treatment groups, the results highlight that the early treatment group participants showed larger treatment gains but only when comparing the difference on the start and end

score; this difference was not observed on BDI and PDS end scores between the two groups. In terms of the cost differences, the early treatment group reported significantly larger costs on all cost categories except direct costs. Taking a societal perspective, the cost-effectiveness analysis showed that, when comparing costs and effects for early and later treatment groups for a willingness to pay above £5000 per unit of improvement on the PDS and BDI measures, the early treatment had only around 60% probability of being cost-effective compared to the later treatment. By looking at the relatively modest probability and a very high cost for only one unit of improvement on each scale, it does not seem to be cost effective to treat participants early.

Cost per clinically significant change provides an alternative way to look at the ST programme. The total cost of achieving clinically significant change for the early treatment group (including costs to society) was around £25,500 for the BDI and £30,000 for the PDS, while for the later treatment group the total cost was around 50% lower for both outcome measures. When looking at treatment costs only, the difference between groups was minimal, with a higher cost per PDS change for both groups.

When interpreting the findings of the cost-effectiveness analysis, it is important to understand the differences between the two comparator groups that could have affected the analysis. The hypothesis I tested in the analysis relied on the assumption that both early and later treatment group are comparable, that the later treatment group can be used as a proxy for the NHS waiting-list for PTSD treatment, and that the two groups differ only in the timing of the treatment. By looking more closely at the differences between the two groups other than treatment timing, it is questionable that those assumptions hold. Namely, the early treatment group had 30% more women than the later treatment group, participants in the later treatment group had on average more screeners than in the early treatment group, and participants in the later treatment group were more likely to have a late onset PTSD (however, the study did not record this information). There are possibly other systematic and non-systematic factors that could have contributed to the timing of the treatment and differences between the groups that were not measured and thus cannot be

controlled for. Possible other interpretations of the larger costs reported early in the programme include: spontaneous recovery (Ehring & Ehlers, 2014); high proportion of hospitalised participants who received treatment early, or larger costs for the early treatment group could possibly indicate that the ST programme identified individuals with great(er) mental health needs early in the programme.

Lastly, the analysis presented in this chapter highlighted again the association between being in a non-white British ethnicity group with higher costs and worse outcomes on mental health measures. Non-white British respondents had significantly higher predicted ST programme-related costs, while controlling for other factors, in comparison to the rest of the sample. Being in the non-white British ethnicity category was associated with higher BDI and PDS end scores in comparison to the rest of the sample. Furthermore, non-white British participants were around seven times less likely to achieve clinically significant change in comparison to the rest of the sample and they reported significantly fewer depression-free and PTSD-free days in comparison to the rest of the sample.

An important finding is that ethnicity was a significant factor in predicting the number of depression-free and PTSD-free days, with white British participants reporting a larger number of depression-free and PTSD-free days in comparison to the rest of the sample.

The finding that members of black and minority ethnic groups reported worse outcomes after exposure to disasters in comparison to members of the majority ethnic group, and that they have restricted access to the evidence-based treatment is well documented in the literature (Norris & Allegria, 2005; Clark, 2011). This finding is of particular importance to service planners and providers, as it highlights yet again the vulnerability of these particular groups and the need to address it in mental health service planning and provision.

In conclusion, although the economic evaluation of the ST programme suggested it is not cost-effective to treat participants early (within the first year after the LB), it is questionable whether this finding is accurate and useful to

policy planners and funders. To begin with, the division of the participants into the early and later treatment groups is based on the estimate of the 8 month waiting list for NHS treatment rather than a well- and pre-defined sampling frame. In addition, in order to get more balanced sample sizes for early and later treatment groups, I extended the 8 month timeframe to 10 months. Furthermore, due to the absence of experimental control conditions in treatment allocation, it is very likely that the differences between the early and later treatment sample could have accounted for the cost differences between the groups rather than the treatment timing itself; hence, it is difficult to establish with certainty whether it is cost-effective to provide treatment early.

9.2.5 Qualitative study on screening for PTSD

The qualitative study aimed to complement findings from the cost-effectiveness evaluation of the ST programme and to explore if and how it could be applied in a wider context. Semi-structured interviews with experts from clinical, academic and policy backgrounds uncovered a number of arguments for and against screening for PTSD in primary care.

Screening for PTSD proved to be a controversial topic with polarised views on many aspects: from the screening concept itself, to PTSD as a disorder and screening as a pathway into treatment. The consensus was only on the paucity of evidence on costs and benefits of screening for PTSD, and a lack of evidence from economic evaluations. There are a number of arguments in support of screening ranging from high prevalence of PTSD and its detrimental effects, poor recognition of the disorder in primary care, to compliance with most of the criteria set out by the UK National Screening Committee. However, from the available data there was still no evidence-based economic argument for introducing such a policy.

Next, the study interviewed the key stakeholders who would ideally be involved in the decision-making process, funding and implementation of such policy in order to gain understanding into the feasibility of screening in general practice. Through the semi-structured interviews, the qualitative study identified the key elements and proposed a design for a pilot PTSD screening

study that in the view of many interviewees would be implementable in the context of the IAPT programme and would bring valuable insights into the actual benefits and barriers of implementing primary care screening for PTSD. These benefits range from prevalence of PTSD cases in the general population, description of types of cases, analysis of pathways into treatment, and shedding light on the low number of PTSD referrals to IAPT services. Although the study findings are limited by the small sample, purposive sampling, and by missing the opportunity to interview participants with PTSD (service users) on their views of screening for PTSD, it still brings together views and experiences of a number of professionals in the field and points out important aspects of decision making in this area, thus can serve as a framework for policymakers and future research. The qualitative study highlighted the major discourse in the area, has reflected on how PTSD has not ceased to be a controversial topic and how general practitioners, academics and policy makers perceive and approach it in their everyday practice.

9.3 Limitations and strengths

There were challenges associated with this study that leave it with some limitations, including design, sample size, data collection methods, timing and missing data, working with skewed distributions, and the lack of comparator groups. It could be argued that the ideal approach would be to use an RCT design, with a carefully calculated sample size based on a power calculation, and perfectly timed data collection points. This approach, while sensible methodologically, is very difficult to implement in real life and is one reason for the scarcity of economic evaluations of mental health interventions. If one wants to include and reflect the real-life challenges of mental health interventions, particularly of mental health responses where the response needs to be set up and run quickly, this study offers a useful template. Working in this difficult context required me to identify ways to overcome the challenges and in my view this constitutes the study's key strength and contribution to the evidence base. Moreover, even though the evaluation sample is not representative, the analysis yielded conclusions that are in line with existing evidence.

9.3.1 The study design

The study design was determined by the set-up of the evaluation of the ST programme, which allowed only for an observational study and a one-point retrospective data collection on the economic effects of the LB.

As previously discussed in Chapter 3, the programme steering group saw the observational study design as the only available option for evaluating the NHS mental health response after the LB. Although the RCT design enables control of unobserved systematic variable factors by random allocation of participants in treatment and control groups, and (often) by blinding researchers and clinicians with regard to treatment allocation, its application in this context would have been inappropriate, both ethically and politically.

Despite its methodological limitations, the main advantage of an observational study is the ability to evaluate real-life situations, giving it high ecological validity. This is in my view the core strength of this study – to capture, measure and evaluate a clinical intervention in the real-world context as experienced by individuals, health systems and societies, particularly to measure health, social and economic impact. Although this study aimed to capture a societal perspective of the costs of PTSD it failed to measure a couple of important aspects of indirect costs such as costs due to presenteeism, and the effects of PTSD on family and carers or to try and capture the burden to informal carers, families and friends.

I tried to overcome the methodological limitations of the observational design by applying multivariate modelling in order to re-create to some extent the conditions of experimental study design. Multivariate modelling was introduced to control for all observable factors that could have influenced costs and outcomes. In practice, this translates into controlling for the same set of factors within each cost and outcome model in the cost-effectiveness analysis to simulate the same conditions. However, this approach was limited to control only for the variables measured in the study. It is unlikely to have captured the majority of the relevant need characteristics in order to standardise for all the differences in the case mix across the user groups used in the evaluation. Future

studies in this area should aim for a more comprehensive inclusion of the measures based on the findings from the literature on risk factors, participant characteristics, exposure factors, social support, informal care, health and mental health needs, service use etc.

The study objectives called for a mixed-methods approach – a quantitative study that explored the costs and outcomes of the ST programme, and a qualitative study that looked into themes around screening for PTSD in primary care. The quantitative analysis involved multivariate regression methods that included GLM and OLS models (Chapters 5, 6 and 7) alongside cost-effectiveness analysis (Chapter 7). Inclusion of both quantitative and qualitative approaches allowed for a greater insight into the process of evaluating mental health intervention and to explore in greater depth the potential policy implications and recommendations. The mixed-method approach was suitable as my study objectives addressed the wide scope of the effects of PTSD and enabled me to explore the implementation of the study findings in a broader context (primary care). The quantitative study explored costs and outcomes of the ST programme, while the qualitative study looked into themes around screening for PTSD in primary care. This approach was particularly informative in identifying the screening pilot scenario that would be readily implementable in a primary care setting.

The quantitative study was designed specifically for the purpose of evaluating the ST programme, and included standardised instruments on mental health outcomes (BDI and PDS), quality of life (EQ5D and SF-12) and service use (CSRI), alongside additional questions on experience and satisfaction with the ST programme, and on social effects of the bombings. Each participant group was followed up with a set of specific outcome measures used for that particular subsample during the running of the ST programme. This approach, pre-determined by the evaluation study design, was not ideal, as it resulted in different indicators for different groups and difficulties in comparing across groups, which required re-transformation of the PDS scale into the TSQ for the treated participant group. Even though the PDS and the TSQ cover the same PTSD symptoms and there are only slight semantic differences in the wording of some of the ten items taken

from the PDS, this practice is not ideal as it alters psychometric properties of the instruments and ideally requires a sensitivity analysis of the results.

Furthermore, the evaluation study omitted to measure the role of social support and networks in the recovery process. Social networks have a very important role in preventing onset of chronic PTSD and it is important to reflect their role supporting individuals in the aftermath of trauma exposure (Bisson et al., 2009).

I identified and used three comparator groups in the analysis of the costs and outcomes to reflect different aspects of the programme. Each analysis presented a slightly different outlook on the programme and the scope of the analysis depended on the availability of the data. The most comprehensive cost-effectiveness analysis was only possible for the sub-sample of participants who received treatment within the ST programme.

Due to the lack of funding, I needed to adapt the original design of the qualitative study. Instead of a study looking into individuals with PTSD on the NHS waiting list for the CBT/EMDR treatment that would have constituted the best comparison group for the economic evaluation, I conducted a small qualitative study that looked into the barriers to and benefits of introducing screening for PTSD in primary care.

9.3.2 Data collection methods

The main limitation in the data collection methods lies in its retrospective nature, with a single data collection point that varied among interviewed participants and relied heavily on their recollection of the economic, health and social effects of the LB. Self-reporting was used in this study for several reasons. It was not feasible to assess service records, and besides this the literature on participants' recall versus care records suggested not many systematic differences, concluded that self-reporting is generally an accurate measure of service use (Patel et al., 2005) and thus can be used in economic evaluations (Byford et al., 2007). Another potential limitation lies in the retrospective nature of data collection; participants were asked to recall service use in some cases up to 37 months ago and it is justified to question the accuracy of the reported costs. Data on functioning of the memory in emotionally charged situations is not

conclusive. There is plenty of evidence on people vividly remembering injuries they experienced, natural disasters or terrorist attacks, however the accuracy of those memories are questionable and often difficult to assess (Kensinger, 2009). Furthermore, it is important to consider the validity of measured indicators of service use associated with the LB only, and if participants were able to distinguish between services and treatment specifically linked to the LB exposure and those that were not. This is a valid and important question, in particular in the context of the retrospective nature of data collection that involved remembering service use in some cases up to two years back from the data collection point. The study tried to ensure accurate reporting and recollection of service use by specifically asking participants to report service use due to the LB exposure only, relying on the participant's subjective interpretation of the nature of their problems. Inclusion of the objective records of service use such as GP or hospital records would ensure more accurate estimate of service use in the future studies.

Although a variety of data collection methods introduced even more variability into an already heterogeneous sample, at the same time such an approach offered flexibility that increased response rates. Moreover, when I checked, my analyses showed no difference between different data collection methods.

Introducing an alternative QoL measure a couple of months after the start of the evaluation study added to the heterogeneity of the data by creating two sub-groups of participants and limiting comparability between them. This limitation was partially addressed by using an algorithm to translate SF-12 into EQ5D scores, which prevented data loss and enabled comparison of the two sub-groups.

The use of standardised instruments in measurement of mental health outcomes (BDI and PDS) allowed for comparability with other studies. For collecting service use and costs I used the CSRI, a standardised measure of service use adapted for this study in consultation with a health economist. The changes involved revising the wording and order of questions, and introducing a

number of study-specific items such as effects on work and productivity, effects of the LB on social domain, and participants' experiences with the ST programme. The CSRI is well known for the versatility of its use and adaptability in different study settings.

All study materials, such as interview schedules, information letters and consent forms were carefully developed and structured with input from clinicians and a health economist, approved by the ethics committee and piloted prior to the start of the evaluation study.

Involvement of two interviewers could have introduced variability and affected the quality of the collected data. However, these effects were minimised by establishment of strict interviewing protocols and interviewer training. Although the clinical approach focused on delivery of CBT and EMDR, there was no specific treatment protocol that clinicians needed to adhere to, which again introduced potential heterogeneity into the treatment data (length of sessions, number of sessions, specific therapy protocol, and adherence to the use of follow-up measures). Moreover, the ST programme database was compiled on the basis of data sent by three different clinics and a dozen clinicians.

Missing responses, in particular for the clinical outcome measures, presented a problem in the data analysis. In order to address this problem and to avoid data loss I used multiple imputation.

The fact that each participant's sub-group was followed-up with a specific set of outcome measures, depending on the aspect of programme they had used, has limited the data analysis. Moreover, it affected comparison of the groups and introduced a need to conduct separate data analysis for each sub-group. This was an unavoidable step that on the one hand resulted in the segmentation of the sample, but on the other hand enabled follow-up of participants.

For the qualitative study I conducted semi-structured interviews with a purposive sample of participants that included policy makers, academics and clinicians involved in work in the PTSD area in the UK.

9.3.3 Study sample

The evaluation study did not use a rigorous sampling technique or power calculation. The aim was to interview as many programme users and non-users as possible. In the qualitative study I used a purposive sample of experts in clinical, academic and policy-making domains. In addition, I employed snowballing sampling to ensure I included relevant experts, particularly in the policy-making domain. The study sampling approach can be seen as a study limitation, and may affect representativeness, comparability and generalisability of the findings, although there was no statistical difference in any of the main socio-demographic and exposure characteristics between the ST programme users and the evaluation sub-sample.

More generally, one can question the representativeness of the ST programme users in general, as the programme only included a fraction of the people involved in the bombings. We tried to address this and to contact people who did not want to participate in the programme or did not know of it. Another selection bias could have occurred in recruiting the evaluation follow-up subsample, as only a number of individuals agreed to take part in the study, while some potential participants firmly refused or could not be reached. The evaluation strategy was to obtain an accurate representation of the sample recorded on the screening team database as well as people who did not use the programme. The sample sizes were mainly determined by the feasibility of identifying, contacting, and persuading these groups to participate, and as such samples should be regarded as indicative rather than representative (Brewin et al., 2009). Again, these limitations need to be assessed in the context of the real-life nature of this study and, as imperfect as it is, the evaluation sub-sample still offers an interesting insight into the programme's effectiveness and the effects of the LB.

9.3.4 Data analysis

A mix of quantitative and qualitative methods was used to reflect the complexity of the subject and to address the study objectives. Both qualitative and quantitative methods were rigorously applied. I used multivariate methods to explore the effects of different factors on cost and outcome measures. The

choice of factors I controlled for was determined by the availability of collected data as well as previous research findings found in the literature. In the qualitative study I used directed qualitative content analysis.

The lack of a proper comparison group is the main limitation of the economic evaluation. Comparing the ST programme users to people on the NHS waiting list or no intervention group would possibly constitute the ideal comparison groups for the analysis. In the absence of alternative options I decided, in consultation with my supervisors, to focus on three different comparator groups, each with its own strengths and limitations, and each offering a different perspective on the intervention. This approach in my view offered an alternative insight into evaluating mental health interventions, and should be seen as a valuable contribution to existing knowledge.

9.4 Research, policy and practice implications

9.4.1 Research implications

The Literature Review highlighted a need for comprehensive and transparent economic evaluation of mental health interventions for PTSD. At the same time the Literature Review demonstrated a paucity of such data for PTSD in particular, and a need for clarity (Barrett & Petkova, 2013) and transparency (Graves et al., 2002) in the costing methodology. Furthermore, apart from the clarity behind the costing methodology, evaluations of mental health interventions should present incremental costs and benefits, include a comparison group and a sensitivity analysis.

The literature on evaluating mental health interventions is unanimous in recommending that evaluation should, where possible, be introduced into an intervention at an early stage. Ideally, this would be done at the time of planning the intervention and not, as is commonly done, as a separate add-on study at the end or half-way into the intervention. Incorporating the evaluation into the intervention from the planning phase should ensure not only the collection of data on the intervention outcomes, but also monitor the process of the intervention, so there is timely data collection and the possibility for multiple points of data collection.

The major contribution of the thesis is not in providing definitive answers but in exploring alternative approaches in evaluating mental health interventions in a real-world context. It offers an insight into how to make the best use of data obtained in an observational study context with the help of econometric tools. I wanted to demonstrate how it is possible to use an alternative evaluation route to an RCT, and so I have explored the use of multivariate modelling to address methodological limitations stemming from the observational study design. In my view, wider application of such techniques should be encouraged and funded, as they can provide useful tools in addressing methodological limitations and enable the potential use of otherwise potentially unusable or 'difficult' data.

As part of the economic evaluation, I explored different techniques of exploring uncertainty of the analysis and decided to plot CEACs. I would recommend the use of this particular type of analysis due to the simplicity of its application and interpretation.

The qualitative study identified and explored opposing views on screening for PTSD in primary care. The study discussed a pilot study scenario that would provide a comprehensive evaluation of such an intervention. Interviewed participants came with a specific set of recommendations for a pilot study scenario and set-up, which in my view offers valuable input for future research in this controversial area, especially at a time of increasingly tight mental health budgets that increase the need for reliable evidence on best resource allocation. It is proposed that a pilot should include at least two GP practices, preferably in an ethnically mixed area. The GPs should write to all members of their practice, providing information on the study, along with the screening questionnaires. Letters should invite participants to fill out the questionnaire and send it free of charge to the local IAPT team. Participants would be encouraged to self-refer to or contact their local IAPT team if they have any questions or concerns. Participants should be given an opportunity to opt out of the pilot at any stage.

The choice of screening instrument should be guided by the recommendations from the qualitative study. Although TSQ would make a logical choice due to its characteristics, alongside the fact it has already been used in a couple of UK studies, which would allow comparison of findings, the role of its use in light of the changes in the diagnostic criteria for PTSD introduced by DSM-5 and ICD-11 needs to be carefully reconsidered. Screening questionnaires would need to be translated into the languages spoken in the local catchment area, and each letter would need to contain an English version as well as a translated one, where appropriate.

The local IAPT team would then need to follow up with people whose screening questionnaires suggest they might need help, offering further assessment and treatment if needed. This assessment could be conducted in the IAPT office face-to-face or, if more convenient, over the telephone. Those in need of treatment should be offered evidence-based treatment by the IAPT team.

In addition, the IAPT team, supported preferably by a researcher, should then collect data on the number of individuals screened, assessed and treated as well as the outcomes and duration of their treatment. The London bombings study would provide a good example in terms of study methodology and implementation. Similarly, it would be valuable to collect data on the nature of the traumatic event that triggered the symptoms and timing of the event.

It would also be important to collect data on all associated costs, including the screening itself, assessment, treatment and the costs of other related services received by participants from the onset of the symptoms, including health services provided by statutory and non-statutory organisations, sick leave, reduced hours or unemployment. It would be important to record the effects on participants' social and family lives following the onset of the symptoms or exposure to the traumatic event and the role of informal carers. This could be done retrospectively, by asking participants to recount the effects of the traumatic event and by accessing GP records. Such an approach would enable comparisons with existing data on the effects and costs of PTSD and ensure optimal use of information collected.

The pilot would enable researchers to collect data on the costs and effects of screening and analyse the costs and benefits of such an intervention, thereby allowing policy makers to make informed decisions grounded in evidence. Furthermore, such evidence would provide an insight into the low referral rates of individuals with PTSD to the IAPT programme, and perhaps improve access to the best evidence-based treatment currently funded by the DH. Importantly, if appropriately designed, data collected by a pilot would enable researchers to undertake a cost-effectiveness analysis of the introduction of such a policy.

9.4.2 Policy and practice implications

In the context of “scarce high-quality research evidence on post-disaster psychosocial management” (Bisson et al, 2010, b, p.71) this study offers a contribution in providing information on the effectiveness of the mental health response programme. Evidence on optimal psychosocial response following disasters and major incidents is very limited (Bisson, 2014) and therefore this study offers insights into the effectiveness of an innovative mental health response based on the stepped-care approach and screening. Information on programme set-up, running, outcomes, costs and effectiveness are of value and offer a template for future responses and their evaluations.

One contribution of the study lies in the evaluation of the innovative mental health response based on screening of individuals exposed to the LB. Although literature recommends early detection and referral for evidence-based treatment of individuals with PTSD, there is an absence of evidence on the effectiveness of screening in the context of mental health responses after traumatic events (Bisson et al, 2010 b). Guidelines on psychosocial care following disasters and major incidents advise against formal screening of everyone involved. However, at the same time, they highlight the need to be “aware of the importance of identifying individuals with significant difficulties” (Bisson et al., 2010 b, p. 7). Similarly, although in the qualitative study GPs expressed mixed views on implementation of primary care screening for PTSD, they nevertheless agreed that a pilot/evaluation was needed. In this context of scarce evidence and conflicting recommendations, it is hoped that this study makes a helpful contribution.

This study highlights the fact that providing the best evidence-based treatment early, in the form of the 'screen and treat' approach, does not seem to be cost-effective, as there is no difference in treatment effectiveness between the early and later treatment groups while early treatment group reported significantly higher costs. I expected to find that the costs incurred for running the ST programme could be offset by the savings from avoiding chronic PTSD and large productivity-related costs to become even larger. However, without having a proper waiting list comparison group, the questions on cost-effectiveness of the ST programme are difficult to answer with certainty. It is difficult to determine whether the higher costs reported by the early treatment group are indeed associated with treating them early or are due to other observed or unobserved factors.

For the same reason, it is difficult to establish with certainty if the treatment effects observed in the programme are due to treatment effectiveness or to natural recovery. However, results showing that 74% in the early and 65% in later treatment group achieved reliable clinical improvement, that the treatment effect was large and well maintained at the follow-up, and results showing no differences in treatment effectiveness between early and later treatment group suggest that the provided treatment was indeed effective (Brewin et al, 2009a).

Another important point to consider is whether or not provision of treatment within the first years after the exposure to the LB can be classified as early treatment, as the NICE guidelines refer to treatment provided up to three months post trauma as 'early' (NICE, 2007). However, due to the logistics of obtaining the contact details of exposed participants, it took around two months to start receiving larger numbers of referrals to the programme with the majority of referrals only being received five months after the LB. This finding highlights the logistical challenges in setting up a mental health response, which can interfere with timely treatment provision and capture the real-world context of the evaluation study.

In examining the cost-effectiveness of the ST programme it is important to look at the effectiveness of the screening process itself. By looking at the qualitative data from the evaluation study, the great majority of people did not object to being approached for screening purposes. In fact, 25% of participants who finished treatment stated they would have not asked for help themselves, which indicates the important role of proactive outreach. In total, 65% of participants identified by the programme were screened and 30.5% of those were referred for treatment, which indicates a high response rate and a good screening uptake. Another finding that possibly points towards the effectiveness of screening to identify people in need of treatment was the negative correlation between the total number of screeners and PTSD ICD-10 diagnosis, meaning that the more screeners individuals received the less likely they were to be diagnosed with PTSD. Most of the participants were referred to treatment after the first screener. This finding may suggest a waste of resources on continuous screening. However, when looking at the percentage of people screening positive on TSQ, the data shows 50% of participants screened positive at the first screener, 30% of participants screened positive at the second screener, while 17% and 9% screened positive on the third and fourth screener respectively. This data may indicate the benefits of continued screening up to at least two consecutive screeners. Brewin et al (2010, p. 397) concluded that “three screeners were the maximum that was worthwhile in terms of the response rate in the mental health response to the LB”. Furthermore, an additional benefit of continuous screening is the ability to detect late onset PTSD.

An important question for the future is: how many screeners is a good use of resources? Most of the participants were referred to treatment after the first screener and there was a negative correlation between the number of people screened and the total number of screeners. As people were screened up to five times in the ST programme, it is questionable as to whether this is the best use of the resources considering the findings above. The evaluation study recommended a maximum number of three screeners as on the fourth screener the number of positively screened individuals dropped to only 9% (Brewin et al, 2010).

The government in England is committed to investing more money in mental health, and long-term funding programmes such as IAPT confirm their pledge. This evaluation suggests that the costs of treatment are offset by savings in indirect costs. Therefore, allocating more money to recognition and treatment of PTSD would be both effective for the individuals concerned and also economically attractive. Apart from investing in the treatment of PTSD, funding should be available for recognition of the disorder itself, especially in the context where usual pathways into treatment, such as GPs and self-referrals, are shown not to be effective. This is particularly important in the case of PTSD, as IAPT reported lower rates of referrals for PTSD than expected from general population PTSD prevalence rates. The finding that only 3% of all referrals to the ST programme came via GPs supports the need for improvement in PTSD recognition at the general practice level. Furthermore, this finding is in line with existing evidence on the need to increase GP awareness and recognition of PTSD, as well as knowledge around effective treatment.

The next recommendation is around the importance of providing information and support to the families of the affected individuals as a part of the mental health response. The protective role of social support in preventing the onset of chronic PTSD has been highlighted by numerous studies (Bisson et al., 2009). Immediate family and social networks play a crucial role in supporting individuals affected by traumatic events, especially in the early days, and are an important element of the path to recovery. However, traumatic events often have a massive impact on the families of those directly involved. Therefore, it is important for families to understand the process of recovery, which will enable them to spot the symptoms of PTSD in the affected individual and refer him/her to specialist services. Secondly, such services would provide support for other family members.

This study highlighted that there is a need not just for better recognition of PTSD but also for continued longer-term monitoring of individuals affected by a traumatic event. With the introduction of IAPT services, this practice is indeed implementable and does not require allocation of additional resources. Yet, if

effective, it can result in great economic benefits and savings by preventing the onset of chronic PTSD.

This study confirmed findings from other studies on factors associated with service use and risk factors for PTSD. Importantly, the analysis identified vulnerable groups such as women, participants of an older age and participants from minority ethnic groups who were either more likely to report the costs or to use the services associated with exposure to the LB, and to report worse mental health outcomes. This study also highlighted being injured, witnessing death or injury, and feeling one will die or sustain injury as predictors of PTSD and higher costs. These findings are of relevance for mental health service planning and provision, and constitute an important element of effective psychosocial response as “the key to effective response is awareness of populations at risk and their particular needs” (DH, 2009, p. 27).

Other populations at a higher risk of developing PTSD due to the nature of their work that involves exposure to traumatic events are first responders, A&E personnel, police officers and fire fighters. Recognising and addressing their psychosocial and mental health needs is an important element of every mental health response programme, as well as an essential part of the support services provided by their employers. This is particularly significant, as these professions have a tendency to create a work culture that stigmatises help-seeking behaviour around mental health.

More generally, when taking into account high indirect costs associated with PTSD due to reduced productivity, sick-leave and presenteeism, there is a strong economic case from an employer’s perspective to recognise and address mental health needs associated with PTSD.

Participants in this study used a wide range of services to support their physical and mental health needs. In particular, there is a need to develop a wider catchment network for the participants who are unlikely to be aware of mental health response or regular pathways into treatment. This can be established by better sharing of information between agencies such as the NHS (hospitals, A&E services and GPs), police and other first response agencies,

councils, and others. Viable communication channels and data-sharing agreements should be established for future emergencies.

To state that evaluation is a crucial part of every intervention and should be much more than just a formal requirement by intervention commissioners and funders is not a finding or recommendation unique to this thesis. However, this is increasingly important in the context of constrained budgets and limited resources, as evaluations (particularly economic evaluations) can help guide the decisions behind resource allocation. More resources should be available for evaluating ways to recognise and treat PTSD. Moreover, it is important to recognise and investigate the potential role and contribution of a range of available evaluation designs. This recommendation translates into more available funding for non-experimental evaluation study designs, which would boost the evidence base on interventions for PTSD.

In conclusion, this thesis has approached the subject of PTSD from several angles. The study has confirmed, in line with evidence discussed in Chapter 2, that the effects of trauma exposure and PTSD have a wide-ranging and long-term health-related and economic impact on exposed individuals. Costs, particularly productivity loss, associated with trauma exposure and PTSD are significant. Long-term health, social and economic effects of PTSD can be prevented or reduced by timely and appropriate treatment provision. This study has not shown that it is cost-effective to implement an outreach programme following a large-scale traumatic event that will identify, screen and treat individuals whose mental health needs would otherwise be likely to remain unmet. However, as discussed earlier in the chapter, I would strongly argue that due to the design of the study and with the available data, it is not possible to provide answers to the questions that economic evaluation addressed in the first place.

This study has pointed out vulnerable groups such as minority ethnic groups and women who are likely to experience worse outcomes and generate higher direct and indirect costs. It is important that future trauma responses are aware of specific needs of these groups in order to ensure equal access to

treatment and to prevent long-term health and economic consequences of chronic PTSD.

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Appendices

Appendix A. Adult screening questionnaire used by the ST programme

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Appendix A. Adult screening questionnaire used by the ST programme

NHS Trauma Response (London bombings)

Your name:		
Your address:		
	Postcode:	
Your telephone	(home):	(mobile):
	(work):	Email:
Your occupation:		
Your date of birth:		
Your gender:	Are you male?	Are you female?

Do you have any children living with you? If yes please provide their details:

	Name	Age	Are they male/female?
child 1			
child 2			
child 3			
child 4			
child 5			

On which day were you involved in the bombings?	7 July	21 July	Both days
Where were you on that day(s)?			
Which, if any, of the following applied to you?	yes	no	
You were injured			
You felt that you might be injured or killed			
You saw someone who had been injured or killed			
A family member or close friend was killed			
A family member or close friend was injured			
You felt that a family member or close friend might be injured or killed			
You personally witnessed the effects of one of the bombings			

With your consent we would also like to let your G.P know of your involvement in the bombings so that you receive the right advice or treatment in the future. Please put a cross in the box if you do not wish us to do this ☐.

Please add your GP name and address here (even if you do not wish involvement of your G.P)

Please consider the following reactions that sometimes occur after a traumatic event. This questionnaire is concerned with your personal reactions to the London bombings that happened in July 2005. Please indicate whether or not you have experienced any of the following AT LEAST TWICE IN THE PAST WEEK:

[illegible]

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	52
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APPENDIX B. Survey questions used in the evaluation of the ST programme



Client no:

Date:

NHS London Bombings Response Evaluation

INFORMATION SHEET & CONSENT FORM

Date of Birth (dd/mm/yy):

Gender:

M

F

Section A. The first few questions regard your experience with the bombings:

- | | 7 July | 21 July | Both |
|--|--------|---------|------|
| 1. On which day were you involved in the bombings? | | | |
| 2. Where were you on that day(s)? | | | |

- | | | |
|--|-----|----|
| 3. Were you injured? | YES | NO |
| 4. You felt that you might be injured or killed? | YES | NO |
| 5. You saw someone who had been injured or killed? | YES | NO |
| 6. A family member or close friend was killed? | YES | NO |
| 7. A family member or close friend was injured? | YES | NO |
| 8. You felt that a family member or close friend might be injured or killed? | YES | NO |
| 9. You personally witnessed the effects of one of the bombings? | YES | NO |
| 10. Other involvement _____ | | |

Section B(i). This section is about how you're feeling now:

- Since completing your treatment, have you experienced any flashbacks relating to the bombings?

YES NO – go to B(ii)
- How often do you experience flashbacks?
 - ☐ More than once a day
 - ☐ Daily
 - ☐ A few times a week

- ☐ Weekly
- ☐ Once every couple of weeks
- ☐ Monthly
- ☐ Less often

3. On a scale of 1-10, how similar or different are these flashbacks to those that you experienced before treatment?

**Extremely similar/
the same**

**Not at all
similar**

1 2 3 4 5 6 7 8 9 10

4. In what way(s) are they different?

Section B(ii).

1. Have you found that you see the world differently since the bombings, or have the bombings made no difference to how you see the world? *For example, have you found that you now have different expectations of other people, or Government? Do you feel that you cannot trust people or that people are out to get you? Do you feel you are part of society?*

NO – go to Q5**A LITTLE****A LOT**

2. In what way do you see the world differently?

3. Is this change...

+VE**-VE****BOTH +VE & -VE**

4. Is this change something you feel is relevant to you every day or just occasionally?

Every day**Occasionally**

5. Have you found that you feel different as a person since the bombings, or have the bombings made no difference to how you feel as a person? *For example, have you found that you now have different priorities or values?*

NO – go to Q8**A LITTLE****A LOT**

6. In what way do you feel different as a person?

7. Is this change...

+VE**-VE****BOTH +VE & -VE**

8. Is this change something you feel is relevant to you every day or just occasionally?

Every day**Occasionally**
Section C. This section refers to special services set up for people affected by the bombings:

1. Do you remember being sent information or otherwise hearing about any of these special services for people caught up in the bombings?

a) Family Assistance Centre (7 th July Assistance Centre)	YES	NO
b) NHS Direct Assistance Line	YES	NO
c) Screening Team/Charlotte St. Clinic	YES	NO
d) London Rescue Programme	YES	NO

2. Did you contact or make use of any of these special services?

a) Family Assistance Centre (7 th July Assistance Centre)	YES	NO
b) NHS Direct Assistance Line	YES	NO
c) Screening Team/Charlotte St. Clinic	YES	NO
d) London Rescue Programme	YES	NO

4. If you did not choose to use these services yourself, why was this?

- | | | |
|--|------------|-----------|
| a) Do not remember hearing about them | YES | NO |
| b) Did not feel I needed them | YES | NO |
| c) Did not have time or opportunity to respond | YES | NO |
| d) Other (<i>specify</i>) | | |

Section D. Your experience with the Screening Team/Charlotte St. Clinic
--

1. How did you come to hear about the Screening Team/Charlotte St. Clinic?

a) Friends or family	YES	NO
b) Newspaper or television	YES	NO
c) From NHS Direct	YES	NO
d) From hospital doctor or G.P.	YES	NO
e) You were written to about it	YES	NO
f) Other _____		

2. If you received a letter about the Screening Team/Charlotte St. Clinic, did this arrive:
 - a) Too soon, before you were ready to deal with it?
 - b) At about the right time?
 - c) Too late, you would have liked to receive it earlier?

3. How satisfied or dissatisfied were you with the information and advice you received from the Screening Team/Charlotte St. Clinic when you were first in contact with them?
 - a) Satisfied
 - b) Neither satisfied nor dissatisfied
 - c) Unsatisfied, felt they could have done more

Details:

4. How satisfied or dissatisfied were you with the speed with which the Screening Team/Charlotte St. Clinic responded to you?
 - a) Satisfied
 - b) Neither satisfied nor dissatisfied
 - c) Unsatisfied, it took too long

Details:

5. Overall, how satisfied or dissatisfied were you with the service you received from them?
 - a) Satisfied
 - b) Neither satisfied nor dissatisfied

c) Unsatisfied

Details:

Section E. Treatment

Treatment clinic:	
Number of sessions:	
Average session duration:	

1) Were your treatment sessions:

- ☐ More than once a week
- ☐ Weekly
- ☐ Once every two weeks
- ☐ Monthly
- ☐ Less often
- ☐ Erratic -

- Sessions erratic:* ☐ AT YOUR REQUEST
☐ AT CLINICIAN'S RECOMMENDATION
☐ COULD NOT MAKE REGULAR SESSIONS

2) How satisfied or dissatisfied were you with the choice of treatment centre offered?

- a) Satisfied
- b) Neither satisfied nor dissatisfied
- c) Unsatisfied

Details:

3) How satisfied or dissatisfied were you with the treatment you received?

- a) Satisfied
- b) Neither satisfied nor dissatisfied
- c) Unsatisfied

Details:

4) Do you think you would have approached your G.P. or NHS mental health services for help if you had not been in touch with the Screening Team/Charlotte St. Clinic?

- a) Unlikely to have asked for help at all
- b) Would have asked eventually
- c) Had already contacted my G.P. or mental health services

Section F. *If there was a similar event in the future, the NHS would aim to set up services to support those affected. We'd like your opinion on what might be helpful and appropriate:*

1. If there was a similar event in the future, would you have any objection to properly qualified NHS professionals:

- a) Writing to you with information about such services YES NO
- b) Telephoning you with information about such services YES NO
- c) Obtaining your contact details from the Police or other organisations that know you were involved

YES NO

2. Is there any other form of information, advice or support that was not offered to you after 7th July that you think would be useful?

YES NO

Details:

Section G. *This section asks about the impact of the bombings on your work and leisure*

1. What is your current employment status?

- | | |
|---|---|
| <input type="checkbox"/> Employed full-time | <input type="checkbox"/> Retired (ill health) |
| <input type="checkbox"/> Employed part-time | <input type="checkbox"/> Student |
| <input type="checkbox"/> Unemployed | <input type="checkbox"/> Housewife/husband |
| <input type="checkbox"/> Self-employed | <input type="checkbox"/> Other _____ |
| <input type="checkbox"/> Retired (age) | |

2. **If you are currently employed:**

- a) Occupation _____
- b) Job title _____

3. **If you are unemployed/retired:**

- a) Do you intend to return to work? YES NO
- b) How long have you been unemployed/retired? ____yrs ____mths

4. Have you had to reduce your working hours as a result of the bombings? YES NO

5. Have you taken sick leave as a result of the bombings? YES NO

6. Have you become unemployed as a result of the bombings? YES NO

Indicate in box below – 'PH' for time off due to physical effects, 'MH' for mental health effects

	July 05	Aug 05	Sept 05	Oct 05	Nov 05	Dec 05	Jan 06	Feb 06	Mar 06	Apr 06	May 06	Jun 06	July 06	Aug 06	Sept 06
Reduced your working															

hours?															
<i>Hours per week reduced each month</i>															
Taken sick leave?															
<i>Days missed each month</i>															
Become unemployed?															
<i>Weeks unemployed each month</i>															

7. Did treatment for PTSD or other mental health issues related to the bombings help you to stay in work, or to return to work earlier than you otherwise might have done?

YES **NO** – go to Q9

8. Indicate which work-treatment relationship is most appropriate to describe your situation:

- ☐ Treatment prevented me from requiring time off work
- ☐ I had time off work, but treatment helped me return to work more quickly
- ☐ Treatment had no effect on time taken off work
- ☐ Treatment caused me to take more time off work, or to return to work less quickly

9. What state benefits (if any) do you **currently** receive?

- | | |
|---|---|
| <input type="checkbox"/> Income Support | <input type="checkbox"/> Council Tax Benefit |
| <input type="checkbox"/> Incapacity Benefit | <input type="checkbox"/> Housing Benefit |
| <input type="checkbox"/> Disabled Person's Tax Credit | <input type="checkbox"/> Working Tax Credit |
| <input type="checkbox"/> Severe Disablement Allowance | <input type="checkbox"/> Statutory Sick Pay |
| <input type="checkbox"/> Jobseeker's Allowance | <input type="checkbox"/> State Retirement Pension |
| <input type="checkbox"/> Disability Living Allowance – Care Component | |
| <input type="checkbox"/> Disability Living Allowance – Mobility Component | |
| <input type="checkbox"/> Other _____ | |

10. Are there any other ways in which the bombings have affected your ability to engage in work or leisure activities?

11. Is there anything else you would like to add?

Section H. Further contact:

3. Your ethnic origin:

- | | |
|--|--|
| <input type="checkbox"/> Arab | <input type="checkbox"/> Mixed – White & Asian |
| <input type="checkbox"/> Asian – Bangladeshi | <input type="checkbox"/> Mixed – White & Black African |
| <input type="checkbox"/> Asian – Indian | <input type="checkbox"/> Mixed – White & Black Caribbean |
| <input type="checkbox"/> Asian – Pakistani | <input type="checkbox"/> White - British |
| <input type="checkbox"/> Black – African | <input type="checkbox"/> White - Irish |
| <input type="checkbox"/> Black – Caribbean | <input type="checkbox"/> White - Other |
| <input type="checkbox"/> Black – Other | <input type="checkbox"/> Other (<i>specify</i>) _____ |
| <input type="checkbox"/> Chinese | |

2. May we contact you if we have any further questions?

YES NO

3. Do you know of anybody else who might like to talk to us?

YES – leave details NO

4. Would you like us to send you details of our findings when they are published?

YES NO

5. Would you be willing to take part in other research relevant to the London bombings?

YES NO

Thank you!

Please don't hesitate to get in touch if you have any points you want to make in the future or want to contact us for any

APPENDIX C. Qualitative study questions

The core set of questions for all participants:

1. Can you tell me a little bit about yourself and your role?
2. PTSD can have a serious impact on the individual's psychological and physical health. Research has shown that screening might be a valid method for detecting the disorder. Screening might also act as a pathway into treatment. What are your views on these two statements?
3. What do you think would be the best way and setting to implement a PTSD screening policy?
 - prompt questions:
 - a. Screening procedure suggestion?
 - b. Issues in regard to referral to detailed assessment or treatment?
4. For someone in your type of job/role, what do you think would be the logistical and organisational challenges in implementing such a policy?
5. What would be needed to overcome such barriers?
6. Is there anything else you would like to add on this topic?

Questions specifically for those in GP practice:

- What would be the best way of tailoring screening for PTSD intervention to fit the GP practice setting;
 - Screening procedure suggestion?
 - Issues in regard to referral to detailed assessment or treatment?
 - Issues around refusal of referral, screening results discussion and provision of educational materials?
 - How time consuming are those steps?
 - What are the challenges?

- GPs education in the detection of PTSD and in improving pathways into treatment – your views and suggestions for improvement?

Questions for clinicians:

- What is the average waiting time for trauma-focused CBT treatment at your clinic? How does this compare with the national average?
- In your experience what is the most common pathway into treatment? Typically, how long after the onset of PTSD, does it take for an individual to have a specialist assessment? And how long to receive treatment?
- What would be the best way of improving the pathways into treatment?

Questions for academics:

- Please can you comment on the characteristics of the appropriate instrument for PTSD screening in GP setting?
- Is there a possibility to incorporate into PTSD screening for other anxiety disorders as well such as depression, GAD, travel phobia?
- Appropriateness for PTSD screening in general population?
- (Distinction between war and non-war related PTSD – symptoms, treatment etc.)
- Any other issues?

Questions for PCT commissioners and policy developers:

- If you are considering providing a particular service or intervention, how important to you is the evidence base?
- If you wanted to introduce PTSD screening in your area, how would you move toward getting it in place? Who would you involve in the decision-making? What would be the process?
- Anything else?

APPENDIX D. Posttraumatic diagnostic scale

Below is a list of problems that people sometimes have after experiencing a traumatic event. Read each one carefully and choose the answer that best describes how often that problem has bothered you **IN THE PAST MONTH**. Rate each problem with respect to the London bombings.

0 Not at all or only one time

1 Once a week or less/once in a while

2 2 to 4 times a week / half the time

3 5 or more times a week / almost always

1*	Having upsetting thoughts or images about the event that came into your head when you didn't want them to	0 1 2 3
2*	Having bad dreams or nightmares about the traumatic event	0 1 2 3
3*	Reliving the traumatic event, acting or feeling as if it were happening again	0 1 2 3
4*	Feeling emotionally upset when you were reminded of the traumatic event (e.g. feeling angry, scared, sad, guilty etc.)	0 1 2 3
5*	Experiencing physical reactions when you were reminded of the traumatic event (e.g. break into sweat, heart beating fast)	0 1 2 3
6	Trying not to think about, talk about or have feelings about the traumatic event	0 1 2 3
7	Trying to avoid activities, people or places that remind you of the traumatic	0 1 2 3
8	Not being able to remember an important part of the traumatic event	0 1 2 3
9	Having much less interest or participating much less often in important	0 1 2 3
10	Feeling distant or cut off from people around you	0 1 2 3
11	Feeling emotionally numb (e.g. being unable to cry or unable to have loving feelings)	0 1 2 3
12	Feeling as if your future plans or hopes will not come true (e.g. you will not have a career, marriage, children or a long life)	0 1 2 3
13*	Having trouble falling or staying asleep	0 1 2 3

14	Feeling irritable or having fits of anger	0 1 2 3
15*	Having trouble concentrating (e.g. drifting in and out of conversations, losing track of a story on television, forgetting what you have read)	0 1 2 3
16*	Being overly alert (e.g. checking to see who is around you, being uncomfortable with your back to the door etc.)	0 1 2 3
17*	Being jumpy or easily startled (e.g. when someone walks up behind you)	0 1 2 3

*Items used for comparison with TSQ, marked as YES on TSQ scale if person stated 2 or more on PDS scale per item

From Foa, E., Cashman, L., Jaycox, L., & Perry, K. (1997). The validation of a self-report measure of PTSD: The Posttraumatic Diagnostic Scale. *Psychological Assessment, 9*, 445-451.

APPENDIX E. Costs and outcomes best-fit explanatory models for early and later treatment groups

Table E.1 *GLM on total costs*

<i>Potentially associated factors</i>	<i>Coefficient</i>
<i>N=101 observations</i>	<i>(95% confidence interval)</i>
Timing of costs measurement	0.09*** (0.05, 0.17)
Treatment start – days after LB	-1.95*** (-2.71,- 1.20)
White British	-1.56*** (-2.18, -0.93)
Q1. Being injured relative to Not being injured	2.05***(1.13, 3.05)
Constant	7.19*** (5.26, 8.63)
Link function	Log
Distributional family	Gauss

	M (95% CI)
Early treatment group	11716.8 (15448, 28086.4)
Later treatment group	1654.32 (6924.16, 12653.6)

Table E.2 GLM on total ST program costs

<i>Potentially associated factors</i>	<i>Coefficient</i>
<i>N=103 observations</i>	<i>(95% confidence interval)</i>
Q1. Being injured relative to Not being injured	0.31** (0.05, 0.56)
Treatment start – days after LB	-0.00 (-0.00, 0.00)
Cost collection date	0.02 (-0.00, 0.00)
PTSD ICD-10	0.37*** (0.06, 0.66)
Ethnicity	-0.35*** (-0.62, -0.09)
Constant	7.87*** (7.26, 8.40)
Link function	Log
Distributional family	Gamma

	M (95% CI)
Early treatment group	1772.5 (1163.61, 2700.01)
Later treatment group	1499.8 (973.13, 2310.98)

Table E.3 *GLM on direct costs excluding ST programme costs*

<i>Potentially associated factors</i>		<i>Coefficient</i>
<i>N=93 observations</i>		<i>(95% confidence interval)</i>
Treatment start – days after LB		-0.00 (-0.00,-0.00)
Gender Male vs. Female		0.89**(0.10, 1.54)
Q1. Being injured relative to Not being injured		0.83**(0.09, 1.57)
Psychiatric comorbidity		-0.84**(-1.63, -0.04)
Cost collection time		0.03 (-0.03, 0.07)
Constant		6.69*** (5.26, 8.17)
Link function		Log
Distributional family		Gamma
M (95% CI)		
Early treatment group		1772.5 (1163.61, 2700.01)
Later treatment group		1499.8 (973.13, 2310.98)

Table E.4 Two stage model on work related costs

<i>Potentially associated factors</i>	<i>Logistic regression of reporting work related costs N= 103 observations</i>	<i>GLM of work related costs due to LB N= 68 observations</i>
	<i>Odds ratio</i>	<i>Coefficient</i>
	<i>(95% confidence interval)</i>	<i>(95% confidence interval)</i>
Q1. Being injured relative to Not being injured	3.55***(1.25, 10.12)	-
Number of previous trauma		-
Total number of sessions		0.04*** (0.01, 0.08)
Treatment start – days after LB	0.99***(0.99, 0.99)	-0.05*** (-0.00, -0.00)
Psychiatric comorbidity		-0.93**(-1.79, -0.07)
Cost measurement time	0.99 (0.91, 1.07)	0.05*(-0.00, 0.10)
Q2. You felt like you might be injured or killed?		0.86**(0.02, 1.69)
Constant		8.50*** (7.06, 10.87)
Link function	-	Log
Distributional family	-	Gamma
Link test p-value	-	
Pearson's chi-squared test p-value	0.49	
Hosmer-Lemeshow chi-squared test p-value	0.23	
Likelihood ratio chi-squared p-value	0.00	
Percent correctly classified	73.4%	

M (95% CI)

Early treatment group	26518.82 (14916.93, 38121.16)
Later treatment group	6084.03 (4062.53, 8105.23)

Table E.5 GLM model on the end BDI score

Potentially associated factors	coefficient
N=94 observations	(95% confidence interval)
Finished treatment	-8.41*** (-12.03, -4.48)
White British	-3.90***(-7.16, -0.63)
BDI score at start of the treatment	0.43*** (0.03, 0.06)
Time elapsed to treatment (days since LB)	-0.00 (-0.01, 0.00)
Physical comorbidity	7.39*** (3.03, 11.76)
Constant	10.87***(4.13, 17.60)
Family	Gauss
Link	

	M (95% CI)
Early treatment group	10.69 (9.09, 12.28)
Late treatment group	8.62 (7.05, 10.29)

Table E.6 OLS model for pre and post treatment difference in BDI score

Potentially associated factors	coefficient
N=101 observations	(95% confidence interval)
Q3. You saw someone who has been injured or killed?	4.57*(0.20, 10.95)
Finished treatment	-7.24***(-11.39, 3.10)
Treatment start (days since LB)	0.01*** (0.00, 0.02)
Having a premorbid condition	4.12**(-0.03, 8.29)
Constant	-14.68***(-18.41, -5.03)

R sq = 0.2

	M (95% CI)
Early treatment group	-14.08 (-16.76, -11.63)
Later treatment group	-10.54 (-12.68, -7.33)

Table E.7 GLM model on the end PDS score

Potentially associated factors	coefficient
N=94 observations	(95% confidence interval)
White British relative to Other ethnic categories	-5.80*** (-0.96, -0.15)
Physical comorbidity	10.68*** (4.17, 17.18)
Finished treatment	-11.90*** (-1.03, -0.48)
PDS score at start of the treatment	0.39*** (0.03, 0.06)
Treatment time elapsed – days since LB	0.00 (-0.01, 0.00)
Constant	13.81*** (5.45, 22.17)
Family	Gauss
Link	
	M (95% CI)
Early treatment group	11.08 (9.65, 13.47)
Late treatment group	8.47 (8.29, 12.67)
R squared= 0.4	

Table E.8 OLS model for pre and post treatment difference in PDS score

Potentially associated factors	coefficient
N=101 observations	(95% confidence interval)
Q1. Being injured relative to Not being injured	5.26** (0.48, 10.05)
Q2. You felt like you might be injured or killed?	-7.52*** (-11.86, -3.19)
Finished treatment	-12.18*** (-17.58, -6.78)
Treatment timing (later vs. early)	0.01** (0.00, 0.02)
Constant	8.78** (1.45, 14.17)
R sq=0.27	
	M (95% CI)
Later treatment group	-15.96 (-17.66, -12.25)

Table E.9 OLS model for depression-free days

Potentially associated factors	coefficient
N=96 observations	(95% confidence interval)
Ethnicity	0.86*** (0.47, 1.25)
Number of previous trauma	-0.30*** (-0.50, -0.10)
Finished treatment	0.58*** (0.09, 1.07)
Treatment time elapsed – days since LB	0.00*** (0.00, 0.00)
Constant	4.66 (3.17, 5.70)
Family	Gamma
Link	

	M (95% CI)
Early treatment group	239.18 (188.65, 303.47)
Late treatment group	400.10 (319.29, 500.67)

Table E.10 model on the end PDS score

Potentially associated factors	coefficient
N=96 observations	(95% confidence interval)
N of previous trauma	-58.40*** (-110.5, -11.70)
Finished treatment	136.44** (15.17, 257.70)
Psychiatric comorbidity	-115.68** (-259.17, -52.1)
Ethnicity	146.20*** (46.03, 245.48)
Treatment time elapsed – days since LB	0.58*** (0.30, 0.86)
Constant	198.57** (18.17, 378.70)
Family	Gauss
Link	Identity

	M (95% CI)
Early treatment group	380.91 (345.65, 441.47)
Late treatment group	558.46 (381.29, 477.67)

Table E.11 GLM model for follow-up EQ5D score

Potentially associated factors	coefficient
N=95 observations	(95% confidence interval)
Q1. Being injured relative to Not being injured	-0.14** (-0.28, -0.00)
EQ5D at assessment	0.58*** (0.34, 0.81)
Treatment timing (later vs. early)	0.09*** (0.00, 0.00)
Constant	-0.60**(-0.83, -0.37)

	M (95% CI)
Early treatment group	0.71 (0.64-0.76)
Later treatment group	0.85 (0.79-0.93)

APPENDIX F. Explanatory models for costs and outcomes between ST users - treated compared to screened and assessed only users

Table F.1 Best-fit (explanatory) GLM on follow-up TSQ score between ST users:

Potentially associated factors	Coefficient
N=138 observations	(95% confidence interval)
Total score at first screener	0.26*** (0.12, 0.39)
Males relative to Females	-0.60** (-1.15, -0.05)
White British relative to Other ethnic categories	-0.68*** (-1.26, -0.11)
Q1. Being injured relative to Not being injured	0.63** (0.25, 1.59)
Q2. You felt like you might be injured or killed?	-0.65** (-1.23, 0.06)
Total number of screeners	-0.46** (-0.82, -0.01)
Treated vs. Screened and assessed only	-1.04*** (-0.82, -0.01)
Constant	1.17** (-0.05, 2.33)
Link function	Log
Distributional family	Gamma

M (95% CI)

Treated 1.15 (0.73, 1.57)

Screened and assessed only 3.27 (1.28, 5.27)

Table F.2 Explanatory GLM on direct costs between ST users: treated compared to screened and assessed only users

Potentially associated factors	Coefficient
N=138 observations	(95% confidence interval)
Age	0.03* (-0,00, 0.06)
Q1. Being injured relative to Not being injured	1.57*** (0.82, 2.29)
Q2. You felt like you might be injured or killed?	-0.80** (-1.43, -0.06)
Treated vs. Screened and assessed only	0.44 (-0.82, -0.01)
Timing of follow-up	0.04* (-0.00, 0.08)
Constant	4.61*** (2.78, 6.33)
Link function	Log
Distributional family	Gamma
M (95% CI)	
Treated 12979.3 (735.23, 2002.60)	
Screened and assessed only 903.64 (260.35, 1545.94)	

Table F.3 Explanatory GLM on total costs between ST users (excluding cost of ST programme): treated compared to screened and assessed only users

Potentially associated factors	Coefficient
N=138 observations	(95% confidence interval)
Age	0.04** (0.01, 0.08)
Q1. Being injured relative to Not being injured	1.70*** (0.52, 2.59)
Q2. You felt like you might be injured or killed?	-0.87** (-1.66, -0.82)
Follow-up timing	0.04* (-0.00, 0.10)
Treated vs. Screened and assessed only	0.41 (-0.18, 1.97)
Constant	3.18*** (1.05, 5.33)
Link function	Log
Distributional family	Gamma
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M	(95% CI)
Treated	1965.92 (1104.23, 2808.60)
Screened and assessed only	1104.64 (398.35, 1928.94)

Table F.4 Explanatory GLM on NHS costs between ST users (excluding cost of ST programme): treated compared to screened and assessed only users

Potentially associated factors	Coefficient
N=138 observations	(95% confidence interval)
Age	0.05*** (0.01, 0.08)
Q1. Being injured relative to Not being injured	1.07***(0.52, 1.99)
Follow-up timing	0.00(-0.04, 0.04)
Treated vs. Screened and assessed only	1.28**(0.18, 1.97)
Constant	5.84*** (4.05, 7.33)
Link function	Log
Distributional family	Gamma

M (95% CI)

Treated 1369.9 (735.23, 2002.60)

Screened and assessed only 903.64 (260.35, 1540.94)