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When less is more: Emergency department staffing in Greece

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ABSTRACT

Background: Greece is a high-income country with over 10 million residents, approximately three times that many annual tourist visits, and about 150,000 refugees from the Middle East. Despite these demands, it has an underdeveloped Emergency Medicine (EM) system, contributing to challenges in access, care quality, system efficiency, and cost. This study aims to: (1) report current staffing in Greek Emergency Departments (EDs), (2) model ED throughput comparing EM-trained and non-EM-trained providers, and (3) propose a national EM dissemination strategy.

Methods: Staffing and operational data were collected from four representative public EDs in Greece: Nikaia, Volos, Lárisa, and Santorini. Facilities varied in physician coverage (0–5 attendings). We compared potential EM- versus non-EM-trained physician throughput. The only difference between provider types was compatibility with patient demand—EM-trained physicians could manage all chief complaints, while non-EM physicians handled a subset based on their specialty. Other factors like bandwidth (max concurrent patients) and speed (patients/hour) were held constant based on available and recognized standards. An expert panel was convened to propose a national strategy for EM dissemination.

Results: Across sites, physician-to-patient ratios ranged from 1:20 to 1:32, with 1–2% of arrivals classified as critically ill. Admission rates ranged from 16 to 20% (6% in Santorini); 23–28% of patients required specialty consultation. Average ED length of stay ranged from 4.5 to 6.2 hours.

Simulations demonstrated that EM-trained staffing reduced physician needs by 53%, driven by a 10.95% increase in throughput (mean 7.83%; 95% CI: 14.2%). Fewer EM-trained attendings were needed (mean reduction 7.26%; 95% CI: 12.47%). These findings likely underestimate benefit, as downstream improvements in quality, access to specialty care, and reduced staffing burden from residents were not modeled. Notably, the lower the staffing level, the greater the benefit of EM-trained physicians. The expert panel endorsed a hub-and-spoke model centered on a national EM center of excellence, launching the first EM residency. With yearly expansion to university hospitals, this model could produce 1500 EM-trained physicians in 10–15 years.

Conclusion: Our model predicts that EM-trained staffing would improve operational efficiency, reduce staffing needs, and potentially yield system-wide benefits and cost savings for the Greek healthcare system.

Introduction

Greece is a developed country with a population of over 10 million inhabitants, 30 million tourist visits per year, and approximately 150,000 refugees fleeing conflict in the Middle East, but underdeveloped Emergency Medicine (EM) [1–4]. The geography of Greece is particularly challenging to healthcare delivery: while the mainland has dense urban areas, thousands of islands in the Aegean Sea are more

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sparsely populated and often require air or boat transfer to mainland Greece. In addition, transfers between institutions to access specialist care including from the Greek Islands to the mainland are not uncommon, with additional risks to patients and cost to the healthcare system [5].

Greece operates a tax-funded National Health System (Εθνικό Σύστημα Υγείας, ESY) and universal health coverage is required by law to all citizens [6,7]. The government regulates and pays the salary of all public physician and resident physicians. It also regulates the number of residency positions available per specialty. Greece does not have a centralized residency match system. Instead, individual hospitals and/or universities offer a government-determined number of residency positions in each specialty. Nationwide, approximately 10 % of residency positions that are budgeted for go unmatched per year.

Only a small percentage of physicians practicing in Greek Emergency Departments are trained in EM, due to a lack of EM residency programs. Instead, Greek EDs are staffed by physicians of different specialties, each dedicated to seeing patients only within their field of expertise. A two-year supra-specialty pathway in EM is available for those who have completed training in another specialty (such as general surgery) however less than 10 % of physicians practicing in Greek Emergency Departments (EDs) have completed this [8,9].

The World Health Organization recognizes 53 countries in Europe, with highly variable levels of EM across the region [10]. Appproximately 28–30 European countries offer EM as a primary specialty, and 3–5 countries as a supra-specialty or additional training qualification. In the remaining countries, EM is still developing [11–13]. Across Europe, EM training standards are set by the European Union of Medical Specialists (UEMS) and the European Society for Emergency Medicine (EuSEM) [14,15]. The 2024 UEMS European Training Requirements (ETR) define EM as a full, independent specialty supported by a minimum five-year, competency-based training program that includes dedicated rotations in intensive care, anesthesia, trauma, and pediatric emergency care [14]. EuSEM's European Core Curriculum 2.0 further articulates the clinical, procedural, and professional competencies required for safe, high-quality emergency care, emphasizing consultant-level EM physician presence, standardized triage systems, and consistent quality and safety practices across EDs [15].

In 2013, the UEMS Section of Emergency Medicine and EuSEM issued a foundational policy statement on EM across Europe explicitly stating a core objective of creating *a comparable standard of clinical care in Emergency Departments across Europe* [16]. Together, these documents outline the training expectations to create a comparable standard of emergency care across European Union member states, delivered by specialists *trained specifically in EM*.

Despite the supra-specialty pathway, Greece remains early in the implementation of EM as a recognized specialty, and substantial gaps persist when benchmarked against European standards [17,18]. Most Greek EDs continue to operate under a multispecialty staffing model, with limited 24/7 EM-trained physician coverage, variable triage practices, and inconsistent integration of core competencies such as point-of-care ultrasound, structured trauma and resuscitation pathways. Training pathways are not yet uniformly aligned with the UEMS-defined curriculum, and ED governance models often lack dedicated EM leadership. Aligning Greek emergency care with European expectations will require the creation and acceptance of a 5-year EM residency training program to enable scaling of the EM workforce, standardizing residency curricula across Greece, adopting EuSEM and UEMS clinical guidelines, and transitioning toward EM-led EDs capable of ensuring consistently high quality, timely access, and high-acuity readiness across the country.

In Greece and other countries without EM residency programs, or where EM is underdeveloped as a specialty, EDs may be staffed partially or fully by physicians from other specialties, who lack training in Emergency Medicine. It is known that EM physicians face unique on-the-job challenges which require specialty training [19,20].

In most of these countries, a multi-specialty, rotating model of ED staffing has been adopted. In Greece, smaller EDs with lower arrival volumes tend to have fewer in-ED staff and instead rely heavily on in-house consultants coming to the ED when needed, while larger EDs do have permanent ED staff however they are not trained in EM. The literature shows that this staffing model results in several unintended consequences, which span the domains of emergency care including access to care, quality of care, efficiency of the healthcare system and costs [21–23]. These effects are summarized in Fig. 1.

First, when non-EM specialists staff an ED, they are pulled away from their primary clinical locations including operating theatres, specialist and outpatient clinics, which results in delays for patients in accessing care. The quality of emergency care also suffers in this model, due a lack of training in clinical EM and secondarily, a lack of training in the culture of EM including the teamwork required to manage complex, critical patients, patient advocacy and communication with providers from all specialties. The efficiency of the system is suboptimal, due to many patients needing to be seen by more than one attending as multiple consultations between specialties are common. This in turn leads to longer ED evaluations, longer lengths of stay and contributes to overcrowding [24,25]. It also contributes negatively to job satisfaction for physicians in Greece, and specifically in Greek EDs [26–28].

The American College of Emergency Medicine defines overcrowding as "a situation that occurs when the identified need for emergency services exceeds available resources for patient care in ED, hospital, or both", or an imbalance between healthcare demand and supply [1]. Globally, overcrowding has negatively impacted healthcare systems since the 1980s, however was exacerbated during and after the COVID-19 pandemic. The ED is especially vulnerable to overcrowding, and there are well- documented adverse effects on patient outcomes and job satisfaction [1,28]. Strategies to overcome ED overcrowding commonly break the issue down into three components: front end problems (volume and acuity of ED arrivals), throughput (ED length of stay) and output (either to admissions or discharge). The pieces of this that can be improved by optimizing ED and hospital operations are throughput and output and thus it is critical that strategies to address ED overcrowding focus on these two components.

Stakeholders in Greece including the Hellenic Society for Emergency Medicine and others are actively advocating for the creation of Greece's first EM residency program. In the interim, a 2-year supra-specialty was introduced as bridge between the existing model and an EM physician-based model of emergency care. The supra-specialty program began in 2019 and offers approximately 30 positions per year, yet in part due to poor uptake, there remains a lack of trained EM physicians across Greece.Error! Bookmark not defined.

The primary aims of this study are thus to (1) report the current attending and nursing staffing of four public Greek EDs, (2) generate a model of ideal attending staffing for four Greek EDs representative of the Greek National Health System (*Gr: Ethniko Systima Ygeias* (ESY)) with trained EM specialists and then (3) evaluate the impact of this modelled intervention on local health economics. A secondary study aim is to assemble a panel of experts and through consensus, propose a strategy to disseminate Emergency Medicine nationwide in Greece.

To achieve these study aims, we conducted an analysis of ED staffing volumes and associated costs, combined with patient factors such as length of stay, in the current emergency health care system in Greece. We then compared this to European and North American standards [29–34]. Although there is strong evidence to support the positive effect of ED operations and patient outcomes when treated by Emergency Physicians, the economic impact on health care systems globally is understudied. Our study is designed to address this critical gap. Finally, we propose a strategy to disseminate EM training across the country to enhance the transition from the existing model to a full EM-based emergency care system.

Access	Quality
• When non-EM specialists are staffing the ED, they are pulled away from their operating theatres, specialist and outpatient clinics. • Staffing Greek EDs with EM providers would allow specialists to return to their area of specialty and improve access to medical care across the health system.	• Lack of EM training of providers • Lack of culture of EM including urgency, patient advocacy • Lack of coherent team due to rotating staff • Lack of a team leader • Inability to adapt staffing when needed eg surge arrivals/extreme census • Staffing Greek EDs with EM providers would improve the quality of emergency care delivered.
Efficiency	**Costs**
• Triage challenges due to the need for multiple consultants. • Longer ED length of stay due to fragmented, specialty-driven evaluations. • Multiple consultations between specialist services. • Inpatient evaluations conducted in the ED instead of on the floors. • Staffing Greek EDs with EM providers would improve the efficiency of Greek EDs.	• Increased costs to the health system due to high number of attendings and residents needed to staff EDs, expensive inter-facility transfers, air transfers. • Increased costs to patients who are forced to delay care due to lack of ability to access it versus seek care in the private sector at high cost. • Staffing Greek EDs with EM providers would decrease costs to the health system, and likely also on a microeconomic scale, to individuals and families.

Fig. 1. Downstream effects of lack of EM-trained providers.

Fig. 2. Map of Four Study Sites [35].

Materials and methods

Setting: four study sites

The Greek ESY is centrally regulated by the Ministry of Health, however depending on the geographic region and the available health care facilities, public EDs have variable operating hours and schedules. To depict Greek EDs as accurately as possible, we have thus selected four representative ESY hospitals in this analysis. Please see Fig. 2 for a map of the geographic location of the study sites, and Table 1 for additional information on each site.

Data collection

ED staffing and operational data were requested from the Medical Director of each of the four study EDs for the year 2023 and subsequently retrieved from paper-based and computer-generated hospital records. Table 2 depicts the data requested from each ED. Not every ED had records for all the data requested.

Table 2
Data requested from medical records of four study sites.

Patient factors	Staffing	Operations
Total number of ED visits/24 h	Number of Physicians by medical specialty present at the ED at any given moment	Number of interdepartmental consultations
Number of ED visits by medical specialty	Number of Physicians by medical specialty on call at the ED at any given moment	Average waiting time from triage to physician with right to treat per specialty
Number of EMS arrivals/24 h	Number of nurses present at the ED at any given moment	Average number of patients in que per specialty
ED admissions/24 h	Total number of certified EM physicians present at the ED at any given moment	Average time from physician with right to treat to admission
ESI at triage		Transfers from ED to another Hospital
Deaths in the ED		

Cost calculations

All aspects of the Greek Healthcare system are regulated by the central government. All attendings and residents, indifferent of their specialty or supra-specialty are paid the same monthly salary and the same bonus depending on years of practice and geographic incentives. Although these fixed monetary compensations vary slightly depending on years working in the ESY, a mean of 2000 Euro/month was used for these calculations [36]. Additional compensation for overtime and weekends is also common and averages approximately 850 Euro/month [37]. Thus, the total mean monthly salary for a Greek physician is estimated at 2850 Euro, or 34,200 Euro/year gross annual income.

Ideal staffing model

In study aim 2, we investigated possible operational improvements of staffing Greek EDs with trained Emergency Physicians. To do so, we aimedto demonstrate the inefficiency of ED staffing with non-EM physicians due to skill mismatch. Due to data limitations—specifically, the lack of reliable measures of arrival rates for each patient type and the skill sets of physicians needed to simulate compatibility—we did not use discrete event simulation but instead employed the mean analysis previously described. For this purpose, we hold the number of patients per hour identical for EM versus non-EM physicians working in the ED, so the difference can be solely attributed to utilization which is used to reflect the skill-mismatch; this hourly rate is a parameter in our study. We conducted sensitivity analysis over the range of 1 to 3 patients per hour with a step size of 0.1. The 2 patients per hour metric is also supported in North American and European clinical operations ED productivity literature [38–40] We denoted this rate as R and the number of work hours scheduled as H. From data collected from each of the emergency departments, we know the number of patients serviced in each ED (denoted as m_{Non-EM}). The utilization level was defined as total hours of actual service provided divided by total scheduled working hours. Then, the utilization of current staffing (non-EM) can be calculated as): $U_{Non-EM} = \frac{R \cdot m_{Non-EM}}{H}$.

A second parameter is the target utilization of EM physicians. A utilization rate of 1 means the EM physician is working at maximum capacity, which is operationally *undesirable*: for physicians, high utilization is associated with burnout; for patients, according to Kingman's approximation and standard operations dynamics, wait times in variable systems do not increase linearly but rather increase drastically after utilization reaches approximately 0.8. In our setting, it means patients will start to spend much longer in the waiting room before being seen if physician utilization reaches 0.8. In other words, in EDs, an 80 % physician utilization rate balances efficiency with the need for surge capacity and responsiveness [41–46].

We conducted sensitivity analysis over the range of 0.6 to 1.0 with a step size of 0.05.

The mismatch between U_{EM} and U_{Non-EM} can be attributed to the skills mismatch when a non-EM physician encounters an ED patient that is not in their specialty, which can lead to idle time.

From the collected data, we know number of current physicians (non-EM) at work at any time of the day, denote as L_{non-EM}. Thus, to get the number of EM physicians required at work at any time of the day, we have $L_{EM} = L_{non-EM} \cdot \frac{U_{Non-EM}}{U_{EM}}$.

We then compared L_{non-EM} to L_{EM}.

Results

Staffing

All four study sites employed a similar staffing model: a mix of physicians (both consultants and residents) from different hospital medical departments staffed the ED along with varying number of non-EM trained physicians appointed to the ED with their primary specialty.

Table 1
Description of the four study sites.

Hospital ED	City	Population served	Emergency visits in 24 h (mean)	Operates	Hospital specialties available	Website
Nikaia “Ag. Panteleimon” Hospital	Piraeus Region of Attiki	3.814.000	1170	1 in every 4 days (08:00–07:59)	Almost all medical specialties	https://www.nikaia-hosp.gr/
Larisa “Koutlimbaneio & Triantafylleio” Hospital	Larisa	164.000	323	1 in every 2 days (08:00 – 07:59)	All major medical specialties	http://www.ghl.gr/
General Hospital of Thira	Santorini	15.000	82	24/7	Core medical specialties	https://www.santorini-hospital.gr/
Volos “Achilopoulio” General Hospital	Volos	85.000	197	24/7	All major medical specialties	http://www.ghv.gr/

Depending on ED volume between 2 and 12 consultants and between 3 and 25 residents from hospital departments can be found at any given moment in the ED. A maximum of two EM certified physicians were present at any time in the ED. In all EDs except Thira Hospital in Santorini, at least one primary care physician staffed the ED. In Thira Hospital, the ED is staffed with primary care physicians from nearby primary care clinics and junior doctors immediately out of medical school doing their obligatory rural service. There are no specialty consultants or residents on site in Santorini. Nursing staffing ranges from 1 nurse to 1.5 physicians to 1 nurse to 2 consultants (Table 3).

ED operations

Patient factors

Calculating the number of physicians that can be found at any time at the ED, irrespective of how many physicians rotate from the floor to cover this post, the total number of incoming patients to total number of physicians in the ED ranges from 1 physician to 20 patients to 1 physician to 32 patients. Since patients are seen by the respective medical specialists (eg Cardiology for a patient that presents with chest pain), the ratio might vary from 1 physician to 90 patients to 1 physician to 8.5 patients. The acuity of incoming patients as a percentage was almost the same in all hospitals, with an admittance rate of 16 % - 20 % (Supplementary Table 1). Only Santorini had a very low admittance rate of 6 %. Critical patients ranged from 1–2 % in all sites.

For medium acuity patients time from being seen by an attending to decision to admit was similar across all specialties and ranging from 4 to 5 h (Supplementary Table 2). The interdepartmental consultation rate ranged from 23 % to 28 %, meaning that on average 23 % - 28 % of patients are seen by more than one attending physician prior to admission.

Ideal staffing model

Using the site-specific data collected above, we then applied our discrete event simulation model to better understand the potential magnitude of operational improvement if the four study EDs were staffed by EM trained physicians. Fig. 3 graphically depicts the estimated decrease in staffing needed in the ED at any moment, by site, if the ED was staffed with EM-trained physicians. Our model predicted increased throughput of 10.95 % (mean: 7.83 %; 95 % confidence interval: 14.2 %) compared to staffing with non-EM trained physicians. Observing the same ED arrival rate and acuity, fewer EM-trained attendings would need to be scheduled. (9.87 % (mean: 7.26 %; 95 % confidence interval: 12.47 %)).

By site, the percent decrease in staffing from current to ideal was calculated as follows:

$$(current\ staffing - ideal\ staffing) \div current\ staffing \times 100$$

We then calculated the difference in cost between the current staffing and ideal staffing predicted by our model, using the following formula:

$$Avg\ monthly\ salary \times 12mo \times \%\ \Delta\ staffing = cost\ savings\ per\ year$$

These results are depicted below, in Table 4.

The average savings across our four sites, which are representative of the types of public EDs in Greece, is 348,840 Euro/year. If this is multiplied across all 52 public EDs in Greece, the estimated, model-derived costs savings on physician salaries alone, is nearly 20 million Euro per year.

Fig. 4 presents the results of our sensitivity analysis as a heatmap. The rows correspond to the assumed patients per hour per physician (ranging from 1.0 to 3.0), and the columns correspond to the target utilization rate (ranging from 0.6 to 1.0). Each cell displays the average number of physicians saved per location, calculated as the difference between the current baseline staffing and the required EM physician staffing under that parameter combination, averaged across all four hospital sites. Positive values (shown in green) indicate that fewer physicians would be needed compared to current staffing levels, while negative values (shown in red/orange) indicate that more physicians would be required.

The sensitivity analysis suggests that staffing EDs with EM physicians reduces required staffing levels under most scenarios. Increased staffing needs only occur under conservative assumptions where physicians see $\leq$1.2 patients/hour AND utilization targets are $\leq$70 %.

Table 3
Medical and nursing staffing present in the ED and on-call in the hospital.

Type of Staff Present in ED and Hospital	Nikaia	Volos	Larisa	Santorini
Specialty consultants on site in the ED at any given moment	17	5	8	0
Specialty Consultants on Call	4	12	7	4–6
Residents on site at any given moment	26	13	15	0
Total number of medical specialties present in the ED	17	4	12	0
Number of medical specialties available on call	4	12	1	4–6
Number of Primary care Consultants covering ED	2	2	1	2
Number of Medical Doctors before residency	0	0	0	2
Nurses on site at any given moment	10	8	8	2–3

Discussion

All four public, Greek EDs in this study relied heavily on non-EM trained attendings and residents from the in-patient hospital medical and surgical departments. These attendings were either dispatched from their departments for shifts in the ED or while on the floor were called to consult in the ED. The smaller the hospital, the more it relied on attendings simultaneously working on the floor and the ED. There are numerous negative downstream consequences of this paradigm including fragmentation of care, delays to decisions regarding necessary diagnostics and disposition, and the inefficiency of multiple consultations per patient, all of which contribute to long ED lengths of stay.

The current model of staffing Greek EDs makes triage challenging, as in addition to having to calculate patient acuity, triage nurses must rapidly establish a working diagnosis in order to refer the patient to the correct medical specialist (for example, consider a young woman presenting with abdominal pain, or a middle-aged man presenting with epigastric pain). The more specialists available, the harder this task becomes: in Santorini, the choice is adult or pediatrics however in the Nikaia ED there are more than 10 medical specialties and subspecialities. The challenges of triaging to the correct service in turn contributes to an increased number of downstream consultations, e.g. patient being seen by multiple attendings, even for low and medium acuity patients. This represents redundancy and inefficiency of the system. In the Nikaia and Larisa EDs, 21 % of patients triaged to internal medicine beds of the ED receive referrals from other specialists. This increased workload leads to a subsequent increase in length of stay for all patients and an increase in waiting times. Even for lower acuity cases initially triaged to the Fast Track in Larisa, Nikaia and Volos, over 15 % receive consultations. On the island of Santorini, where not all medical specialties are available, this leads to an increase of transfers (costly helicopter transfer or by boat) to specialists on mainland Greece.

Based on the preliminary results of our model, using four sites representative of the types of public EDs across Greece, and focusing on attending physician salary alone: staffing Greek EDs with Emergency Physicians would decrease the number of attendings required by nearly 50 %.

This decrease in overall ED staffing numbers offers notable cost savings for the Greek government, totaling nearly 1.4 million Euro per year at the four hospital EDs sampled for this study. Extrapolating out our model-based, preliminary findings: if this were multiplied across the 52 hospital EDs in Greece, the total yearly cost savings to the Greek

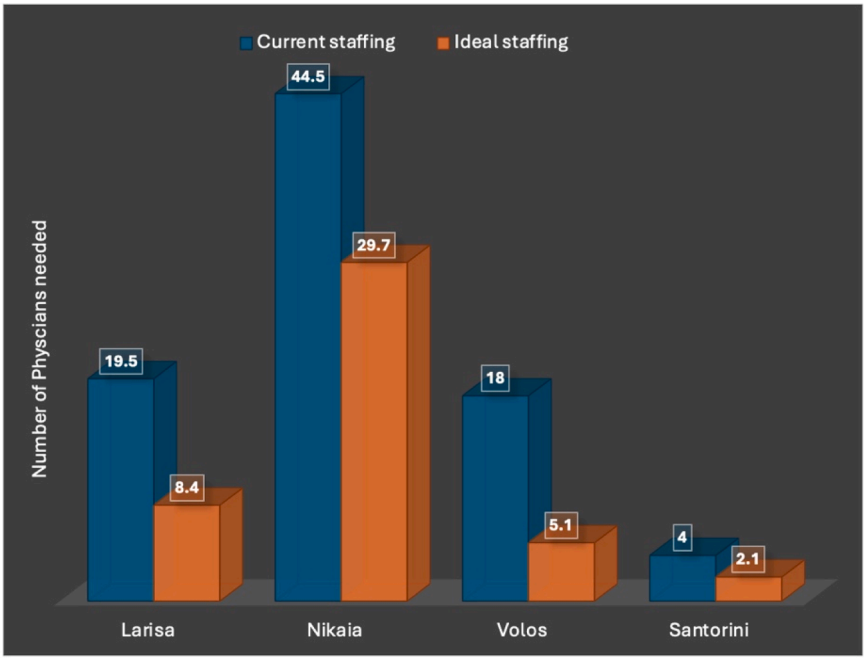

Fig. 3. ED staffing: Current number of attending physcians versus Ideal number of attending physicians.

Table 4
Current and ideal staffing with associated costs.

	Nikaia	Volos	Larissa	Santorini	Mean across 4 study sites
Current number of permanent MDs staffing ED at any time	44.5	18	20	4	21.6
Ideal number of MDs staffing ED at any time	30	5	8.5	2	11.4
Difference in staffing from current to ideal staffing (%)	−56.9	−71.7	−33.2	−50 %	−52.9 %
Current staffing costs (Euro/year)	1521,900	615,600	666,900	136,800	735,300
Ideal staffing costs (Euro/year)	1015,740	174,420	287,280	68,400	386,460
Cost difference between current and ideal staffing (Euro)	506,160	441,180	379,620	68,400	348,840

government is estimated at nearly 20 million Euro per year. The creation of Greek EM residency programs could be achieved at relatively no additional cost by shifting the yearly 10 % of unfilled residency spots from other specialities to EM, which would operationally be budget neutral for the Ministry of Health. In addition, teaching infrastructure already exists at seven sites across Greece due to the supra specialty training pathway which has been functioning since 2019.

Our study has several limitations. First, just four sites were used as input data into the model. The sites were chosen as representative of the types of public hospital EDs across Greece, yet this is a small number. In the future, it would be helpful to input data from more hospital sites to refine the model. This small ED sample size limits the generalizability of our results both in and outside of Greece. Another limitation of our method is the assumption that non-EM physicians work at the same rate as EM physicians. This assumption likely makes our estimates conservative, as EM physicians should be able to provide care more efficiently due to standardized training and greater familiarity with emergency department workflows. If EM physicians do in fact see patients faster than non-EM physicians, the potential staffing savings from transitioning to EM-staffed EDs would be even greater than our analysis suggests.

In addition to the direct savings predicted by the model, staffing Greek EDs with EM-trained physicians would likely provide positive downstream ED operational and patient-related benefits that are harder to measure and critically important to study but beyond the scope of our current model. These include improved patient outcomes, decreased length of stay and fewer costly, timely referrals. There are additional indirect positives for the Greek public health system, which are harder to measure but important to mention. The first is improved access to all types of medical care: EDs staffed by EM physicians would allow specialists who are currently covering the ED to return to their specialty: surgeons to operate, medical specialists to see outpatients in their clinics. This would improve access to care for Greek patients by decreasing delays to being seen, leading to earlier diagnoses and improved care. In addition, with EM Physicians staffing all Greek EDs, we would expect a reduction in unnecessary consultations or decrease in the number of patients that need to be seen by more than one attending, thus increasing the efficiency of the health system.

We estimate that the country of Greece would need approximately 1500 EM Physicians to fully staff each of its 52 public hospital EDs. We estimate that this could be achieved in 15 years from the time of the creation of Greece's first EM residency, through the following proposed timeline and milestones. To achieve this goal efficiently while creating a highly trained work force in both the practice and culture of EM, we propose a hub and spokes model for dissemination of EM in Greece, starting with one site and expanding out after the first graduating class. The proposed plan includes the creation of a central EM center of excellence or hub, which would also be the site of the first EM residency. Subsequent sites would then follow, at locations with the existing infrastructure of supraspecialty training sites and potentially funded by the cost savings to the healthsystem which are predicted by our model. The establishment of Greece's first Emergency Medicine residency programs would guarantee the steady creation of EM trained physicians, and over time, would create a work force of EM-trained physicians and

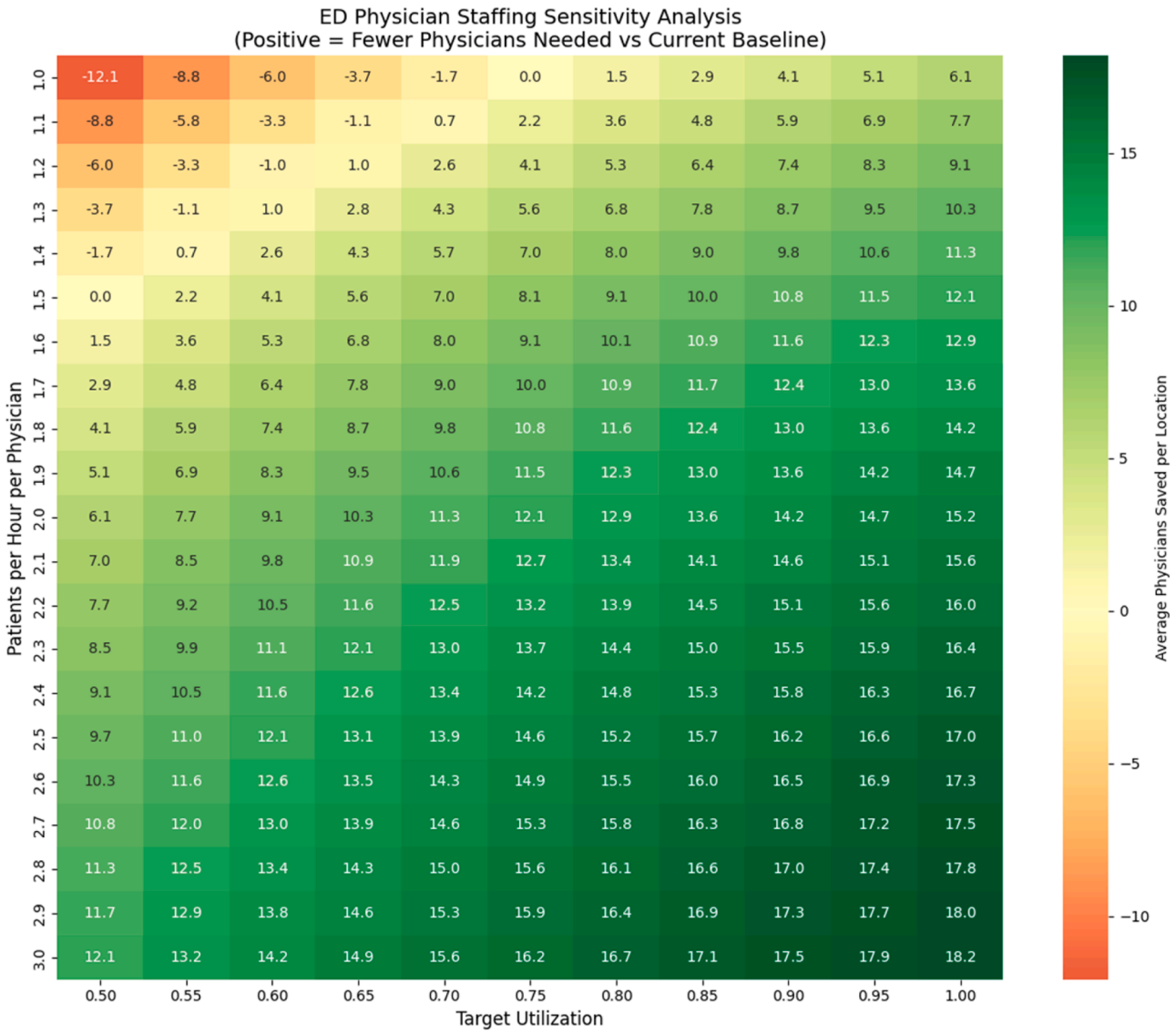

Fig. 4. Sensitivity analysis of ED physician staffing requirements.

EM resident physicians to staff EDs throughout Greece.

Conclusion

Preliminary results of this model predict that with minimal cost investment to create EM residency programs in Greece, substantial improvements across all domains of access, quality, efficiency and costs could be achieved, within 15 years. Creation of Greece's first EM residency through an EM center of excellence thus offers what is likely a 'best buy' for the health system. Critical next steps include a expanding the model by importing data from more sites, a mapping project to better understand emergency care capacity across Greece to inform a national strategy, in addition to the ongoing support of the Greek Ministry of Health and international collaborators.

Declarations

- Ethics approval and consent to participate: N/a
- Consent for publication: All authors consent for publication.
- Availability of data and materials: The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.
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CRediT authorship contribution statement

Eleanor Reid: Writing – review & editing, Writing – original draft, Project administration, Methodology, Formal analysis, Conceptualization. **Huifeng Su:** Writing – review & editing, Software, Methodology, Investigation, Formal analysis. **Monisha Dilip:** Writing – review & editing, Methodology, Investigation. **Dimitrios Babalis:** Writing – review & editing, Methodology, Data curation. **Ilias Karametos:** Methodology, Data curation. **Maria Plasati:** Formal analysis, Data curation. **Anna Patrikakou:** Investigation, Formal analysis, Data curation. **Lilian Venetia Vildiridi:** Writing – review & editing, Methodology. **Andrew Ulrich:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Methodology. **Dimitrios Tsiftsis:** Writing – review & editing, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jemint.2026.100004.

Data availability

Data will be made available on request.

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