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Conflict Research Programme

Policy Memo

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Forecasting the scenarios for COVID-19 in Syria with an SIR model (till the end of August 2020)

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Executive Summary

In this policy memo we forecast COVID-19 development during August according to four scenarios using SIR epidemiological model and adopting different assumptions. For this purpose, we estimate the active number of COVID-19 cases at 35,500 persons in Syria till the end of July. Our estimations and projections reveal that, contrary to the unreliable low official number of cases, the country is at the edge of a severe uncontrolled outbreak of the pandemic.

Currently, a very limited number of containment mitigation measures are in place in Syria. Should this continue to be the case and with low improvement of public commitment, our modelling predicts around 2 million COVID-19 active cases by end of August 2020. If effective measures were introduced and were accompanied by public commitment, this would take the number of active cases down to about 100,000. It is important to emphasise that our projections are indicatives and in the absence of reliable data are based on various assumptions, but they form a

[1] This research was supported by an LSE small grant for pilot research to support national and international responses to the COVID-19 pandemic and UK aid from the UK government. Authors email addresses: Z.Mehchy@lse.ac.uk and r.turkmani@lse.ac.uk

good start for policy discussions.

In our first scenario, we assume a severe outbreak, with an average R0 of 3 during August, which we believe is close to actual current value of R0 in Syria. This assumes the government does not introduce strict measures and the level of public and individual commitment and adherence to protective measures only improves slowly. Under such a scenario, we forecast that by the end of August, the total number of active COVID-19 cases would be 1.982 million and the total related deaths to be around 119,000. In the second scenario, we assume an increased awareness and adherence to measures but with limited improvement on the measures introduced by the authorities which would take the R0 value down to 2. We forecast that by the end of August, the total number of active COVID-19 cases would be 289,500 and the total related death to be around 17,400. In the third scenario, we assume the introduction of effective measures and increased awareness. We project that by the end of August, the total number of active COVID-19 cases would be 101,000 and the total related death to be around 6,100. In the final scenario, we assume a phased approach and a gradual decrease of R0 from 3 to 1.5. Under this scenario, we forecast that by the end of August, the total number of active COVID-19 cases would be 400,000 and the total related deaths to be around 24,100.

The acute situation requires urgent attention from the local authorities and international community to prevent an uncontrolled outbreak, the harm of which could threaten the regional and global health security. Any response plan should not to be based on the misleading official figures and should look into other alarming indicators on the ground.

Introduction

Although the official figures of COVID-19 cases in Syria stand around one thousand, many indicators, news, statements and our primary sources point at that the actual numbers are significantly higher. The situation seems to have exploded in the last few weeks. The burial office in Damascus reported a sharp increase in the daily number of people dying in Damascus since the 10th of July. According to the figures of Damascus burial office 133 people have died in Damascus on 29th of July. This is compared to 25 to 30 people dying per day around the same period in 2016. This four to five folds increase in the number of deaths corresponds to similar estimated that were given to us by Damascus hospital doctors whom we interviewed for our research. Although officials and doctors at public hospitals are discouraged from speaking publicly on the actual situation, increasing number of doctors and officials are breaking their silence and are speaking about much higher number of cases and that the health system reached its limit in its ability to deal with new cases. The deputy health director of Damascus for example estimated the actual number of cases in Damascus and its countryside to be around 112,000 cases[2]. In the northwest of the country the reported and estimated number of cases are still relatively low but they could be quickly affected by the outbreak in the government-controlled areas.

Back on 21 March and even before the first COVID-19 case was officially declared in Syria, the government introduced an array of strict measures including curfew and closure of schools. But shortly after, it became clear that the county cannot afford the economic costs of lockdown. Measures were then lifted gradually between April and May, and the number of cases increased gradually, then sharply increased in July. In an earlier policy paper we outlined the socioeconomic and institutional challenges that hamper the efforts to supress the spread of the virus and put forward policy options for international donors and organisations.

With limited measures currently in place, and with alarming reports about the high number of cases and the struggle of the wrecked health system to cope it is important to undertake the exercise of forecasting the difference scenarios, which the spread of COVID-19 would potential follow, and the projected number of deaths. Given the absence of reliable data, the results of our modelling and our estimates could only be taken as indicatives numbers. But they form a good start for discussions on potential risks, scenarios and policy discussions.

The model and the assumptions

In this memo, we use the SIR epidemiological model to forecast the spread of COVID-19 in Syria during the month of August following different scenarios. The S, I and R stand for: ***Susceptible*** which includes the population who are not infected but could become infected; ***Infected*** which refers to those who have the disease and can transmit it to the susceptible; and ***Removed*** which refers to individuals who cannot become infected or transmit the disease to other which mainly include previously infected or dead people. The model uses two parameters: β which is

[2] Alaraby, 3 August 2020. https://bit.ly/31iTOIZ

transmission rate that reflects the probability of infection given contact between a susceptible and infected individual; and α is the removal rate, which is the inverse of the expected duration of infection. The transmission rate β is calculated based on R0 assumptions as $R0=\beta/\alpha$.

We run the SIR epidemiological model using Stata 16 to produce, for each scenario, what would be the daily expected COVID-19 Infected people and the number of Removed persons in Syria for the month of August 2020[3]. We assume four different scenarios using different basic reproductive number "R0". Given the unreliability of official data, it is very difficult to estimate the values of all the parameters and the initial conditions required for the modelling. We use various secondary and primary resources to estimate these on 31st July.

We take the number of Susceptible to COVID-19 in Syria to be the overall country's population, estimated at around 20 million.[4] We take the infectious period of COVID-14 to be 14 days,[5] accordingly the removal rate is α=0.0714. To estimating the number of infected and removed population on 31st July, it is not possible to rely on official figures. We rely on the statements made by some health officials, doctors and hospital directors in additions to interviews we conducted with doctors across Syria to reach a reasonable estimate of these figures. One telling indicator is the number of cases reaching hospitals. On 1st of August the dean of the medical faculty at Damascus University announced that there are 100 daily patients with COVID-19 symptoms visiting public hospitals in Damascus.[6] Private health sector, including private clinics, pharmacies, and hospitals, in Syria provides almost 50% of health services in Syria, meaning that additional 100 patients are estimated to have visited private health facilities which take the number of hospitalised patients in Damascus per day to be around 200. According to WHO 20% of COVID-19 patients need hospitals,[7] thus we estimate the additional number of active COVID-19 cases in Damascus per day to be 1000 people. Taking into consideration the percentage of people testing positive for COVID-19 in Damascus comparing to the rest of the country, **we estimated the number of daily COVID-19 cases in Syria in the 31st of July to be around 1715**. The official number is 23 cases; thus, the adjustment factor is 74.6 (1715/23). Based on the official data adjusted by this adjustment factor, we estimate the currently **Infected** person in Syria to be around at 35,500 and the **Removed** to be around 21,000 persons.

In our calculations we adopt the global death rate at 6% of the **Removed** population,[8] which means around 1260 people have died of the virus in Syria. The death rate due to other diseases is expected to surge in Syria since the health sector has almost collapsed with the current COVID-19 cases above 6,500.[9]It is worth noting that the death rate could well be higher in Syria as a conflict affected country.

[3] StataCorp. 2019. Stata Statistical Software: Release 16. College Station, TX: StataCorp LLC
[4] Mehchy, Zaki (2019): "Population inside Syria", https://syria.chathamhouse.org/research/population-inside-syria-refugees-and-returnees-2010-2030
[5] World Health Organization (2020)" "Coronavirus disease 2019, Situation report-73"
[6] https://alaan-media.com/article/24147/
[7] https://www.who.int/indonesia/news/detail/08-03-2020-knowing-the-risk-for-covid-19
[8] https://www.worldometers.info/coronavirus/
[9] Mazen Gharibah and Zaki Mehchy, COVID-19 Pandemic: Syria's Response and Healthcare Capacity, Policy Memo, London School of Economics and Political Science, 25 March 2020. https://bit.ly/2K7lc4C

The different scenarios

An essential parameter in determining the different scenarios in Syria is the assumed value of R0. The value of R0 changes considerably in any country, according to the mitigation and suppression measures adopted. [10] In Iran, for example, the value ranged between 0.6 and 4.9 according to the measures adopted by the authority in different times.[11] The high level of community awareness and commitment to the mitigation measures is essential for their success.[12] Also, awareness at the individual level is crucial to reduce the spread of COVID-19. For example, different studies proved that individuals' commitment to wear facemasks contributes in the reduction of Coronavirus transmission rate and thus R0.[13]

In the following four scenarios we assume several R0 levels in Syria corresponding to different levels of awareness, commitment and official measures.

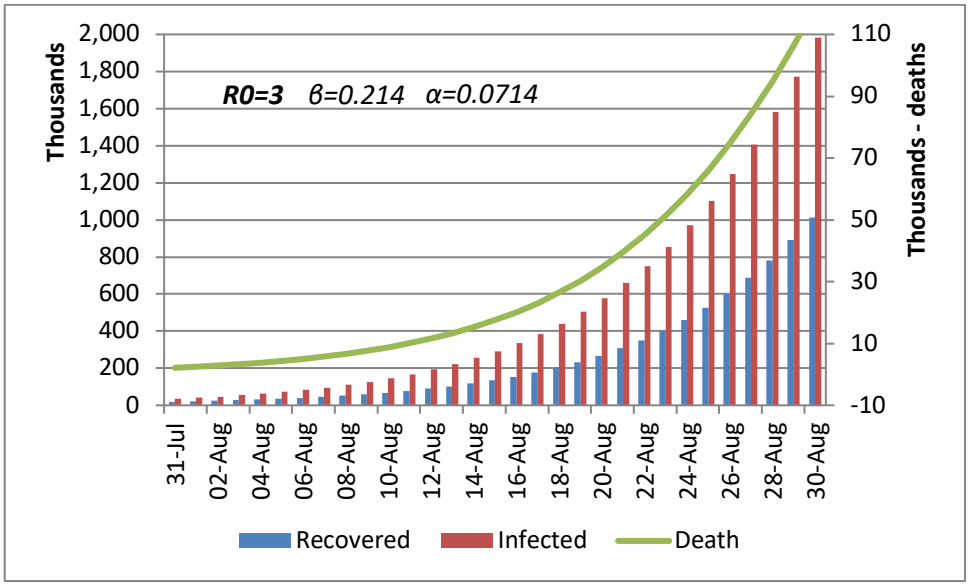
For all scenarios, the daily changes of COVID-19 Infected and Removed persons reflect the outbreak of COVID-19 in Syria ranging from a severe outbreak in scenario 1 (R0=3) to controllable spread in the third scenario in which R0=1.5. The results of our modelling are summarized in the table at the end of this memo and are explained below in graphs.

Scenario 1 R0=3; to take no more action leading to a severe outbreak

This scenario assumes a slow increase in people's awareness and no effective additional official measures like lockdown and closure of economic activities. Under such conditions we estimate the value of R0 would be around 3 during the month of August.

The results of our modelling show that under such scenario by the end of August 2020 the total number of active COVID-19 cases would be 1.982 million. The number of recovered cases would reach 1.012 million, and the total death due to the pandemic would be 118,900.

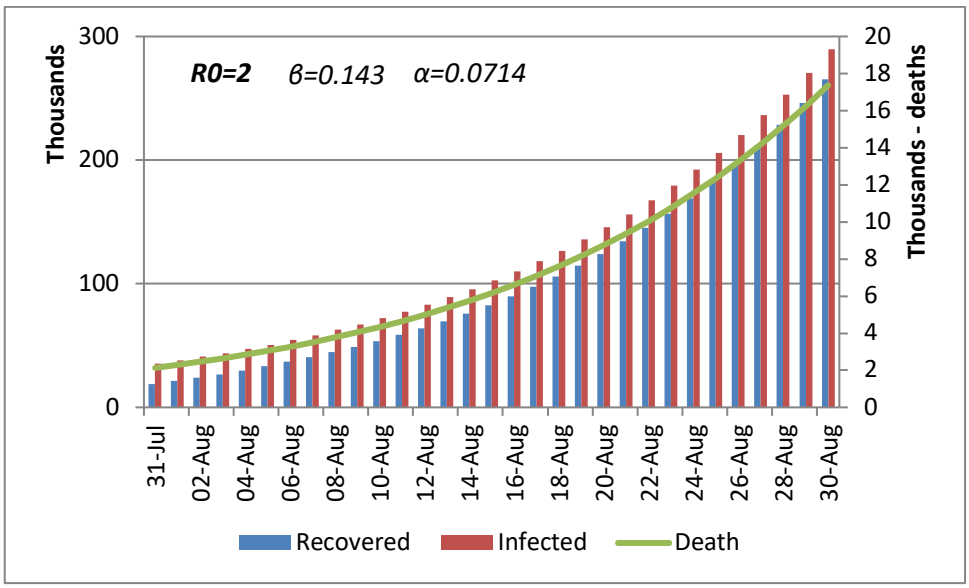
[10] Roy Anderson, Hans Heesterbeek, Don Klinkenberg, and T Deirdre Hollingsworth (2020): "How will country-based mitigation measures influence the course of the COVID-19 epidemic?", The Lancet, Vol 395, Issue 10228 PP 931-934
[11] Ebrahim Sahafizadeh and Samaneh Sartoli (2020): "Epidemic curve and reproduction number of COVID-19 in Iran" https://bit.ly/39ONe0V
[12] European Centre for Disease Prevention and Control (2020): "Coronavirus Disease 2019 (COVID-19) Pandemic", Seventh update. https://bit.ly/2Pjvp0D
[13] Richard O. J. H. Stutt, Renata Retkute, Michael Bradley, Christopher A. Gilligan, and John Colvin (2020): "A modelling framework to assess the likely effectiveness of facemasks in combination with 'lock-down' in managing the COVID-19 pandemic", The Royal Society, Vol 476 Issue 2238



Scenario 2 – R0=2; increased awareness with limited measures

The second scenario assumes a widespread awareness of the pandemic and commitment to mitigation measures among Syrians, with few effective official measures such as closure of restaurants and suspension of large gatherings, and strict monitoring of border. Under such conditions we estimate the value of R0 would be around 2 during the month of August.

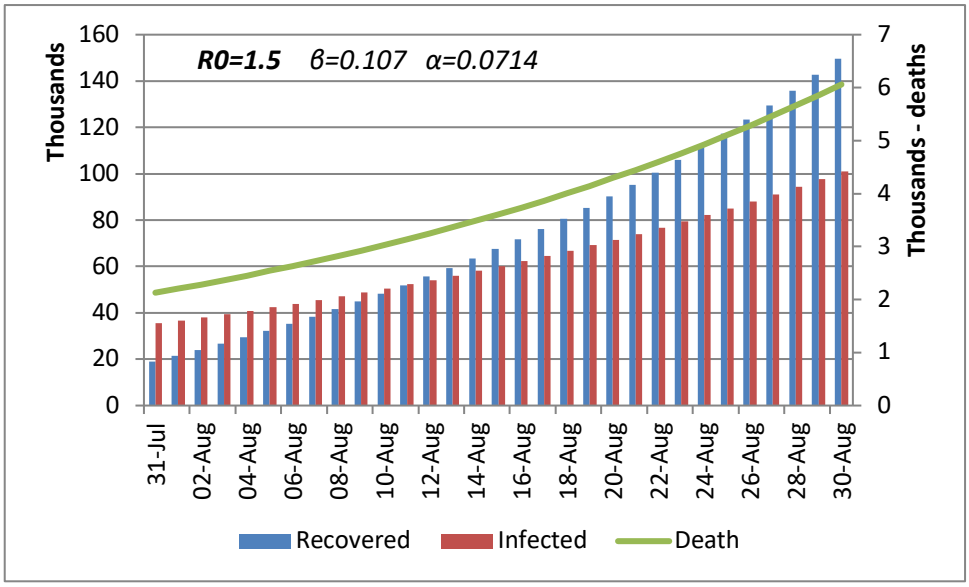
The results of our modelling show that under such scenario by the end of August the total number of active COVID-19 cases would be 289,500. The number of recovered cases would reach 265,100, and the total death because of the pandemic would be 17,400.



Scenario 3 R0=1.5; Official measures and increased awareness

The third scenario assumes a widespread awareness of the pandemic and commitment to mitigation measures among Syrians, with strict and effective official measures such as banning of large gatherings, closure of nonessential economic activities, and limiting social visits. In this Scenario we also assume notable international support for Syria's health sector including PPE and medical equipment. Under such conditions we estimate the value of R0 would be around 1.5 during the month of August.

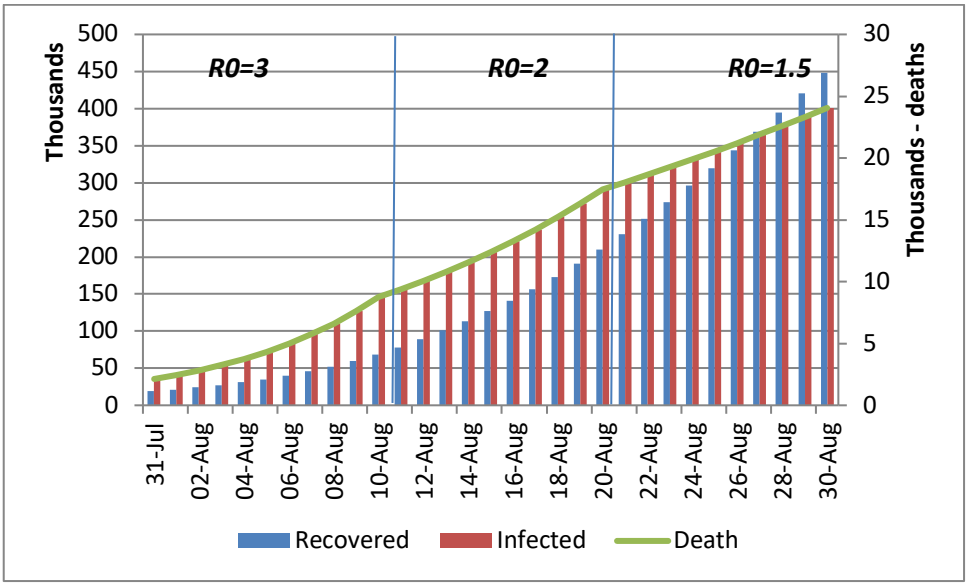
The results of our modelling show that under such scenario that by the end of August the total number of active COVID-19 cases would be 101,000. The number of recovered cases would reach 149,500, and the total death because of the pandemic would be 6,100.



Scenario 4 Phased approach

In this scenario, we assume three different levels of R0 during August during three different phases, each last for 10 days. The first phase is similar to Scenario 1 conditions with R0=3, the second one has the same conditions of Scenario 2 with R0=2. The third phase assumes the beginning of a high level of awareness and commitment among residents together with strict official measures, which is similar to Scenario 3 where R0 level is at 1.5.

The results of our modelling show that under such scenario by the end of August the total number of active COVID-19 cases would be 400,900. The number of recovered cases would reach 448,400, and the total death due to the pandemic would be 24,100.



Conclusion

The results of our modelling highlight the importance of immediate implementing of strict measures in all Syrian regions to contain the widespread of the pandemic. They also reveal the need for an effective and impactful intervention by the international community aiming to assist the war-torn country in responding to the pandemic. The intervention should provide immediate aid to the health system such as protective personal equipment (PPE), testing tools and ventilators. It also needs to support local authorities and their policies that address the issues of health governance, corruption, accountability and coordination mechanisms in Syria. All international interventions are better to be designed in ways that provide support for the civil society initiatives and organisations, especially since that Syria's civil society is widely perceived to be less politicized than the authorities.[14] It is also essential that any international help, plan and advice not to be based on the misleading official figures.

[14] Rim Turkmani, Zaki Mehchy and Mazen Gharibah, COVID-19 in Syria: Polic Options, Policy Memo, London School of Economics and Political Science, 28 July 2020. http://eprints.lse.ac.uk/105823/

			1-Aug	*5-Aug*	*10-Aug*	*15-Aug*	*20-Aug*	*25-Aug*	*30-Aug*
Scenario 1 (R0=3)	*Active COVID-19 Cases*		40,915	72,112	45,859	92,513	76,782	1,101,052	1,982,252
	Closed COVID-19 Cases	*Recovered*	21,268	35,121	68,089	134,601	67,303	526,370	1,011,921
		Deaths	2,455	4,327	8,752	17,551	34,607	66,063	118,935
Scenario 2 (R0=2)	*Active COVID-19 Cases*		38,119	50,654	72,182	02,670	45,654	205,871	289,478
	Closed COVID-19 Cases	*Recovered*	21,340	33,181	53,591	82,660	23,972	182,510	265,111
		Deaths	2,287	3,039	4,331	6,160	8,739	12,352	17,369
Scenario 3 (R0=1.5)	*Active COVID-19 Cases*		36,775	42,341	50,470	60,116	71,545	85,061	101,007
	Closed COVID-19 Cases	*Recovered*	21,374	32,319	48,357	67,468	90,227	117,303	149,482
		Deaths	2,207	2,540	3,028	3,607	4,293	5,104	6,060
Scenario 4 (R0=3, 2, 1.5)	*Active COVID-19 Cases*		40,915	72,112	145,850	206,573	91,066	342,391	400,907
	Closed COVID-19 Cases	*Recovered*	21,268	35,121	68,090	26,750	09,692	319,477	448,425
		Deaths	2,455	4,327	8,751	12,394	17,464	20,543	24,054

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