

Still looking in the wrong place: Literature-based evidence of why patients really attend an emergency department

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ABSTRACT

Presenting complaints at an Emergency Department (ED) that could (and should) have been seen in primary care is discussed in the literature as ‘inappropriate use’ of hospital-based emergency services. These medically inappropriate requests are perceived as a threat to service quality, implying more costs than necessary. Using Systems Thinking/Dynamics, this paper introduces an evidence-based framework to explain why people increasingly attend an ED instead of a primary-care-based emergency facility, with patient demographics (age and deprivation), signposting sources and patients’ perceptions (reflecting latent needs) identified as the main determinates of ED use. The framework makes explicit the endogenous dynamics of referral, service choice and service reputation (where expectations and confirming experiences are iteratively shaped over time). The work can be employed at the strategic level as a framework to inform attendance management when evaluating or altering the healthcare system. This is achieved by presenting how the healthcare system responds to patient encounters and how patient behaviour adapts in response. At the operational level, the proposed framework enables modellers and healthcare planners to develop hospital-based and primary-care-based emergency care interventions with empathy and compassion for patients. We highlight opportunities for future work as the healthcare system is complex and requires more in-depth exploration/modelling to complete the picture.

1. Introduction

Emergency Departments (EDs) are one of the healthcare system’s most studied (and simulated) entities [1–3]. Researchers frequently focus on performance modelling within a narrow boundary (ambulance arrival to transfer to an inpatient bed or discharge), predominantly modelling patient flows using Discrete Event Simulation (DES) [4]. This narrow approach usually leaves out endogenous feedback effects essential to fully understand the patient flow and concludes that, eventually, we can improve performance solely through additional resources [1,2].

[5] pioneered using a more comprehensive approach: The authors discussed the demand pattern, ED resource deployment, elective treatments, and bed numbers within a System Dynamics (SD) framework. Due to the inverse relationship between ED wait times and the number of elective cancellations, [5] showed that looking at a single

performance measure in the system could be misleading. Research following this track employed SD modelling as the core of a whole-system review of emergency and on-demand health care in Nottingham, England [6]. While DES is helpful in developing policies for managing queues and finding bottlenecks, SD identifies the displacement of demand and the unintended consequences of interventions within the system.

This paper aims to address why the impressive body of research has not helped EDs run smoothly, measured by hitting metrics such as the UK’s 4-hour target. Firstly, comprehensive healthcare-modelling literature reviews, such as those by Refs. [7,8], highlight lacking implementation and impact of the insight generated by simulation studies. Secondly, [1] report strategic thinking and individual patient behaviour issues as under-represented and often neglected aspects of ED modelling and areas for future research.

There has been an emerging interest in Behavioural Operational

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Research (BOR) in recent years [9]. BOR studies are designed to advance our understanding of how behavioural factors affect the conduct of (and interaction with) model-based processes that support problem-solving and decision-making [10]. A recent review of BOR in healthcare [11] revealed that a third of the papers identified in the literature review include behavioural aspects but do not acknowledge that they did so. Given these literature-based appeals for further work on ED patient behavioural issues, our paper proposes a framework for considering behavioural aspects within the context of unscheduled care: the ED setting, to provide modellers and healthcare planners with a basket of elements for explicit consideration. We seek to avoid ‘*looking in the wrong place*’ (again) — a timely phrase coined by Ref. [5] more than twenty years ago. The intention is to fully grasp ED demand and its emergence by understanding the latent needs of ED patients (rather than only managing them as ED throughput). Recently, discussions have appeared around telephone triaging that supply emergency patients with 24/7 ED appointments to avoid long in-hospital waits. In this context, a thorough understanding of an ED self-presenter’s motivation is vital to assess the potential of such an approach.

The paper is structured as follows. The next section outlines how we ran a sequence of qualitative system dynamics workshops alongside shaping the literature-based model proposed in this paper to develop our core concepts. We also explain our search strategy, analysis, and thematic mapping. Sections 3.1, 3.2, and 3.3 discuss the core concepts for understanding emergency demand and ED activity (patient characteristics, source of referral and patient perception of acceptable ED use,

respectively). Identifying the dynamic relationships between these core concepts determines the robust and valid structure of an SD model of the unscheduled care system that provides modellers and healthcare planners with a framework to guide decision-making around primary care and hospital-based emergency services. The paper concludes in section 5 after offering some lessons learned for modellers and healthcare planners in section 4.

2. Methods

The model described in this paper was developed as part of a wider modelling approach that began in 2015. It was motivated by concerns that, when considering the relationship between hospital, primary and social care, the view of the unscheduled care system boundary is too narrow and that there is a need to broaden this to capture the dynamic responsiveness of the system.

The full model aims to comprehend the demand for unscheduled care and comprises two modelling strands (see Fig. 1). A structured literature analysis identified the core system entities and the existence of relationships between them to create model A. The model was discussed with experts at academic conferences and healthcare seminars for structural validation. A sequence of interactive-model-building workshops with 40+ experts from health and social care divisions created model B. These experts originated from primary, secondary community and social care. Patient and third-sector views were incorporated into the model building, too. This paper describes work to date with the sole

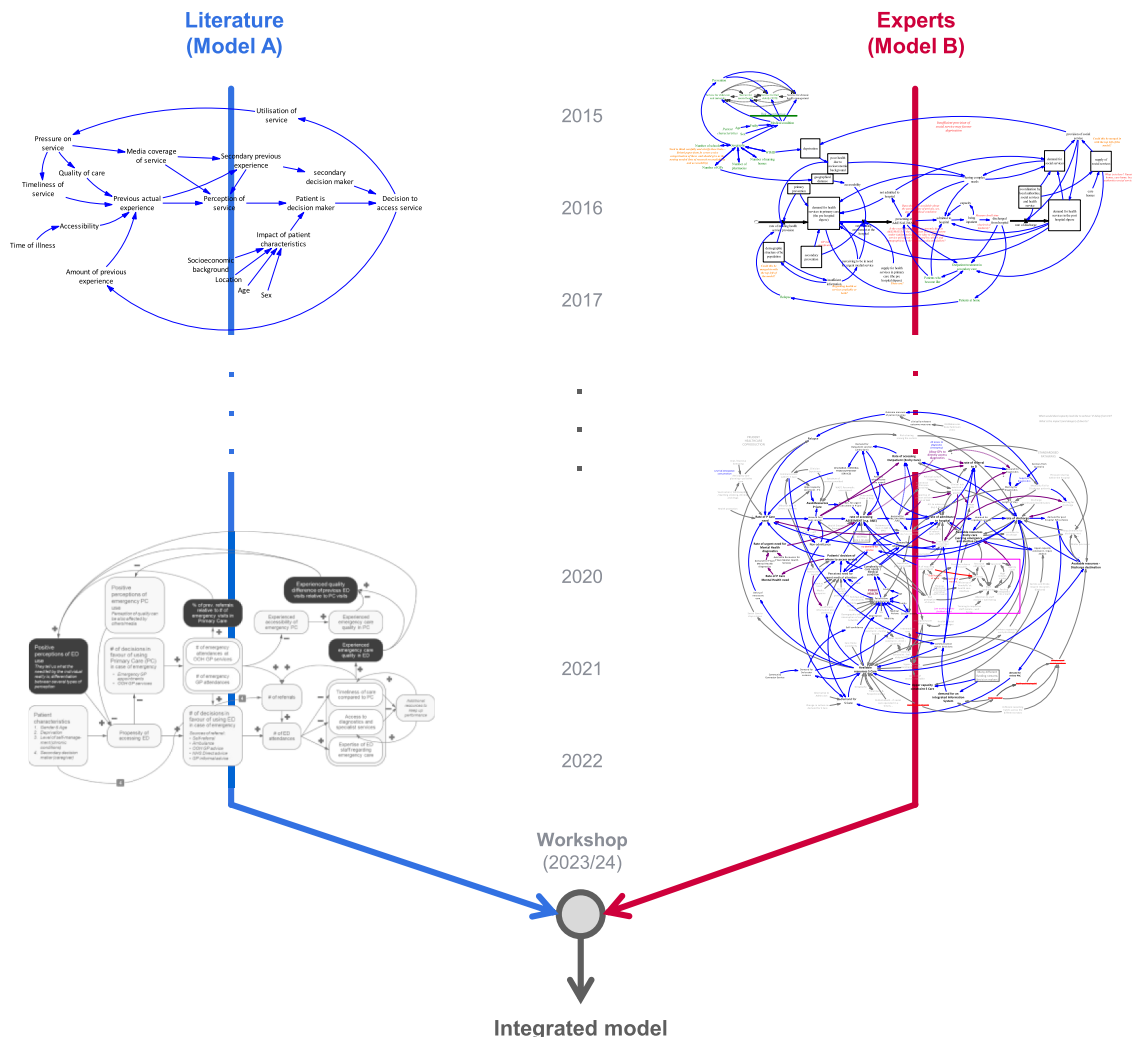


Fig. 1. Methodology of building a model of unscheduled health and social care.

focus on model A, while future work may link both models.

To evaluate relevant literature, we followed the approach from Ref. [12]. Before executing the second part of the structured literature review described below, we sampled related work on patient characteristics, decision-making processes of and for patients, carers and clinicians, and patient perceptions concerning emergency care use, as informed by the expert workshops, focused interviews, staff feedback and patient surveys [193]. In doing so, we identified search terms, defined inclusion and exclusion criteria and developed an initial set of themes for the review. For what we now call our scoping study, which started in January 2015, we used the following search string, where the asterisks indicate using a wildcard (i.e., one or several characters can follow the expression in the search term): ((decision mak* OR choic* OR choos*) AND patient*) AND use AND (emergency OR minor injury OR assessment unit*). We decided to focus on papers published (in English) between 1990 and 2014 and searched PubMed as a database.

Twenty-nine papers were identified in this scoping study, with a subset of them provided in Table 1.

A subsequent mix of snowballing and forward-backwards search (lasting until November 2020) uncovered another batch of articles, with 34 meeting our inclusion criteria (see Fig. 2). After this search procedure was concluded, in 2020, we conducted a structured literature search from the papers identified in the scoping study. It used the following search string (visualised in Fig. 3): ((decision OR choic* OR choos*) AND patient) AND (appropriate OR inappropriate OR low-acuity OR avoidable) AND (emergency OR minor injury OR assessment unit*). We focused on papers published (in English) between 1995 and 2020. An update of the literature search was performed in 2023, considering papers published between 2021 and June 2023. In addition to using PubMed, we searched through Scopus.

We decided to include a paper if the abstract explicitly referenced insights on *why* patients come to ED, other than medical reasons. Foci were patient characteristics, perceptions, and decisions (or accepting the decisions of others) to access emergency GP appointments, GP out-of-hours (GP-OOH) services, or hospital-based emergency departments. In total, five researchers undertook the initial scoping review to aid the reproducibility of results. First, one researcher summarised the potentially eligible papers. Two researchers identified and summarised upcoming themes in tandem (after removing two papers for lacking appropriateness based on the abstract). Two more researchers independently validated these themes. A relationship map [32] was used to structure the core concepts and causal links identified from the literature. The diagram (available upon request from the authors) constituted the entry point for the structured review. During the scoping review, we noticed that most publications focus on the characteristics but less on the decision-making of medically non-urgent patients. However, the latter reveals the richness of motives around attending an ED. Therefore, we took five years' worth of learning on top of the insights generated during the scoping study and launched another search.

The scoping study search string was selected based on terminology typically used by decision-makers within the British NHS when discussing the challenges they face around hospital-based emergency services. We found that the keywords 'emergency' and 'unscheduled' yielded a focus on A&E but did not pick up social and primary care. We learned that dropping the term 'unscheduled' kept in primary care emergency services (like GP-OOH services) but left out the social care literature. Furthermore, we found that the search terms around 'choice' (see Fig. 3) had to be logically linked to the search term 'patient' to stay focused on healthcare decision-making rather than diverting into the Human Resource (HR) body of literature. Finally, adding a set of search terms referring to the 'type of service request' (see Fig. 3) was critical. Patient choice in emergency care settings focusing on the patient's underlying motives is primarily discussed in the context of, e.g., 'low-acuity' or non-urgent service requests. Still, we dropped the search term 'non-urgent' (after evaluating it) because it pulled in a vast body of non-relevant literature (for the research question) focusing on the medical

Table 1

Studies on patients' motives and patients' characteristics in emergency settings (excerpt).

Paper	Country	Study Design	Population	Motives for attending EDs
[13]	UK	Qualitative study (interviews)	Patients presenting at hospital ED and linked urgent care centre	Anxiety or concern about the presenting problem Range of services available to the ED Perceived efficacy of ED services Lack of alternative services
[14]	USA	Qualitative study (interviews)	Parents of children presenting at children's hospital ED for non-urgent care	Long appointment waits for PCPs Dissatisfaction with the PCP Communication problems Health care provider referral Efficiency of ED services Convenience of ED attendance Amount of ED resources Quality of care ED expertise with children
[15]	FRA	Qualitative study (interviews)	Non-urgent patients presenting at hospital EDs	Fulfilled health care needs, access to technical facilities Barriers to PCPs Convenience, obtaining rapid appointments with various specialists Male gender Other caregivers' referral (60.1–87.9%)
[16]	SWE	Prospective descriptive study (Questionnaire)	Patients presenting at an ED by their own means or by ambulance	Distance travelled to reach the ED Perceived ED waiting time
[17]	CAN	Cross-sectional survey	Ambulatory patients with a Canadian Triage and Acuity Scale (CTAS) level 3–5; age 19+	Previous experiences with care providers, accessibility of service, practitioners' perceived expertise Belief that their problem was serious (61%) Other caregivers' referral (35%) Advice of a provider, family member, or friend (48%)
[18]	UK	Qualitative study (interviews)	Patients with long-term conditions using emergency care	Patients who regarded their condition as serious, unambiguous, distressing, and difficult to manage Referral by a third party Difficulty with accessibility to primary care Patient preferences for timely care Fast-track access to specialist care
[19]	USA	Cross-sectional (web-based) survey	Patients presenting to an ED	
[20]	UK	Population-based (postal) survey	Patients using unscheduled health care (ED, family doctor consultations, pharmacist)	
[21]	AUS	Qualitative study (interviews)	Older lower urgency patients presenting at ED	

(continued on next page)

Table 1 (continued)

Paper	Country	Study Design	Population	Motives for attending EDs
[22]	NLD	Cross-sectional comparison (postal) survey	AED (Accident & Emergency Department) self-referrals	Perceived need for diagnostic facilities Conviction that the hospital specialist was best qualified to handle their problem
[147]	USA	Cross-sectional survey	University ED self-referrals for non-urgent care	Unawareness of alternative services (66%) Dependence on ED for all medical care (27%) Perceived efficacy of ED services
[23]	USA	Online survey	Adolescents ages 12–21 years and their parents/guardians presenting at urban ED at an academic children's hospital	Perception of illness requiring immediate care (34%) PCP referral to the ED (21%)
[24]	CAN	Survey	Patients seeking after-hours care in the Eds	Perceived need for services unavailable at family medicine clinics, such as specialist consultation or diagnostic imaging
[25]	USA	Population-based (web-based) survey	National sample of parents	Unawareness of alternative services (7%–56%) Lack of alternative services (office hours after 5:00 p.m. on 5 nights or more a week)
[26]	CAN	Population-based, observational, cross-sectional study	Frequent ED users	Low socioeconomic neighbourhoods Diagnosed with psychosocial conditions
[27]	CH	Observational, cross-sectional comparison study	Group 1: Patients presenting at hospital ED Group 2: Patients using out-of-hours GP	Younger age (43.8 years) Male gender (53.1%) Injury-related medical problems
[16]	SWE	Prospective descriptive study (Questionnaire)	Patients presenting at an ED by their own means or by ambulance	Male gender Shorter symptom duration
[22]	NLD	Cross-sectional comparison (postal) survey	Group 1: AED (Accident & Emergency Department) patients Group 2: Patients contacting the GP cooperative	Age between 15 and 64 Injury-related medical problems Musculoskeletal, cardiovascular and respiratory problems Distance to the GP centre
[28]	NLD	Population-based, prospective cross-sectional comparison study	Group 1: AED self-referrals Group 2: GP cooperative patients	Younger age Male gender Injury-related medical problems, fracture (19%)
[29]	BEL	Prospective comparison survey	Group 1: Patients presenting at ED Group 2:	Male gender Having visited the ED during the past 12 months at least once

Table 1 (continued)

Paper	Country	Study Design	Population	Motives for attending EDs
			Patients using the GP (on call)	Foreign origin, Speaking another language than Dutch or French, African nationality (Sub-Saharan as well as North African) No medical insurance Younger age Suffering minor trauma
[23]	USA	Online survey	Adolescents ages 12–21 years and their parents/guardians presenting at urban ED at an academic children's hospital	Public insurance or no insurance/unknown insurance status
[30]	BEL	Population-based, cross-sectional comparison study	Group 1: Patients seeking out-of-hours care in EDs Group 2: Patients seeking out-of-hours care in PCCs	Patients living in socially deprived areas

ED: emergency department; GP: General Practitioner; AED: Accident & Emergency Department; PCP: Primary Care Provider; PCC: Primary Care Centre.

condition, not the element of choice.

Journals included in the 2019 Clarivate Analytics Journal Citation Report within the category Emergency Medicine published from 1995 onwards were searched through Scopus and PubMed. Journal titles, abstracts and keywords were matched to the search terms captured by Fig. 3. One researcher reviewed the initially 534 English-language papers in the structured review and selected 31 papers (informed by a survey, randomised control trial, qualitative or quantitative study, data analysis or literature review) as the starting point of a forward-backwards search. A second independent researcher reviewed the choice and disagreed on six papers (kept for the forward-backwards search but removed at the end). Another six papers that were kept for the forward-backwards search matched the output of the scoping review. Additional papers were included from a literature search update in 2023.

Within the realm of the research question, the inclusion criteria were relatively wide and covered factors, recommendations (or direct referral), perceptions, motives, beliefs, needs, and desires related to appropriate and inappropriate use of emergency departments and/or inappropriately not using primary care facilities. Papers that targeted the choices of specific patient groups (e.g., elderly or socially vulnerable people) were included. Our initial learning shaped exclusion criteria. We did not consider non-English language papers, papers with insufficient detail on study design or data quality, papers with a primary focus on the medical condition and flow management themes or papers about settings where the element of choice was primarily governed by the budget constraint not by the preferences of patients, caregivers, or referrers. There were no explicit geographical restrictions. Yet, we excluded studies around the price of medical aid as a rationing mechanism. This led to the removal of substantial amounts of US studies. However, we kept studies from the UK, the Commonwealth of Nations, and other countries with public healthcare systems.

Forward and backwards searches uncovered 199 and 273 papers, respectively. Two researchers independently conducted abstract and paper screening and reached a consensus about inclusion through

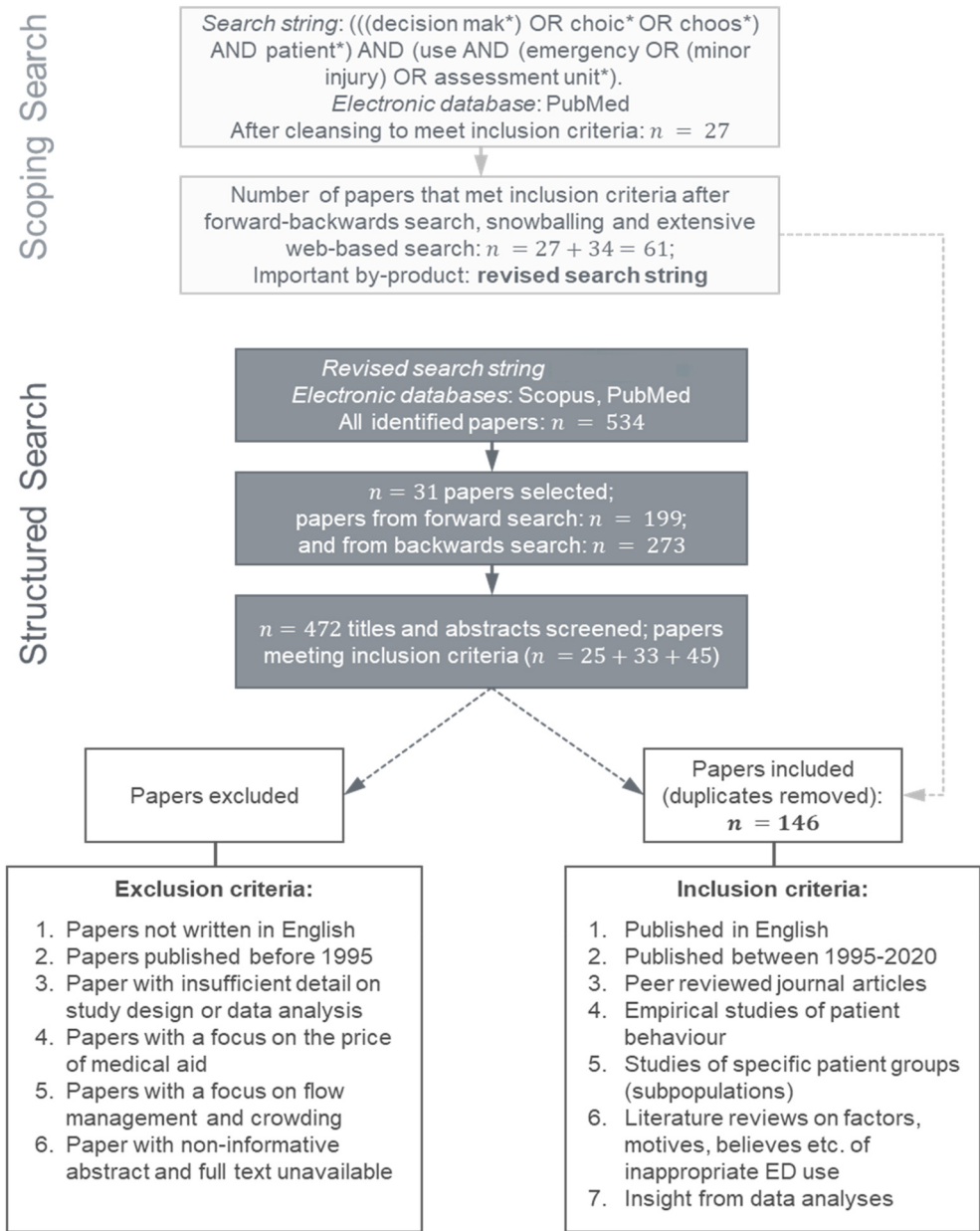


Fig. 2. Structure of the literature research [31].

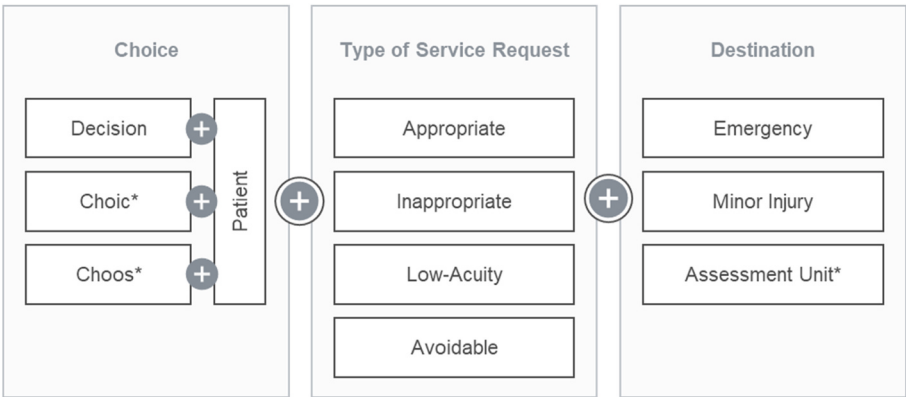


Fig. 3. Search criteria used for the literature search described in this paper.

discussion—the resulting 103 papers marginally overlapped with those found during the initial scoping review. The structured review thus complemented the older study via a more precise focus on medically non-urgent patients. One researcher reshaped the original catalogue of perceptions based on this information, refined the Systems Thinking/System Dynamics aspects, and split the motives around accessibility and convenience into two distinct (yet related) categories. Also, the rich information about non-urgent patient characteristics enabled the researcher to refine section 3.1 and avow that gender is ambiguously related to an ‘appropriate’ use of services. A second researcher closely reviewed all changes over the entire process. A third researcher checked the output from a social-sciences viewpoint. Two other researchers sense-checked the framework presented in section 3 from the narrowed-down viewpoint of Operational Research and Mathematical Modelling.

Causal diagrams structure the core concepts and the causal links identified from the literature (see section 3). These diagrams were developed iteratively throughout the literature review but are presented alongside the relevant subsections to aid readability. Numerous iterations of the causal diagram were developed, first informed by the scoping study. Each iteration was assessed across the research group as more detail was added, simplifications were made, and additional concepts were identified in the literature (a graphical abstract of the process is available from the authors upon request). Using the modelling cascade methodology, the structured review yields a BOR framework (with the associated evidence base) of why people attend a hospital-based ED rather than a primary care service [33].

3. Analysis: pinning down the core concepts

3.1. Characteristics of ED patients (concept #1)

Attempts to understand emergency demand usually start with collecting and analysing data on patient characteristics. These characteristics consist of measurable metrics like age, gender, and information from patient homes (e.g., rurality, deprivation, distance to the primary care provider, and an ED). Another set of characteristics relates to who decides whether a person should present at a hospital-based emergency department. Fig. 4 provides an overview of the corresponding relationship. We will discuss the profiles of ED patients derived from the literature and publicly available NHS data in what follows.

3.1.1. Age and gender

Reviewing patient characteristics of ED presenters and patients who turn for help to a primary care out-of-hours service reveals pervasive patterns (see, e.g., Ref. [34]). Both attendance and self-referral to a hospital-based emergency service are positively associated with younger age (15–64) [22,35–38]. A more detailed analysis of data from English NHS hospitals and English NHS commissioned activity in the independent sector confirmed that around 20% of attendances refer to children under 15. Moreover, approximately 59% of demand belongs to the age bracket between 15 and 64. The remaining 21% cover patients aged 65 or older [67]. Note that planned attendances are excluded from Table 2; so are data from the period dominated by the NHS response to COVID-19.

Older people who attend hospital-based emergency services are small in numbers compared to other age groups (see Table 2). They present, however, with more complex clinical conditions, consume more resources, have longer lengths of stay in the ED, are more likely to be admitted to hospitals and experience more adverse outcomes than younger patients [39–44]. They also have a higher rate of return visits to the ED [40]. For example, Ref. [21] said that 20% of lower-urgency community-dwelling patients aged ≥ 70 years had attended ED 3–6

times in the previous 12 months.¹ Partially, this was because more than half of all advanced-age (mean: 82 years) ED patients found it difficult to access care outside regular office hours. About a third of them reported wait times of more than 2–3 days for urgent problems in primary care. The latter explains why three-quarters of the older patients presented at an ED during business hours. Referral by a third party and patient preferences for fast-track access to specialist care were other reasons for more frequent ED attendances of older patients [21]. The formation of perceptions that may have reinforced this behaviour will be addressed in section 3.3. Still, several studies identify older patients as ‘appropriate’ ED users [46–49].

One explanation for the phenomenon that the age distribution (Table 2) is disproportionate is that patients under 25 have a high attendance rate for medically non-urgent conditions [50–52]. According to Ref. [38], health services are used in the day’s final hours and at weekends. Another often considered factor is gender. Gender-related results concerning the appropriateness of ED use are, however, ambiguous. On the one hand, ED self-referrals were found to be primarily young adult males presenting with an injury, e.g., a fracture [28,38]. Ref. [29] confirmed this result and reported that young men were more likely to seek help at an ED for minor trauma. On the other hand, studies found that presenting medically non-urgent conditions is significantly higher in females [36,53,54] – despite women seeking their healthcare providers’ support for their emergency complaints before ED attendance more often than males [16,27,55].

3.1.2. Sociodemographic characteristics and deprivation

People who live in more impoverished areas have more years of ill health and are more likely to die early from disease [56,57].² The onset of multimorbidity occurs 10–15 years earlier, and the prevalence of physical and mental health disorders is higher in people living in the most deprived areas than in people living in the most affluent communities (11% vs 5.9%) [59]. Also, residents of deprived areas are more likely to be diagnosed with psychosocial conditions (24.1% vs 11.1%) [26]. All this translates into more ED activity.

Since more deprived parts of society often experience fewer choices to access healthcare than an ED, also medically ‘inappropriate’ ED use is associated with socioeconomic vulnerability [60]. Patients living in socially deprived areas have a higher propensity to attend an ED [30,35, 61–63] and are more likely frequent ED users [26,64–66] than their counterparts living in more affluent neighbourhoods. The NHS England counted nearly twice as many ED attendances for the 10% of the population living in the most deprived areas (3.1 M) compared to the least 10% [67].

3.1.3. Successful self-management of a long-term condition

Patients who successfully self-manage long-term or chronic conditions show an improved health status [68]. They are also identified as knowledgeable, discriminating users of healthcare services and choose in an informed way among the available resources [18]. People with non-chronic conditions who rate their illness as ‘serious, unambiguous, distressing and difficult to manage’ are more likely to use primary care facilities, while patients with chronic conditions use secondary care facilities [20]. (Consult Footnote 5 for the motivation behind the observed type of behaviour.)

3.1.4. Caregiver decision

More often than we think, the patient is not the primary decision-maker: [69] report that patients (51%), health and medical professionals (31%) and others (18%) decide whether to attend an ED. The

¹ While advanced age is a factor associated with frequent readmission, gender, time, day or season of presentation and country of birth are not [45].

² This result may be partly explained by the inverse correlation between the availability of healthcare and the people who require it most [58].

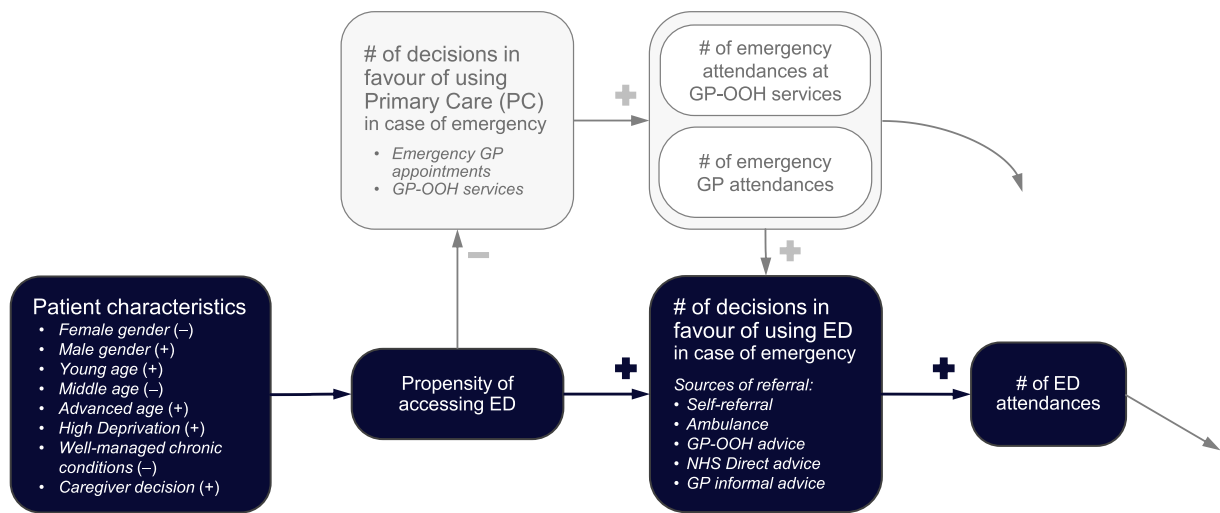


Fig. 4. Impact of patient characteristics on the propensity of accessing an ED and, subsequently, ED attendance. (The “+” and “-” signs indicate that variables affect one another positively (moving in the same direction) and negatively (moving in opposite directions), respectively).

Table 2

A&E Attendances by Age Band, 2015-16 to 2019-20.

Age band	2015-16	2016-17	2017-18	2018-19	2019-20
0 to 4 years	10.2%	10.1%	10.1%	10.1%	10.0%
5 to 14 years	10.3%	10.4%	10.2%	10.1%	9.9%
15 to 34 years	28.9%	28.3%	27.7%	27.6%	26.8%
35 to 64 years	30.4%	30.4%	30.7%	30.9%	31.3%
65 to 79 years	11.6%	11.9%	12.1%	12.3%	12.6%
80+ years	8.6%	8.9%	9.2%	9.0%	9.4%
Total numbers	19,938,978	20,600,191	20,941,694	21,865,363	21,991,601

‘other’ secondary decision-maker is mostly a caregiver, for example, a parent [14]. For young children, ED attendance is informed by the adult taking the child to the emergency department [70,71]. In this context, younger maternal age was associated with a higher frequency of

presenting infants to an ED for medically ‘inappropriate’ conditions [72]. Moreover, Ref. [73] reported that parents perceive an ED as the default to-go-to when a child is unwell.

Typical factors reported by a caregiver to choose an ED over the

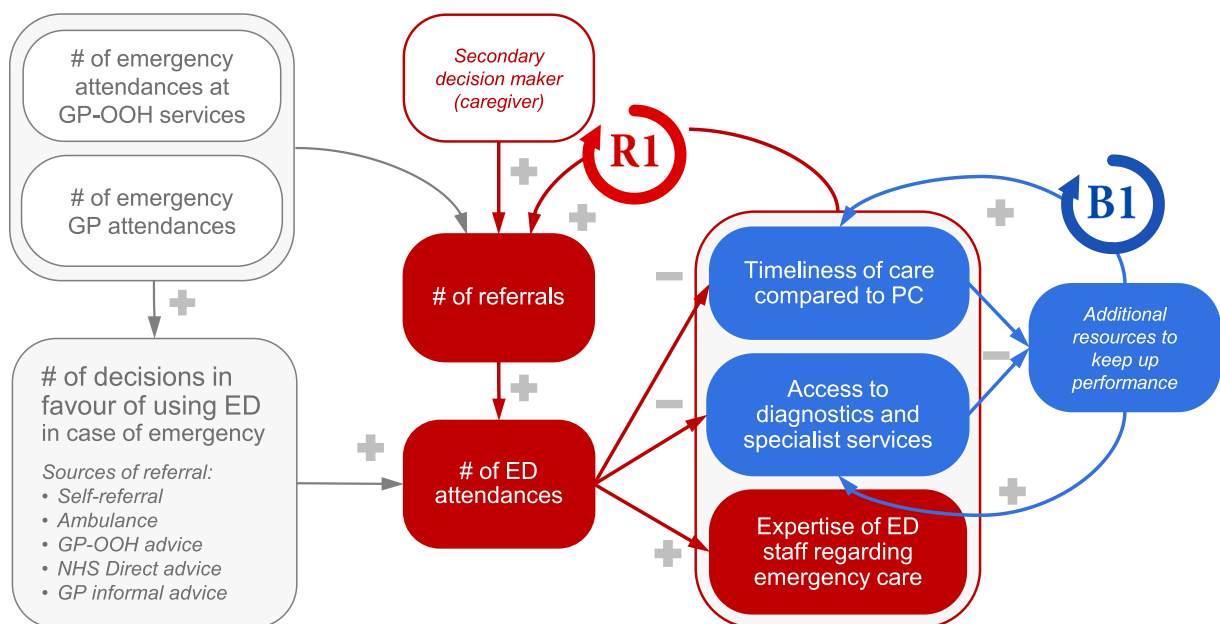


Fig. 5. Quality-referral dynamic, pulling patients from primary care into an ED. In the diagram, B1 refers to a balancing loop; R1 refers to a reinforcing loop. The former prevents timeliness of care and access to diagnostics from deteriorating, while the latter reinforces the referral dynamics and increases the number of ED attendances. (The “+” and “-” signs indicate that variables affect one another positively (moving in the same direction) and negatively (moving in opposite directions), respectively).

family's primary care provider are long appointment waits, communication problems, (perceived) higher efficiency and efficacy of ED, resources available at an ED (like instant access to diagnostics), convenience, different experiences of care quality and ED staff's expertise with children [14]. Moreover, caregivers can resist new initiatives, like walk-in-centres [74] due to a mix of tradition, anxiety, and risk aversion.

Even when the patients decide for themselves, they often seek advice from trustworthy people with more experience or (perceived) system knowledge [75]. For example, Ref. [76] found that females tended to attend ED because of others' advice more than males, with families and friends being their most common source of healthcare advice. Section 3.3.7 will revisit the 'experience' theme and discuss it more thoroughly.

3.2. Directed to ED by a healthcare professional (concept #2)

In section 3.1.4, we have already alluded that healthcare professionals may perceive it as adequate to direct patients to an ED [37,77,78]. Both clinical and non-clinical factors influence the referral decision [79]. Regarding paediatric ED referrals, GPs report, for example, that not only the medical condition guides their decision but also the assessment of a parent or caregiver (see Fig. 5). If the latter perceive their child's illness as severe, an ED referral will come about [80].

Other factors affecting the outcome of the referral decision are the GPs' degree of risk aversion and system-level considerations such as access to diagnostics and specialist services [80,81]. More referrals increase ED attendances, which enhances the expertise of ED staff through more experience. The higher skill level to manage emergencies then again biases GPs' future referral decisions. Crowding, made obvious by extended periods till triage or seeing a physician [82], no longer reduces an ED's attractiveness because of ongoing 'ED fixes' to meet performance targets [1,2]. Altogether, this results in a reinforcing loop that gradually pulls patients from primary care into hospital-based emergency services (see Fig. 5).

Ref. [19] reported that one-third of ED patients came because of a referral,³ and every other patient came at the advice of a provider, family member or friend. 33% of ED patients tried to reach their primary care physician before presenting at the ED (with an 80% success rate) [19]. 29% of ED patients had contacted their GPs before presenting at the emergency department [16]. If a caregiver was involved, the probability that a patient accessed an ED increased [14,16,80]. The caregiver's anxiety and risk aversion are prompting the outcome. Consequently, elderly patients (70+) often attend ED because a third party referred them [21] or someone called an ambulance [83]. On the other end of the spectrum, a Canadian study on the appropriateness of children's non-urgent ED visits found that 38% of parents called for advice before coming to ED; of those, 60% were told to use hospital-based emergency services rather than emergency primary care [84].

Altogether, emergency ambulance services, General Practitioners and GP-OOH services are the primary sources of referral [13]. Both GPs [28,85–88] and ambulance services [28] effectively select the patient/s/conditions suitable for presentation to an emergency department – with the odd 'inappropriate' exception [52]. Sources of a service request for an emergency department other than emergency services, GPs, OOH services and NHS Direct include nursing homes, police, transfer from another medical unit within the same trust and planned ED follow-up appointments.

A source of referral that has increasingly gained importance is telephone triage. It is difficult to assess a disease's severity via telephone [89,90]. Still, for the patient, it is vital to follow the advice given.

³ A smaller proportion of paediatric (and younger) patients is referred to ED. For example, [23], state that primary care providers referred 21% of ED patients between 14 and 24 years.

However, only around two-thirds (68.4% CI 66.4–70.4%) of those instructed to attend ED are compliant with guidance [89,91–93]. The proportion rises to 74% for paediatric OOH services [94]. On the other hand, 3.8% (3.8% CI 0–9.1%) of those explicitly advised by telephone triage not to attend ED ignored the advice and showed up at the hospital [89,91]. This discussion does not only make it clear that approximately one-third of those patients recommended presenting at an emergency department ignore the advice. It also raises another issue: the use of the term 'referral.' The survey-based literature does not clearly distinguish between formally referring and informally directing patients to an emergency department. Technically, the latter is, however, classified as self-referral, not as a referral. This shortcoming explains why data analysed in practice typically produce a higher proportion of 'self-referrals' (usually around 90% and above) than those suggested by the literature. For any planning or service redesign, we need to know the size of the current problem – and if the terms 'referral,' 'recommendation' and 'informal advice' have been used interchangeably, we base any healthcare improvement on speculation, not facts.

3.3. Patient's perception of ED service provision (concept #3)

Perception is the organisation, identification, and interpretation of sensory information to make sense of our environment and the available information [95]. However, perception is more than a passive receipt of signals. Experiences (including those communicated by others), memory, learning and expectations shape how we later perceive a subject or a situation (and how we act). Emotions like fear or insecurity also influence how we perceive (and respond to) the world around us [9,96].

Whether we step into the shoes of a patient, carer, consultant, nurse, or any other clinician, we notice that people do not always do what they are told. For example, patients do not necessarily attend recommended healthcare services, especially during an 'emergency crisis.' Patients go where they think and feel the best available place is. Suppose we want to help our patients when suffering and in distress. In that case, we must understand what they truly need (which goes far beyond understanding the 'presenting complaint'). Hence, we pay attention to how (potential) emergency patients shape their perception of service provision and the terms of acceptable service use (which may differ from a clinician's view [97,98]) as perceptions guide decisions and drive behaviour (see Fig. 6).

Understanding these perceptions enables the supply of prudent healthcare [99] – and even more critical: compassionate healthcare [100,101]. Note that usually, several perceptions blend into each other and jointly motivate a person to seek help at an emergency department.

Each of the following eight subsections addresses a facet of a patient's (potential) motivation to request ED services (retrieved from the structured literature search). Our approach does not consider the patient's physical condition, only the decision of where to seek care. Our focus is on how we (as human beings) approach decision-making in this context and behave in a situation that feels alarming. Each 'perception' discussed here stands for a latent patient need or endogenous mechanism identified by the academic literature. Many informal conversations with NHS staff in South Wales inspired the authors' specific labelling of a perceived need.

3.3.1. 'I have other options, and I should be at an ED.'

The '**right-place**' perception prompts the decision of an informed person who knows that (among all available alternatives) the emergency department is the most appropriate place to go. It refers to people who are experienced caregivers or successfully self-managing long-term/chronic conditions. The latter relates to patients with an elevated level of self-awareness, who are knowledgeable, discriminating users of healthcare services, and choose in an informed way among the offered

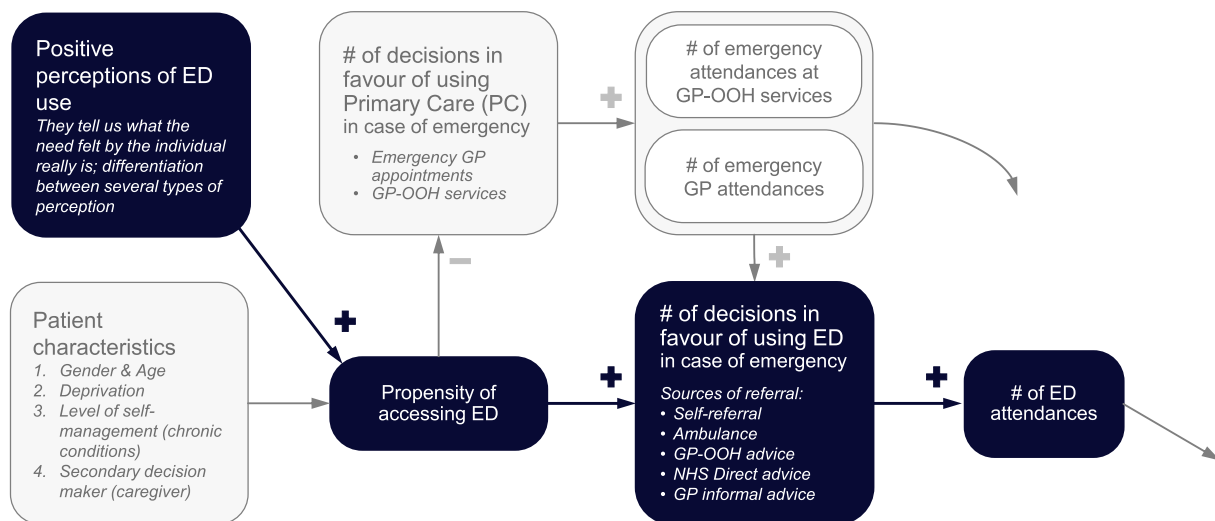


Fig. 6. Relationship between the perception of ED use and its actual use. (The “+” and “-” signs indicate that variables affect one another positively (moving in the same direction) and negatively (moving in opposite directions), respectively.)

resources [18].⁴ When they decide to present to an emergency department, they do it with good cause [20]. In this context, confidence and self-managing ability are critical [68].⁵

Discussing behaviour rooted in the right-place perception, we must also include that a patient (or caregiver) can get it wrong. In other words, the decision-makers are not deliberately abusing services. They know that EDs are designed to deal with life-threatening conditions, e.g., stroke, breathing difficulties or major trauma as possibly caused by a road traffic accident [102]. They are also aware of the alternative services. However, they misperceive their attendance of hospital-based emergency services as appropriate [103–105,196], i.e., a medical necessity [76,106–110] requiring immediate attention [111] (cf. sections 3.3.2 and 3.3.8).⁶

For example, a US study found that about 40% of ED patients between 14 and 21 were triaged as medically non-urgent. At the same time, a third remained of the conviction that they were severely ill, requiring immediate attention [23]. Half of the respondents of an Australian study expected a higher priority than the actual triage

category they were assigned [113]. Two-thirds of Canadian Triage and Acuity Scale (CTAS) V patients and one-third of CTAS IV patients believed their conditions were more urgent than their triage nurse rating [114]. Another US study reported that ED physicians triaged no more than 67% of ED presentations as medically appropriate [115].⁷

In comparison, around 88% of the patients perceived their condition to be a medical emergency [115,118] – the flip side being that between 12% [115] and 20% [113] of ED patients rated the medical urgency of their condition (far) too low. A quarter of these patients (rated requiring immediate attention by a physician) thought they could wait from one hour to several days [115]. This is worrying because this subset of patients stays at home when trusts, health boards and the media ask the population not to overburden emergency departments (e.g., during winter pressures). It may take the (otherwise) good health or even the lives of these patients. Still, the discussion is mostly limited to ‘inappropriate’ use of services, i.e., presenting to an emergency department with primary care needs.

In this context, it is regrettable that a high proportion of formal referrals and informal advice to present to an ED blur the picture and reinforce existing (mis)perceptions [119] (cf. sections 3.2, 3.3.7 and 3.3.8). For example, let us assume that a patient presented, say, four times to an emergency primary care provider in the more recent past. If the patient is referred to ED in three out of the four encounters, the person will have ‘learned’ to go straight to ED the next time (to save some time). Over time, sending patients on to attend ED (‘just to make sure’) will decrease the number of emergency attendances in primary care altogether [79]. This behaviour corresponds to the balancing loop displayed in Fig. 7. This dynamic does not exclusively rely on personal experience: observations of friends, kin or social media shape the perception of ED use by supplying context-free information. From the economics literature, we know that decisions solely based on outcome knowledge (neglecting context information) often produce inferior results for both the individual and the system [120]. The same applies to healthcare.

Having said all this, it is remarkable that ‘only’ around a third of ED patients get it wrong when presenting to an emergency department

⁴ Patients’ health competency is usually quite limited, with the internet as an important influencing factor [81].

⁵ The right-place perception also explains an interesting phenomenon that was already mentioned in section 3.1.3 and appears counterintuitive at first sight. People with non-chronic conditions who rate their illness as ‘serious, unambiguous, distressing and difficult to manage’ are more likely to use primary care facilities while patients with chronic conditions use secondary care facilities [20]; 862. So, what happens here? Vital is in this regard that patients themselves rate their illness as ‘serious, unambiguous, distressing and difficult to manage’. Suppose that troubling symptoms occur suddenly to an otherwise healthy person. These symptoms will cause anxiety and result in a perceived assessment need. Especially in times of stress, human beings revert to beaten tracks. In a healthcare context, this indicates that patients prefer already known service providers to ones they are not yet familiar with [29]. Consequently, as a first choice, non-frequent users of the healthcare system will (try to) contact their GPs for assessment rather than presenting at an ED. Additionally, for a person who effectively self-manages a long-term or chronic condition and is used to a volatile health status (involving occasional pain), it usually takes a lot more to self-classify a situation as ‘serious, unambiguous, distressing and difficult to manage’. A patient in such a state is usually well advised to self-present to an emergency department without further ado.

⁶ Between 47% and 61% of ED patients self-classify their presenting complaints as severe [19,69] – and many of them may be right as 68% of ED patients are clinically assessed as ‘to be seen only in the emergency department’ [112].

⁷ It is not only physicians and patients who disagree on the characterisation of presentations as “emergencies” and the appropriate treatment location. There is lack of consensus among clinicians as well [116,117] and the categorisation depends, among others, on physician training, speciality, and beliefs rather than on some objective criteria.

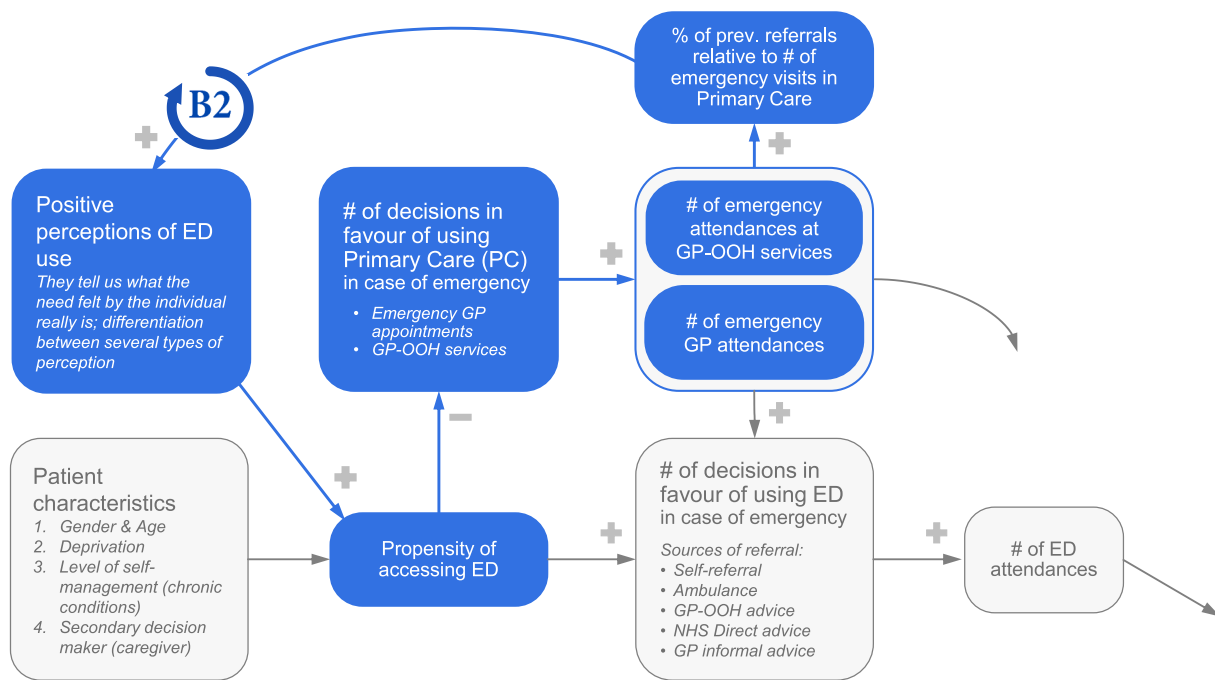


Fig. 7. Reinforcement of the perception that secondary emergency care is superior to primary emergency care. In the diagram, B2 refers to a balancing loop; it mitigates the number of emergency attendances in primary care. (The “+” and “-” signs indicate that variables affect one another positively (moving in the same direction) and negatively (moving in opposite directions), respectively.)

[112,115,121–123]. The variation of this proportion across a multitude of studies is, however, enormous. I.e., it fluctuates between roughly 5% and 90% [49,53,121,124–129]. Hence, we dig deeper to understand all relevant motives for attending an emergency department, especially when the decision is labelled ‘inappropriate’.

3.3.2. 'I have other options, but I am afraid and need help. Now.'

The ‘urgency’ perception differs from the incorrect ‘right-place’ perception (presented in section 3.3.1). Here, it is not the (misperceived) nature of the condition that motivates ED use but an ED’s rapid response speed. In fact, around a quarter of ED patients with medically non-urgent conditions said that their (perceived) need for immediate attention was why they did not present to a primary care provider [110,130]. In this case, the patient does not perceive the condition as life-threatening – but as something irritating where they would feel better when being instantly examined.

An example would be an acute illness (usually triggering a feeling of urgency [18,23]). The same applies when patients are in pain [131,198], stressed or anxious about the presenting problem [13,81,103,132–134] or when people must decide on behalf of someone else [134,135]. A yearning for fast-paced reassurance then generates self-referral [75,81,132,136–138] and physician-initiated ED visits [81].⁸ Unexpected acuity is at the core of the ‘urgency’ perception. An injury or acute unwellness powerfully sparks sensations associated with loss of control, increased anxiety, and fear for the injured/poorly person’s wellbeing. Hence, it is no surprise that self-referral to an emergency department is positively related to injury [22,51,140,197]. At the same time, patients with non-injury-related medical problems seem to prefer primary care to secondary care emergency services (93% vs 55.6%) [27]. A Minor Injury Unit (MIU) would often be the right place to present an injury. In this context, it is critical to acknowledge that even if an MIU would be the

‘right’ place seen from a healthcare provider’s perspective, a patient or caregiver may take a vastly different view at the instance of decision-making.

In practice, the urgency perception and the right place perception are often difficult to disentangle – and jointly explain why 10%–43% of the patients presenting to an emergency department are eligible for management in primary care or elsewhere [141].⁹ Still, it needs more than misperceived urgency to explain ‘inappropriate’ ED attendances. The perceived quality of care also matters, bringing us to the following motivation for ED use.

3.3.3. 'I have other options, but I want the best available service.'

The ‘**efficacy**’ **perception** resonates with the mindset of a patient who senses that the presenting complaint is a non-life-threatening one but perceives the quality of care in an ED as superior to the care provided elsewhere – and there is some truth in it.¹⁰ A wide range of services is available (only) within an emergency department [13], *de facto* serving urgent *and* non-urgent patients [121]. Specialist consultation and diagnostic imaging attract patients in perceived need of immediate attention [24,75,106,132,136,143,144,196,198]. Also, prompt availability of an extensive spectrum of diagnostic and therapeutic options makes ED services attractive for patients [46,143,145,146,199] and referring GPs [81,106].

The underlying patient concern is that the absence of the correct diagnoses could damage their health and threaten their lives. It is, however, the perception of efficacy that guides decision-making, not effectiveness itself. The perception that a hospital specialist is best qualified to handle the presenting problem is, for example, what increases self-presentations [22,69,133,147–149]. Patients prefer the alleged expertise and diagnostic facilities provided by an emergency department [22,73,143,150]. Parents bring their children to an ED for

⁸ The most frequent reason given by patients for their visit to the emergency department was that they felt their problem was an emergency [53] and needed immediate attention [139]. This is where the acuity of the presenting complaint and anxiety blur the boundary to the ‘right place’ perception.

⁹ Medically non-urgent conditions account for 58%–82% of paediatric emergency department visits [14].

¹⁰ [142] identified a need for further education of out-of-hospital emergency care providers (concerning triage, transportation, and destination decisions).

non-urgent care because of the supposed advantages of ED care like efficiency, availability of resources, quality of care and expertise with children [14,151]. Elderly patients (70+) attend an ED because of specialist care expectations [21]. In many cases, expected investigations and no confidence in general practitioner/primary care were identified as motives of self-referred ED patients [128] – an argument opening the floor to the following motivation for ED use.

3.3.4. *'In theory, I have other options, but no one is there.'*

Another related yet different motivation to seek aid in an ED is that patients understand it as being more accessible than other healthcare services, including their GPs, see, e.g. Refs. [13,36,51,52,69,73,109,121,149], and in particular OOH services [152]. For 32% of non-urgent ED patients, lack of accessibility is why they did not present to a primary care physician [130]. In rural areas, with a shortage of GPs, this proportion may be even higher [65,153,154], reinforced by considering this scarce GP resource inaccessible to a patient's emergency needs [155]. In non-public healthcare systems, alternative services may be available but non-affordable for underinsured patients. Then, an ED additionally becomes a last resort for healthcare seekers [107,156].

Parents bring their children to an emergency department for non-urgent care because of problems accessing their primary care provider [14,157]. Ref. [55] reports that emergency admission rates declined as the proportion of patients able to consult a particular GP increased. For example, 57% of ED patients interviewed for a Canadian study said they would have used their family physicians if they had only been available [24]. Older (70+) patients of lower clinical urgency attend an ED because of a perceived access block to primary or specialist services [21]. Often (the communication of) negative experiences in primary care compared to hospital-based emergency care reinforce the corresponding '**accessibility**' perception.

Most low-acuity patients are acutely injured and motivated by the perception of easier accessibility of expertise [88]. On the one hand, this incorporates that a patient could not obtain an appointment with a primary care provider [79,137,149,158]. On the other hand, it includes that the accessibility of radiologic and laboratory investigations sways the decision in favour of an ED [46].

3.3.5. *'I have other options, but an ED is an easy service.'*

Single point-of-care convenience is among the most reported reasons for attending an ED [88]. It spares the patient from being overwhelmed with appointments with various specialists [15]. Also, patients seem to like single point-of-access conveniences, where health professionals pick the right service [159].

Other convenience-related factors for ED attendance include expected wait times [14,17,36,106,121,146,148,152,160], proximity [17,35,62,65,106,132,161] and/or convenient location [148]. In this context, it is not only the physical distance¹¹ between the patient's home and the ED that matters regarding the '**convenience perception**'. Self-referral to an emergency department is also positively correlated with the distance to the GP practice [22,55,161].¹²

Also, opening hours matter [36,132].¹³ Moreover, younger patients and those with painful conditions appear to place greater priority on wait times [17]. Up until the first SARS-CoV-2-induced spike in English hospital demand, 84% of all ED attendances spent less than four hours in the emergency department [67]. Also, an ED provides access to medical care 24/7 [114], which brings us back to the quality aspect discussed in

section 3.3.3 (cf. Fig. 8) in the following way. The Insitute of Medicine [162] identifies the domains of quality in healthcare as patient-centredness, safety, equity, efficiency, effectiveness, and timeliness of care. When patients are motivated in their service choices by the belief that a 24/7 ED provides more timely access to what they need [46,114], 'accessibility', 'convenience', 'efficacy' and 'urgency' blend into each other as the single guiding motive for seeking ED care in case of a perceived emergency.

Fig. 9 shows what happens on the system level due to the perceived quality gap between ED and emergency primary care. The more the quality scale tips into the direction of hospital-based emergency services, the more patients are inclined to choose ED over primary care. EDs get busier than before while (emergency) primary care calms down. ED consultants get more experienced than without the extra activity. EDs receive more resources than the departments already had (to continue meeting performance measures) if wait times increase. Patients' perception of ED quality increases. The reinforcing loop corresponds to a self-fulfilling prophecy about the quality of hospital-based emergency care. The balancing loop that keeps emergency primary care attendances stable prevents the development of additional emergency care skills in primary care. The perceived quality of primary care as an emergency service declines further. This dynamic leads to increased GP referrals to hospital-based emergency services (cf. Figs. 5 and 7). The ED workload increases, and so does the timeliness of appointments, staff skill level, and the availability of advanced diagnostics. The 'success to the successful' archetype comes to mind [163].

3.3.6. *'I do not have other options. An ED is all I know.'*

Lacking knowledge of how the healthcare system works and what emergency services are available also influence patient choice [146]. Many patients (7%–56%) see an emergency department as the only place to present health concerns outside regular office hours [25,137]. I. e., patients perceive a lack of options [13] or do not know where to go (with their medical complaint) [106]. For example, Ref. [147] reported that for 66% of self-referred non-urgent patients in a university ED, the emergency department was the only service they knew. 27% of these patients said they depended on the ED for all medical care [147]. A fifth of ED patients reported they would have changed their decision about attending ED if they had known about alternatives; only 12% were aware of Choose Well [73]. In this context, a Canadian survey informs that three-quarters of GPs were not educating their patients about which situations/conditions are appropriate for presentation at a hospital-based emergency unit [164]. Fair enough, one may argue that the responsibility to be an informed patient sits with the patient. However, half of the Canadian GPs reported not even informing their patients about their own services. This potentially leaves us with substantial shares of patients poorly educated about how to navigate the healthcare system.

Partially, parents' '**destined to be here**' perception is also acknowledged when they express that they would like education on (the urgency of) their child's paediatric problem [14]. They do not have enough information to make an informed decision.¹⁴ A US study reports that ED patients (aged between 14 and 21 years) with public insurance or no insurance/unknown insurance status were significantly more likely to be triaged as non-urgent as compared to those with private insurance [23]. It is plausible that patients with private health insurance are better informed about which services to use because it relates to what proportion of their expense is covered. These (presumably) better-informed patients or their caregivers make 'more appropriate' choices about the use of emergency departments. Information conveyed at the right time matters.

¹¹ Note that [17] report that 44% of respondents to their survey stated proximity as the primary reason for accessing an unscheduled secondary care service.

¹² In this context, it also makes sense that meteorological factors matter [65].

¹³ After establishing an out-of-hours primary care physician cooperative in a Dutch city, the proportion of patients using emergency care decreased by 53%, and the proportion of patients using primary care increased by 25% [138].

¹⁴ Most parents report enhanced access to their child's primary care office during office hours, but many parents do not have access or do not know if they have access outside of regular office hours.

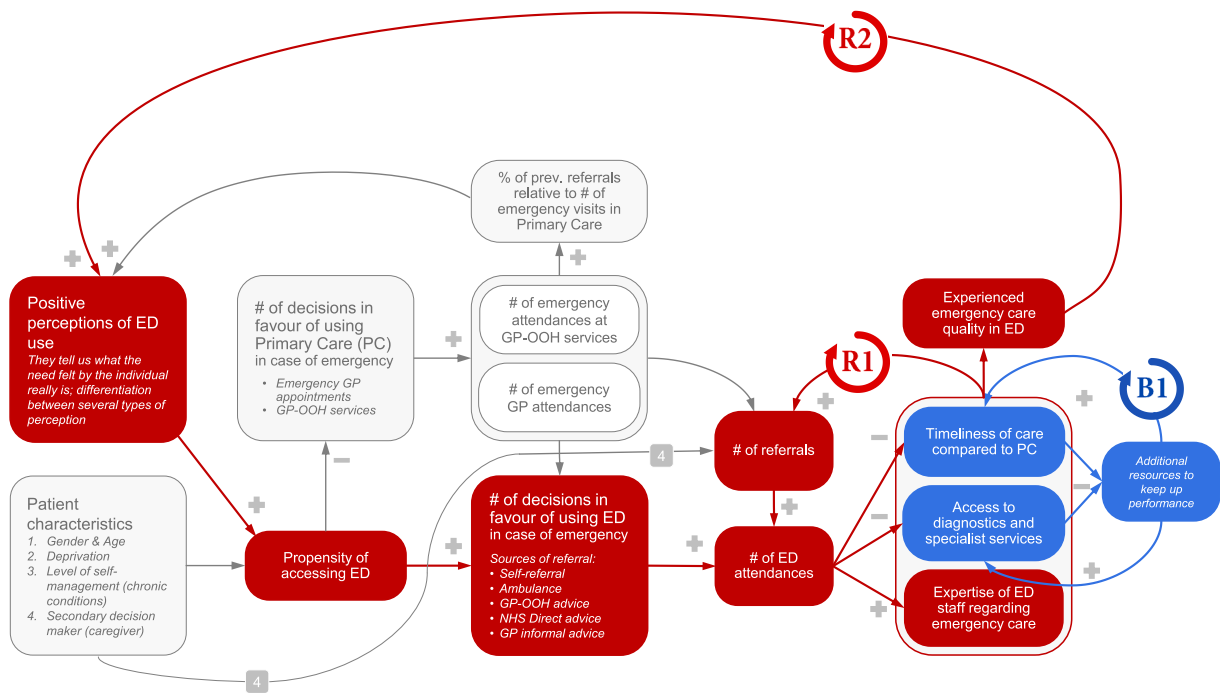


Fig. 8. The reinforcing power of the (perceived) quality of care at an ED. In the diagram, B1 refers to a balancing loop; R1 and R2 refer to reinforcing loops. The former mitigates two of ED's quality indicators from deteriorating, while the latter reinforce the perceptions of ED use (R2) and drive the number of ED attendances (R1). (Again, the "+" and "-" signs indicate that variables affect one another positively (moving in the same direction) and negatively (moving in opposite directions), respectively.)

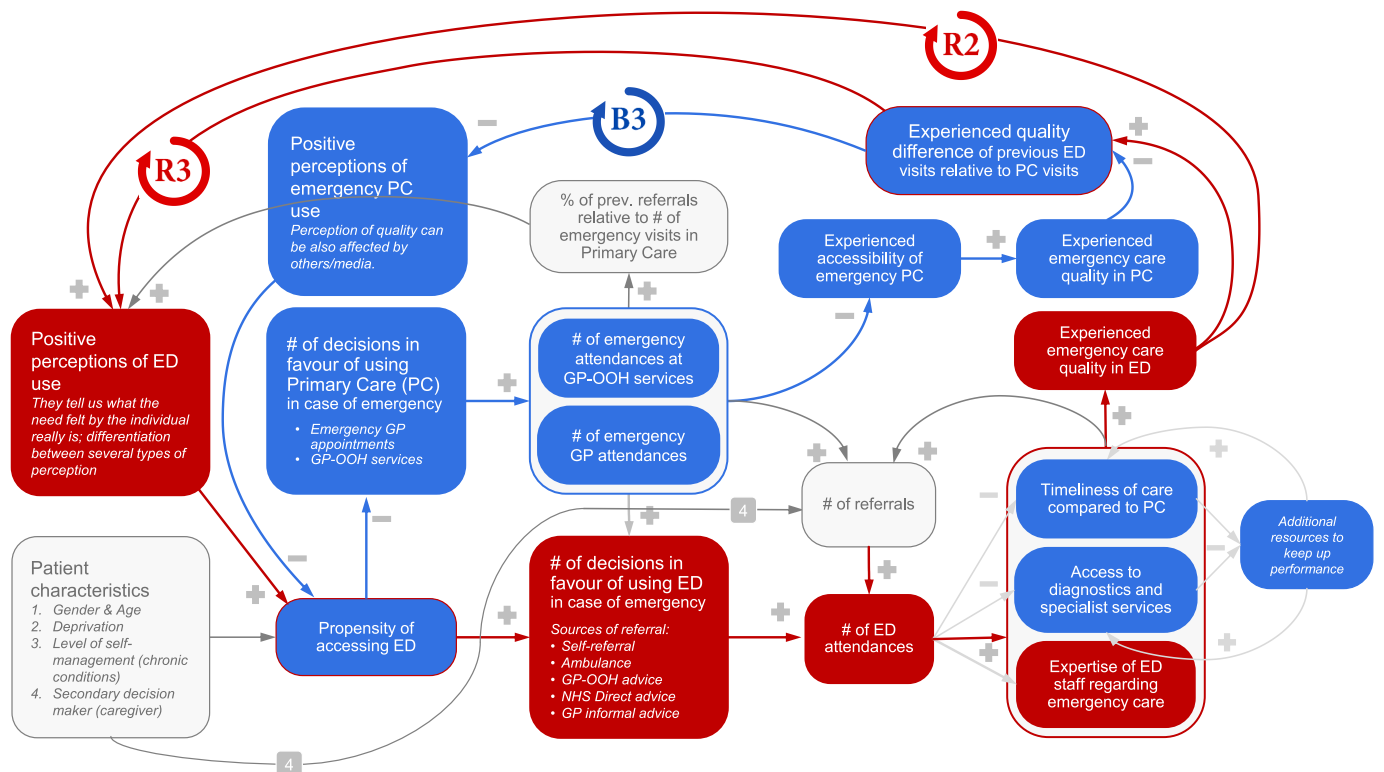


Fig. 9. Dynamics generated by the perceived quality gap between primary care (PC) and ED. In the diagram, B3 refers to a balancing loop; R2 and R3 refer to reinforcing loops. The former mitigates the dynamics and stabilises the number of emergency attendances in primary care, while the latter reinforce the positive perceptions of ED use. (Again, the “+” and “-” signs indicate that variables affect one another positively (moving in the same direction) and negatively (moving in opposite directions), respectively.)

3.3.7. 'I have learnt my lesson. An ED is the place to go.'

Having visited an emergency department in the last 12 months is a significant predictor of ED attendance [29].¹⁵ Long-term patients who often use healthcare services develop a refined sense of which service to use and when [18]. Earlier experiences on accessibility and the practitioner's perceived responsiveness and expertise guide a person's judgment of urgency and service choice [14,18,134,148,166,199]. Once formed, negative perceptions about alternatives to an ED (such as primary care providers) play a vital role in driving non-urgent ED use [37].

Experience **recursively shapes (patients') perception of ED use** (see Fig. 10 and Table 3). It is, however, not only the personal experience that matters in this context. Information conveyed by a healthcare provider, family member, friend [19,132] or another caregiver [16] also shapes a person's perception of ED use [134]. Moreover, if we decide for someone in our care, risk aversion and anxiety creep in, tipping the scale further into the direction of ED use.¹⁶

Despite the learning that happens over time, people often stay creatures of habit. This becomes apparent in a healthcare context after introducing new services, when people still stick to familiar services (see, e.g., Refs. [29,74,168]). It becomes clear that more frequent users of healthcare services are more successful in navigating through the system to get what they want (not necessarily what they need) than less frequent users. Even frequent ED users have one main ED and one main GP [26], and around 10% of non-urgent ED patients prefer their trusted ED over a primary care provider [130]. Today, news and social media also contribute to shaping perceptions about emergency care use – a blessing and a curse at the same time.

3.3.8. Other misperceptions about service use (e.g., GP and ED are substitutes)

We have already mentioned the influence of misperceptions in this paper. They alluded to mistaking the severity of the presenting complaint (section 4.3.1) and the (biased) mindset created by repeatedly being referred to an ED (section 3.2). We have not yet mentioned a false understanding of the role of an ED in general. From an Australian study, we learn, for example, that GP-type patient attendance at an ED is not evenly distributed across the week. Proportionally more patients present to an ED during weekday daytime (08:00–17:00) and proportionally fewer overnight (00:00–08:00). We have perceived access blocks in primary care prompting this behaviour, with patients effectively mistaking GPs and EDs as substitutes [125]. Moreover, especially in rural areas, GP and ED services compete during office hours (based on wait times, not price) for patient attention [169].

It seems unclear whether patients genuinely know/understand the role and functions of an ED [170,171]. For example, Ref. [172] identified that patients who attended an ED with an inappropriate presenting complaint believed that EDs 'provide services for every kind of health problem'. **Misperceiving the role of an ED is not limited to patients.** An incorrect understanding of 'non-urgent ED visits' also exists amongst

¹⁵ The proportion of frequent users includes between 4.5% and 8% [165] and 20% [45] of all ED patients. On average, frequent ED users have higher-acuity complaints and are at greater risk for hospitalisation than occasional ED users [165]. 75% of frequent users of EDs visited GPs at least six times yearly, and more than 50% visited at least twelve times yearly [26].

¹⁶ For example, single parenting is the strongest predictor for a parent to seek care in an emergency department, stronger than low parental perceptions of their child's physical health or lacking satisfaction with their primary healthcare provider [167]. Caregivers are more likely to approach emergency departments, *ceteris paribus*. Reasons that parents name for choosing an ED over their child's primary care provider are long appointment waits and communication problems (accents and unhelpful primary care staff) leading to general dissatisfaction with their primary care provider [14,135]. Also, they complain about lacking efficiency in primary care. What they acknowledge, on the other hand, is that EDs are better resourced, exhibit a higher quality of care and are more convenient to use [14].

caregivers, primary care providers, and ED personnel [173]. This is reflected by substantial differences in the opinions on inappropriate ED use between health professionals (ED nurses, doctors, and paramedics) and patients [23,170,174,175]. Moreover, the literature suggests that ambulances are also prone to 'inappropriate' utilisation (using expert opinion and the benefit of hindsight for judgment). Figures show that the proportion of 'appropriate' ambulance users is between 50% and 68% [83,176].

4. Insights for modellers and healthcare planners

This paper opened by arguing that modellers (and decision-makers) still look 'in the wrong place' when fixing mediocre ED performance. Exploring the behavioural patterns of emergency patients and what urged them to present at a hospital-based emergency department, this article confirmed that the problem of ED is not ED. As well, Ref. [177] found that although a patient's perception of an emergency does not always correspond to the clinical interpretation, the primary factors prompting attendance (including GP unavailability, referral and specialist service need) suggest that, from the patient's perspective, most presentations to a hospital-based ED are justified (cf. section 3.3.1). This study provides a strategic approach to complement (traditional) operational flow-focused ED modelling and problem-solving. It expands the viewpoint for mathematical modelling and potential healthcare interventions.

4.1. How system design and patient behaviour are interrelated

The first glance is at the people (self-)presenting at an ED. We found that mistaking urgency for something life-threatening (requiring immediate attention), insecurity and anxiety are among the most potent motivators for seeking emergency care/treatment at an ED. The need for prompt relief (at odds with the wait time at other parts of the system) drives ED self-referral, bringing ease when anxious about one's health condition and insecure about the severity of the problem. For many patients, an emergency department appears to offer a higher quality of care than a primary-care-based emergency facility (cf. section 3.3.3). The results of our literature review provide insights that can be broken down along four dimensions, forming quality perceptions of care users: 'timeliness of care', 'convenience of access', 'availability of diagnostics and specialist services' and 'expertise of ED staff regarding emergency care'. In other words, an ED outranges an emergency primary care service in terms of perceived quality, accessibility, and convenience. EDs have iteratively shaped a reputation for being *the place to go* when immediate medical attention is needed.

This study finds two fundamental causes of variation in patient behaviour to be considered within a BOR framework. Firstly, patients are strongly affected by latent needs and emotions, making them behave non-rationally when navigating the healthcare system (categorised as 'inappropriate users' by providers); secondly, patient behaviour changes in response to experiences made during service delivery. In this context, both first-hand experiences and stories (conveyed by peers and other people within the patient's social network) matter. System design hence determines system performance via the response of those who have experienced the design.

4.2. How the excellent reputation of hospital-based emergency services backfires

The analysis of evidence-based demand patterns reveals a reinforcing 'ED use' cycle (outlined in section 3.3.3 and summarised in Fig. 8), which resonates with social cognitive theory [178]. As a consequence, reciprocal interaction among personal factors, behavioural elements and environmental influences shape perceptions of quality and govern human behaviour [179]. In this context, the perceived gap between ED performance and urgent primary care performance is crucial for patient

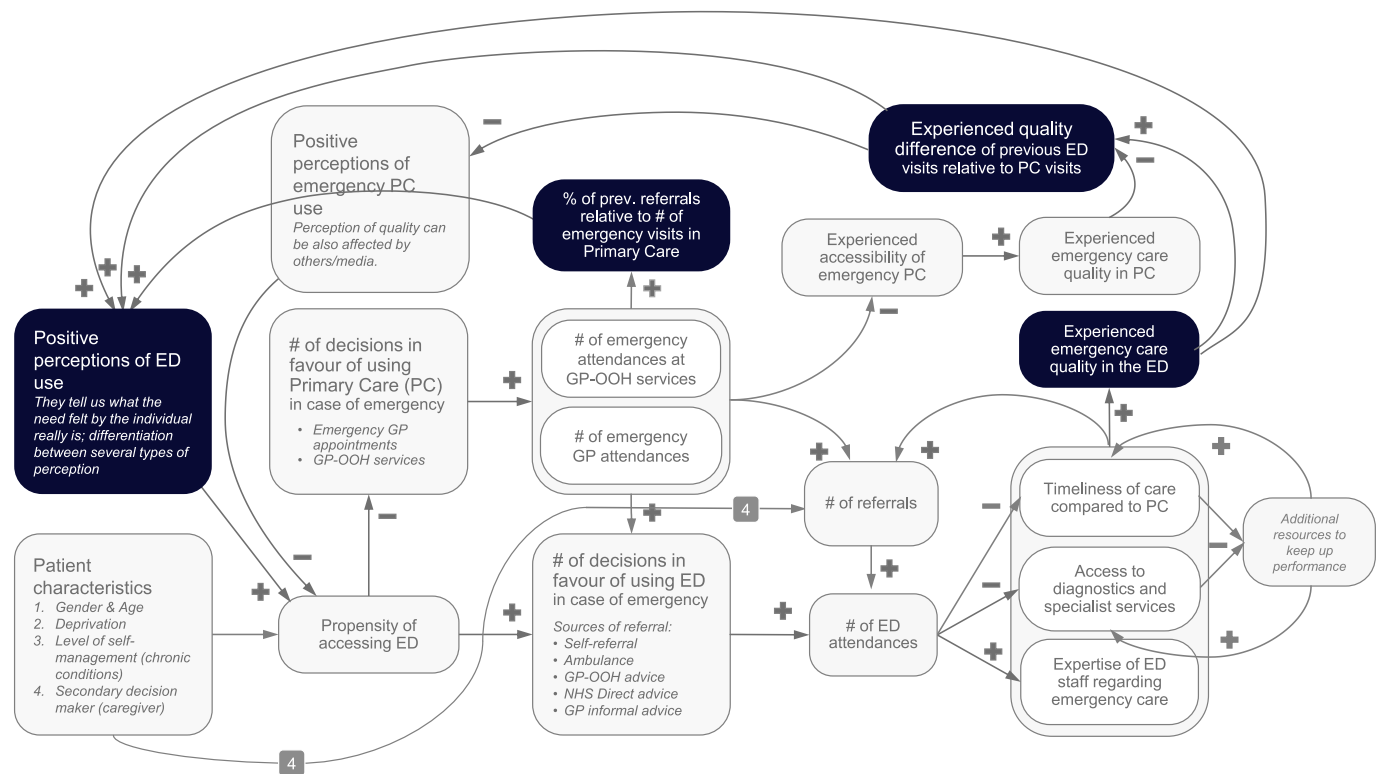


Fig. 10. Key elements of the recursive process of shaping perceptions of ED use. (The “+” and “-” signs indicate that variables affect one another positively (moving in the same direction) and negatively (moving in opposite directions), respectively.)

Table 3
Links between concepts supported by the medical literature.

From	To	Evidenced by
Experience gathered about ED relative to primary care	Perceptions of ED use	• Earlier experiences of care (including the accessibility of service and the expertise of practitioner) guide judgements about the urgency of need and their choices about what services to use [18] • Past experiences made within the health care system influence patient choice (recursively shaped) for or against self-presentation at an Emergency Department [18,134] • ED Patients with long-term conditions are knowledgeable, discriminating users of services and choose in an informed way between services [18] • Reasons cited by caregivers for choosing the ED over their child’s primary care provider (PCP) were long appointment waits, dissatisfaction with the PCP, communication problems (accents and unhelpful staff at PCP), efficiency, ED resources, convenience, quality of care, and ED expertise with children [14].

choice and behaviour (see Fig. 9).
A (relatively) higher reputation of an ED as an emergency care facility draws in more patients. Consequently, the ED workload increases, and staff indeed gain more experience in treating emergency patients (as compared to the primary care setting). ED patients, in turn, experience high-quality care in terms of the specialist services provided by expert

staff. If the service is not yet approaching the limits of its capacity, patients also experience a higher quality relating to timeliness and accessibility of care/diagnostics. Patients feel that their attitude about the supreme quality of ED services has been spot on, and emergency primary care is (indeed) inferior when it comes to emergency service delivery. The perceived gap between ED and primary care quality widens, with more patients developing a taste for hospital-based emergency services. This process only ends (balancing loop) when ED resources are constrained. However, with a nearly ‘automated’ allocation of additional funds (for ED resources) preventing exhaustive breaches of the 4-hour target, there will be no increased wait times and insufficient access to diagnostics deterring potential patients. The balancing loop that keeps up performance (4-hour target) contributes to the emergence of the reinforcing ‘ED use’ loop (see Fig. 5). With scarce funds more likely resourcing EDs, the perceived performance gap between hospital-based and primary-care-based emergency services further widens, and primary care’s reputation as a provider of high-quality emergency care erodes. GPs then devote their resources to offering elective appointments and indeed gather less experience in treating emergency patients. This focus reinforces existing perceptions about the lower quality of primary care emergency services.

4.3. How to pin down the ‘right’ scope of the model

Modelling isolated parts of the healthcare system makes sense only if the specific part includes both symptoms and root causes of a problem. If a root cause sits elsewhere in the system, such a model (no matter how sophisticated it is) will aid in finding a quick fix (to buy valuable time) but not a long-term solution. A BOR (modelling) framework applied to healthcare requires a broader definition of system boundaries and thus holds the potential to include more root causes. Then healthcare modelling is no longer confined to the ‘faulty’ part of the system (e.g., a single hospital-based emergency unit) but also includes other parts that influence patient flows.

Among others, this paper presents an evidence-based framework to study medically inappropriate ED use in an archetypical whole-system context, with the (non-tangible) interdependencies of two systems (primary care and hospital-based emergency services) made explicit. The framework can help (re)design primary care emergency services such that we generate a reinforcing cycle favouring primary care (rather than hospital-based emergency services), redirecting the patient flow. This endeavour needs to address people's perceptions about ED and primary care performance. One strategy could be designing, and funding primary care services tailored to the local community's health needs. The latter refers to shaping a service that considers (local) perceptions of security, accessibility and convenience alongside equity and dignity.

4.4. How to utilise our BOR framework to redesign services

Patient flows interact with information flows and behaviours and form a complex system [180]. We aim at better understanding how to intervene in a system characterised by feedback and nonlinearity. Therefore, we could match intertemporal ED demand patterns to opening times and staffing of primary care services incorporating service parameters like accessibility and convenience. For example, Ref. [181] estimated that improved accessibility of primary care services could reduce inappropriate ED admissions by 10%–15%. This is not a single result. Ref. [182] said that GP practices that offered seven-day service reduced A&E attendances by 9.9% (compared to a reference group of traditional practices). On weekends, A&E attendance of patients registered in a pilot practice even fell by 17.9%. Ref. [183] confirmed that more accessible GP services had to deal with fewer self-referred ED visits (per registered patient). Alongside expanding office hours, also subsidised staffing for offices in medically underserved areas was identified to remove access barriers [78]. A mixed-methods modelling approach (where perceptions result from an Agent-Based Model (ABM) that sits within a System Dynamics reflection of patient flows) could be deployed to simulate the effects of interventions like more prolonged office hours/more staff or shorter wait times for emergency primary care services. The ABM would capture the accumulation of perception over time, how this shapes the propensity to access ED (or primary care) and thus service use. The interaction effect of individual versus shared perceptions can be captured, as per [184]; and for intervention appraisal [185].

Unfortunately, supplying directly and extensively accessible primary care services is not the magic bullet to significantly reducing ED use [152,186,187]. For example, [188] report limited evidence of reducing non-urgent and semi-urgent emergency department visits in response to improved access to after-hours primary care. However, concentrating on the specific health needs of the local community would enable primary care providers to undertake economically viable investments in diagnostics, generate expertise and improve their reputation as an urgent care facility. Moreover, refining the interpersonal quality of care [189] such that patients feel taken seriously would improve patient satisfaction [190]. Spending time with the patient, listening, reassuring, communicating care pathways/choices and inviting the patient to participate in the decision-making process would make all the difference [159,190]. The effect of these changes on ED usage through the associated shift in patient experience/satisfaction would increase trust and improve service reputation (and could be estimated using simulations). In this context, BOR modelling could reflect the intertemporal growth or decline of the reputation of (and trust in) emergency care providers. Simulations could pin down the effect on service usage (brought about by a shift in patient experience and service reputation).

Our modelling framework maps the relationship between changes in experience, service reputation, and the number of patients and can evaluate another practical intervention. [191] find that nurses could safely reassign non-urgent patients to GP care (apart from cases with a borderline semi-urgent or non-urgent status). This would be an intervention deflecting potential ED patients but leaving the reputation of GP

services untouched. However, we look to make primary care more attractive for 'minor' complaints and not only ED less attractive (even though both interventions reduce the perceived quality gap between service providers). Hence, the effect of this intervention could be controversial and alludes to exploration using the BOR modelling framework. Another intervention pertains to bringing the service where the patients are, not the other way around. Employing a GP within a hospital-based emergency department has been identified as a cost-effective intervention (more effective, less expensive) compared to a standard ED service concerning process time and patient satisfaction [192]. However, this will not improve primary care's reputation but ED's standing as a 'we meet all patient needs' type of service. A model-based reputation analysis would enable modellers and planners to jointly evaluate the entire cost of the intervention, incorporating the forgone reputational change of primary care.

4.5. How to make primary care truly attractive

We believe that a whole-system approach to understanding ED use should start with a detailed analysis of the demographic patient characteristics of ED self-referrers and their (latent) needs. Analysing the local community's demand patterns would reveal specific healthcare requirements alongside intertemporal peaks of patient flow. Elements from Design Thinking (e.g., simple shadowing) could also give clues derived from observing patients and clinicians in an emergency. Analysing the local community's demand patterns would show specific healthcare needs (alongside intertemporal peaks of patient flow) and reveal which local healthcare needs we could more effectively (and efficiently) serve in a primary care setting. The next step would be to tailor services to the needs of the defined target groups (e.g., to redirect self-referrers to primary care services outside hospital premises).

For example, the literature review identified deprivation as a socio-demographic factor increasing ED activity (cf. section 3.1.2). Let us assume analysis of ED service users revealed a considerable number of patients from communities characterised by low income and educational levels and diverse cultural backgrounds who arrive with minor injuries that could be easily overseen outside hospital emergency care. An attractive offer could be an MIU within the community equipped with the necessary diagnostic and therapeutic instruments to inspect and treat minor injuries. This MIU could be staffed with health professionals among the nationalities represented in the local community. Culturally diverse staff would be familiar with the language and the cultural norms of the people they serve. Being treated by a native speaker could activate feelings of belonging, security, and relief.

This paper focused on patient perceptions in analysing ED demand patterns. A considerable number of patients arrive on referral or the advice of a provider. Further research could explore caregivers' perceptions and needs to fully understand the formation of ED demand patterns (based on the relative attractiveness of the service for help-seeking patients).

5. Limitations and conclusions

5.1. Limitations

The patient characteristics proposed may be available only for some populations. The behavioural OR model may need adjustments if it will be applied to a population with different characteristics. Consequently, the results of our study are only applicable for a subset of populations.

Another point is that in some countries, the urgent care system includes Minor Injury Units as part of A&E and ED departments. However, GPs work usually within appointment-based services but also cover emergency appointment slots. For non-appointment-based services such as urgent care minor injury units we have found less literature and may be underrepresented in our search. However, a community-led approach may be an attractive offer.

This research has stretched over a considerable amount of time, starting in early 2015 and being wrapped up nearly seven years later. Between 2015 and late 2016, we used academic literature, expert workshops, focused interviews, staff feedback and patient surveys to build a comprehensive System Dynamics (SD) representation of an unscheduled care system within the UK's National Health Service NHS [193]. Later, the causal loop representation guided decision-making and intra-hospital Quality Improvement (QI) programmes around patient safety, see, e.g., Ref. [194]. However, the core mechanism that drives ED attendance (at the front end of a hospital) has received less attention for decision-making in practice.

5.2. Conclusions

Healthcare services consist of multiple reinforcing and balancing feedback loops, making it hard to manage and navigate these complex systems. In this paper, we have presented a behaviour-focused framework for why patients present to an emergency department. Since it is mostly the undesired and unplanned use of ED services that raises discussions, we paid particular attention to the motives and perceived needs of (medically) non-urgent ED patients. Therefore, we have performed a structured literature review including Operational Research and Systems Thinking perspectives, which helped construct the said framework for accessing emergency services. Our work's managerial insights are at the strategic, tactical, and operational levels.

Strategic level – *Where* to allocate funding? Use the SD approach as a framework to inform where to allocate resources and design services and information to patients. It should be used to evaluate or experiment with changes in the healthcare system: if consideration is given to intervention at A, we expect an impact B. A user can better understand the reputational impact of changes on the system and the inherent behavioural dynamics that continue to shape the system beyond the intention of the intervention, disrupting the fragile balance of the reputations of primary-care-based and hospital-based emergency services. Because there is no gatekeeping to ED, this reputation matters.

Tactical level – *What* characteristics are needed to make primary-care-based emergency services attractive for medically non-urgent patients? Use the archetypes of behaviour displayed in the modelling framework to design the interventions needed to shift the balance of the system – to ‘ponder and deliberate before you make a move’ [195].

Operational level – *How* can this be put into practice? Use the proposed SD model as a framework for quantification of plans to intervene in the system, with empathy and compassion for our patients. Section 4 describes one possibility: employing staff to relate to the cultural and language needs of the population, thereby offering the opportunity for patients to use their native language. This approach provides the opportunity to evaluate the impact of fully deploying patient choice within the planning process, testing whether patient-centredness and dignity are possible even within an emergency setting within primary care (economies of scale for small areas served).

The framework presented in this paper uses a system dynamics methodology to capture how the various parts of the emergency healthcare system interact and create archetypical behaviour. Time spent waiting at an ED is a target *and* serves as a quality indicator for both those seeking access to emergency care and those managing and governing the healthcare system. These indicators provide a compelling message to the population and decision-makers that goes far beyond a performance measure. When fixing the omnipresent 4-hour target, the ED does not deplete its attractiveness relative to primary care (as crowding issues are suppressed). Future work will consider the two modelling strands that will be merged in a final workshop to validate the system archetypes that describe the crucial dynamics determining unscheduled care service usage. In this workshop, models A and B (see section 2) will be compared to highlight commonality and contradiction to validate the system archetypes derived from the models to describe unscheduled care service usage.

We encourage with our modelling framework to not focus on what we do not want to happen – but instead focus on what we want. The framework is a step away from again addressing the problem and not only the symptom: finally, we would ‘look in the right place’.

Author statement

DB and JM led on the conceptualisation, data curation and formal analysis. EK, DG, DB and JM worked together on the second part of the literature review. PH acquired funding for the study. DB and JM validated the models in the workshops with the various stakeholders. At varying extent, all authors contributed to the writing, review and editing.

Data availability

Data will be made available on request.

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References

- [1] Salmon A, Briscoe S, Rachuba S, Pitt M. A structured literature review of simulation modelling applied to Emergency Departments: current patterns and emerging trends. *Oper Res Health Care* 2018;19:1–13. <https://doi.org/10.1016/j.orhc.2018.01.001>. [Accessed 15 January 2021].
- [2] Mohiuddin S, Busby J, Savović J, Richards A, Northstone K, Hollingworth W, Donovan JL, Vasilakis C. Patient flow within UK emergency departments: a systematic review of the use of computer simulation modelling methods. *BMJ Open* 2017;7:e015007. <https://bmjopen.bmj.com/content/7/5/e015007>. [Accessed 16 January 2021].
- [3] Hulshof PJH, Kortbeek N, Boucherie RJ, Hans EW, Bakker PJM. Taxonomic classification of planning decisions in health care: a structured review of the state of the art in OR/MS. *Health Syst* 2012;1(2):129–75. <https://doi.org/10.1057/hs.2012.18>. [Accessed 16 January 2021].
- [4] Günlal MM, Pidd M. Discrete event simulation for performance modelling in health care: a review of the literature. *J Simulat* 2010;4(1):42–5. <https://doi.org/10.1057/jos.2009.25>. [Accessed 16 January 2021].
- [5] Lane DC, Monfeldt C, Rosenhead JV. Looking in the wrong place for healthcare improvements: a system dynamics study of an accident and emergency department. *J Oper Res Soc* 2000;51(5):518–31. <https://doi.org/10.1057/palgrave.jors.2600892>. [Accessed 16 January 2021].
- [6] Brailsford SC, Lattimer VA, Tarnaras P, Turnbull JC. Emergency and on-demand health care: modelling a large complex system. *J Oper Res Soc* 2004;55(1):34–42. <https://doi.org/10.1057/palgrave.jors.2601667>. [Accessed 16 January 2021].
- [7] Fone David, Hollinghurst Sandra, Temple Mark. Systematic review of the use and value of computer simulation modelling in population health and health care delivery. *J Publ Health Med* 2003;25(4):325–35.
- [8] Brailsford S, Harper PR, Patel B, Pitt M. An analysis of the academic literature on simulation and modeling in healthcare. *J Simulat* 3 (3: Special Issue: Simul Healthc Part 1): 130–140 2009. <https://doi.org/10.1057/jos.2009.10>. [Accessed 16 January 2021].
- [9] Hämäläinen RP, Luoma J, Saarinen E. On the importance of behavioral operational research: the case of understanding and communicating about dynamic systems. *Eur J Oper Res* 2013;228(3):623–34. <https://doi.org/10.1016/j.ejor.2013.02.001>. [Accessed 15 January 2021].
- [10] Franco LA, Hämäläinen RP. Engaging with behavioral operational research: on methods, actors and praxis. In: Kunc M, Malpass J, White L, editors. *Behavioral Operations research: theory, methodology and practice*. London: Palgrave Macmillan; 2016. p. 2–25. https://link.springer.com/chapter/10.1057%2F978-1-137-53551-1_1. [Accessed 16 January 2021].
- [11] Kunc Martin, Harper Paul, Katsikopoulos Konstantinos. A review of implementation of behavioural aspects in the application of OR in healthcare. *J Oper Res Soc* 2018:1044–72.
- [12] Howick Susan, Ackermann Fran. Mixing OR methods in practice: past, present and future directions. *Eur J Oper Res* 2011:503–11.
- [13] Agarwal S, Banerjee J, Baker R, Conroy S, Hsu R, Rashid A, Camosso-Stefinovic J, Sinfield P, Habiba M. Potentially avoidable emergency department attendance: interview study of patients' reasons for attendance. *Emerg Med J* 2012;29(12):e3. <https://doi.org/10.1136/emmermed-2011-200585>. [Accessed 21 October 2020].

- [14] Berry A, Brousseau D, Brotanek JM, Tomany-Korman S, Flores G. Why do parents bring children to the emergency department for non-urgent conditions? A qualitative study. *Ambul Pediatr* 2008;8(6):360–7.
- [15] Durand A-C, Palazzolo S, Tanti-Hardouin N, Gerbeaux P, Sambuc R, Gentile S. Nonurgent patients in emergency departments: rational or irresponsible consumers? Perceptions of professionals and patients. *BMC Res Notes* 2012;5:525. <https://bmresnotes.biomedcentral.com/articles/10.1186/1756-0500-5-525>. [Accessed 1 November 2020].
- [16] Göransson KE, De Waern M, Lindmarker P. Patients' pathway to emergency care: is the emergency department their first choice of care? *Eur J Emerg Med* 2013;20(1):45–50.
- [17] Grafstein E, Wilson D, Stenstrom R, Jones C, Tolson M, Poureslami I, Scheuermeyer FX. A regional survey to determine factors influencing patient choices in selecting a particular emergency department for care. *Acad Emerg Med* 2013;20(1):63–70.
- [18] Hunter C, Chew-Graham C, Langer S, Stenhoff A, Drinkwater J, Guthrie E, Salmon P. A qualitative study of patient choices in using emergency health care for long-term conditions: the importance of candidacy and recursivity. *Patient Educ Counsel* 2013;93(2):335–41. <https://doi.org/10.1016/j.pec.2013.06.001>. [Accessed 28 October 2020].
- [19] Lobachova L, Brown DFM, Sinclair J, Chang Y, Zink Thielker K, Nagurney JT. Patient and provider perceptions of why patients seek care in emergency departments. *J Emerg Med* 2014;46(1):104–12. <https://doi.org/10.1016/j.jemermed.2013.04.063>. [Accessed 28 October 2020].
- [20] Lowe R, Porter A, Snooks HA, Birdie EE. The association between illness representation profiles and use of unscheduled urgent and emergency health care services. *Br J Health Psychol* 2011;16(4):862–79. <https://doi.org/10.1111/j.2044-8287.2011.02023.x>. [Accessed 28 October 2020].
- [21] Lowthian JA, Smith C, Stoelwinder JU, Smit D, McNeil JJ, Cameron PA. Why older patients of lower clinical urgency choose to attend the emergency department. *Int Med J* 2013;43(1):59–65. <https://doi.org/10.1111/j.1445-5994.2012.02842.x>. [Accessed 29 October 2020].
- [22] Moll van Charante EP, ter Riet G, Bindels P. Self-referrals to the A&E department during out-of-hours: patients' motives and characteristics. *Patient Educ Counsel* 2008;70(2):256–65. <https://doi.org/10.1016/j.pec.2007.10.012>. [Accessed 29 October 2020].
- [23] Weiss AL, D'Angelo LJ, Rucker AC. Adolescent use of the emergency department instead of the primary care provider: who, why, and how urgent? *J Adolesc Health* 2014;54(4):416–20. <https://doi.org/10.1016/j.jadohealth.2013.09.009>. [Accessed 29 October 2020].
- [24] Wong W-B, Edgar G, Liddy C, Vaillancourt C. Can after-hours family medicine clinics represent an alternative to emergency departments? *Can Fam Physician* 2009;55(11):1106–7. <https://pubmed.ncbi.nlm.nih.gov/19910600/>. [Accessed 29 October 2020].
- [25] Zickafoose JS, DeCamp LR, Prosser LA. Association between enhanced access services in pediatric primary care and utilization of emergency departments: a national parent survey. *J Pediatr* 2013;163:1389–95. <https://doi.org/10.1016/j.jpeds.2013.04.050>. [Accessed 28 October 2020].
- [26] Chan BTB, Owens HJ. Frequent users of emergency departments. Do they also use family physicians' services? *Can Fam Physician* 2002;48:1654–60. <https://pubmed.ncbi.nlm.nih.gov/12449550/>. [Accessed 30 October 2020].
- [27] Chmiel C, Huber CA, Rosemann T, Zoller M, Eichler K, Sidler P, Senn O. Walk-ins seeking treatment at an emergency department or general practitioner out-of-hours service: a cross-sectional comparison. *BMC Health Serv Res* 2011;11:94.
- [28] Moll van Charante EP, van Steenwijk-Opdam PCE, Bindels PJE. Out-of-hours demand for GP care and emergency services: patients' choices and referrals by general practitioners and ambulance services. *BMC Fam Pract* 2007;8:46. <https://doi.org/10.1186/1471-2296-8-46>. [Accessed 29 October 2020].
- [29] Philips H, Remmen R, De Paep P, Buylaert W, Van Royen P. Out of hours care: a profile analysis of patients attending the emergency department and the general practitioner on call. *BMC Fam Pract* 2010;11:88.
- [30] Willems S, Peersman W, De Maeyer P, Buylaert W, De Maeseneer J, De Paep W. The impact of neighborhood deprivation on patients' unscheduled out-of-hours healthcare seeking behavior: a cross-sectional study. *BMC Fam Pract* 2013;14:136. <https://doi.org/10.1186/1471-2296-14-136>. [Accessed 28 October 2020].
- [31] Webster J, Watson RT. Analyzing the past to prepare for the future: writing a literature review. *MIS Q* 2002;26(2). xiii–xxiii. <https://www.jstor.org/stable/4132319>. [Accessed 20 February 2021].
- [32] Hart C. Doing a literature review: releasing the research imagination. 2nd. SAGE Publications Ltd; 2018.
- [33] Howick Susan, Eden Colin, Ackermann Fran, Williams Terry. Building confidence in models for multiple audiences: the modelling cascade. *Eur J Oper Res* 2008;106:8–83.
- [34] Lowthian JA, Curtis AJ, Cameron PA, Stoelwinder JU, Cooke MW, McNeil JJ. Systematic review of trends in emergency department attendances: an Australian perspective. *Emerg Med J* 2011;28:373–7. <https://doi.org/10.1136/emj.2010.099226>. [Accessed 18 July 2021].
- [35] Walsh M. Geographical factors and A&E attendance. *Nurs Stand* 1990;5(8):28–31. <https://doi.org/10.7748/ns.5.8.28.s41>. [Accessed 23 July 2021].
- [36] Carret ML, Fassa AC, Domingues MR. Inappropriate use of emergency services: a systematic review of prevalence and associated factors. *Cad Saúde Pública* 2009;25(1):7–28. <https://doi.org/10.1590/s0102-311x2009000100002>. [Accessed 23 July 2021].
- [37] Uscher-Pines L, Pines J, Kellermann A, Gillen E, Mehrotra A. Emergency department visits for nonurgent conditions: systematic literature review. *Am J Manag Care* 2013;19(1):47–59. <https://pubmed.ncbi.nlm.nih.gov/23379744/>. [Accessed 24 July 2021].
- [38] Guimarães Jr DS, Soares EJ, Júnior GF, Medeiros DD. Attributes and circumstances that induce inappropriate health services demand: a study of the health sector in Brazil. *BMC Health Serv Res* 2015;15:65. <https://doi.org/10.1186/s12913-015-0728-0>. [Accessed 25 July 2021].
- [39] George G, Jell C, Todd BS. Effect of population ageing on emergency department speed and efficiency: a historical perspective from a district general hospital in the UK. *Emerg Med J* 2006;23(5):379–83. <https://doi.org/10.1136/emj.2005.02979>. [Accessed 17 July 2021].
- [40] Aminzadeh F, Dalziel WB. Older adults in the emergency department: a systematic review of patterns of use, adverse outcomes, and effectiveness of interventions. *Ann Emerg Med* 2002;39(3):238–47. <https://doi.org/10.1067/mem.2002.121523>. [Accessed 17 July 2021].
- [41] Chu K, Brown A, Pillay R. Older patients' utilisation of emergency department resources: a cross-sectional study. *Aust Health Rev* 2001;24(3):44–52. <https://doi.org/10.1071/ah010044>. [Accessed 17 July 2021].
- [42] Singal BM, Hedges JR, Rousseau EW, Sanders AB, Berstein E, McNamara RM, Hogan TM. Geriatric patient emergency visits. Part I: comparison of visits by geriatric and younger patients. *Ann Emerg Med* 1992;21(7):802–7. [https://doi.org/10.1016/s0196-0644\(05\)81025-x](https://doi.org/10.1016/s0196-0644(05)81025-x). [Accessed 17 July 2021].
- [43] Clark MJ, Purdie J, FitzGerald GJ, Bischoff NG, O'Rourke PK. Predictors of demand for emergency prehospital care: an Australian study. *Prehospital Disaster Med* 1999;14(3):167–73. <https://pubmed.ncbi.nlm.nih.gov/10724741/>. [Accessed 21 July 2021].
- [44] Gruneir A, Silver MJ, Rochon PA. Emergency department use by older adults: a literature review on trends, appropriateness, and consequences of unmet health care needs. *Med Care Res Rev* 2011;68(2):131–55. <https://doi.org/10.1177/1077558710379422>. [Accessed 23 July 2021].
- [45] Kirby SE, Dennis SM, Jayasinghe UW, Harris MF. Patient related factors in frequent readmissions: the influence of condition, access to services and patient choice. *BMC Health Serv Res* 2010;10:216. <https://doi.org/10.1186/1472-6963-10-216>. [Accessed 30 October 2020].
- [46] Kraaijvanger N, Rijpsma D, van Leeuwen H, Edwards M. Self-referrals in the emergency department: reasons why patients attend the emergency department without consulting a general practitioner first-a questionnaire study. *Int J Emerg Med* 2015;8(1):46. <https://doi.org/10.1186/s12245-015-0096-x>. [Accessed 1 November 2020].
- [47] Eagle DJ, Rideout E, Price P, McCann C, Wonnacott E. Misuse of the emergency department by the elderly population: myth or reality? *J Emerg Nurs* 1993;19(3):212–8. <https://pubmed.ncbi.nlm.nih.gov/8510362/>. [Accessed 18 July 2021].
- [48] Pereira S, Oliveira e Silva A, Quintas M, Almeida J, Marujo C, Pizarro M, Angélico V, et al. Appropriateness of emergency department visits in a Portuguese university hospital. *Ann Emerg Med* 2001;37(6):580–6. <https://doi.org/10.1067/mem.2001.114306>. [Accessed 23 July 2021].
- [49] Carret ML, Fassa AG, Kawachi I. Demand for emergency health service: factors associated with inappropriate use. *BMC Health Serv Res* 2007;7:131. <https://doi.org/10.1186/1472-6963-7-131>. [Accessed 2 August 2021].
- [50] Unwin M, Kinsman L, Rigby S. Why are we waiting? Patients' perspectives for accessing emergency department services with non-urgent complaints. *Int Emerg Nurs* 2016;29:3–8. <https://doi.org/10.1016/j.ienj.2016.09.003>. [Accessed 31 October 2020].
- [51] van der Linden MC, Lindeboom R, van der Linden N, van den Brand CL, Lam RC, Lucas C, de Haan R, C J, Goslings. Self-referring patients at the emergency department: appropriateness of ED use and motives for self-referral, 7; 2014. p. 28. <https://doi.org/10.1186/s12245-014-0028-1>. [Accessed 1 November 2020].
- [52] Sempere-Selva T, Peiró S, Sendra-Pina P, Martínez-Espín C, López-Aguilera I. Inappropriate use of an accident and emergency department: magnitude, associated factors, and reasons—an approach with explicit criteria. *Ann Emerg Med* 2001;37(6):568–79. <https://doi.org/10.1067/mem.2001.113464>. [Accessed 23 July 2021].
- [53] Bianco A, Pileggi C, Angelillo IF. Non-urgent visits to a hospital emergency department in Italy. *Publ Health* 2003;117(4):250–5. [https://doi.org/10.1016/S0033-3506\(03\)00069-6](https://doi.org/10.1016/S0033-3506(03)00069-6). [Accessed 18 July 2021].
- [54] Williams CA, Haffizulla F. Factors associated with avoidable emergency department visits in broward county, Florida. *Cureus* 2021;13(6):e15593. <https://pubmed.ncbi.nlm.nih.gov/34277214/>. [Accessed 24 July 2021].
- [55] Bankart MJ, Baker R, Rashid A, Habiba M, Banerjee J, Hsu R, Conroy S, Agarwal S, Wilson A. Characteristics of general practices associated with emergency admission rates to hospital: a cross-sectional study. *J Emerg Med* 2011;28(7):558–63. <https://doi.org/10.1136/emj.2010.10854>. [Accessed 18 July 2021].
- [56] Public Health Information for Scotland. The Scottish burden of disease study, 2016. Deprivation Report, Edinburgh: NHS Health Scotland, 28; 2018. <https://www.scotpho.org.uk/media/1656/sbod2016-deprivation-report-aug18.pdf>. [Accessed 24 January 2021].
- [57] Tinson A, Tallack C. Deprivation and excess deaths. Reducing inequalities in mortality in England. <https://www.health.org.uk/news-and-comment/charts-and-infographics/deprivation-and-excess-deaths>. [Accessed 24 January 2021].
- [58] Hart JT. The inverse care law. *Lancet* 1971;297(7696):405–12. [https://doi.org/10.1016/S0140-6736\(71\)92410-X](https://doi.org/10.1016/S0140-6736(71)92410-X). [Accessed 24 January 2021].
- [59] Barnett K, Mercer SW, Norbury M, Watt G, Wyke S, Guthrie B. Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study. *Lancet* 2012;380(9836):37–43. [https://doi.org/10.1016/S0140-6736\(12\)60240-2](https://doi.org/10.1016/S0140-6736(12)60240-2). [Accessed 24 January 2021].

- [60] Naouri D, Ranchon G, Vuagnat A, Schmidt J, El Khoury C, Yordanov Y. Factors associated with inappropriate use of emergency departments: findings from a cross-sectional national study in France. *BMJ Qual Saf* 2020;29(6):449–64. <https://doi.org/10.1136/bmjqs-2019-009396>. [Accessed 18 July 2021].
- [61] Hull SA, Jones IR, Moser K. Factors influencing the attendance rate at accident and emergency departments in East London: the contributions of practice organization, population characteristics and distance. *J Health Serv Res Pol* 1997; 2(1):6–13. <https://doi.org/10.1177/135581969700200104>. [Accessed 1 November 2020].
- [62] Baker R, Bankart MJ, Rashid A, Banerjee J, Conroy S, Habiba M, Hsu R, Wilson A, Agarwal S, Camosso-Stefinovic J. Characteristics of general practices associated with emergency-department attendance rates: a cross-sectional study. *BMJ Qual Saf* 2011;20(11):953–8. <https://doi.org/10.1136/bmjqs.2010.050864>. [Accessed 20 July 2021].
- [63] Hong R, Baumann BM, Boudreaux ED. The emergency department for routine healthcare: race/ethnicity, socioeconomic status, and perceptual factors. *J Emerg Med* 2007;32(2):149–58. <https://doi.org/10.1016/j.jemermed.2006.05.042>. [Accessed 4 August 2021].
- [64] Hunt KA, Weber EJ, Showstack JA, Colby DC, Callahan ML. Characteristics of frequent users of emergency departments. *Ann Emerg Med* 2006;48(1):1–8. <https://doi.org/10.1016/j.annemergmed.2005.12.030>. [Accessed 31 October 2020].
- [65] Purdey S, Huntley A. Predicting and preventing avoidable hospital admissions: a review. *J Roy Coll Phys Edinb* 2013;43(4):340–4. <https://doi.org/10.4997/jrcpe.2013.415>. [Accessed 21 July 2021].
- [66] Johnson L, Cornish R, Boyd A, Macleod J. Socio-demographic patterns in hospital admissions and accident and emergency attendances among young people using linkage to NHS Hospital Episode Statistics: results from the Avon Longitudinal Study of Parents and Children. *BMC Health Serv Res* 2019;19(1):134. <https://doi.org/10.1186/s12913-019-3922-7>. [Accessed 23 July 2021].
- [67] NHS Digital. "Hospital accident & emergency activity 2019–20." 31 March. <https://digital.nhs.uk/data-and-information/publications/statistical/hospital-accident-emergency-activity/2019-20>. [Accessed 17 July 2021].
- [68] Lorig KR, Sobel DS, Ritter PL, Laurent D, Hobbs M. Effect of a self-management program on patients with chronic disease. *Effect Clin Pract* 2001;4(6):256–62. <https://pubmed.ncbi.nlm.nih.gov/11769298/>. [Accessed 28 October 2020].
- [69] FitzGerald G, Toloo G, Aitken P, Keijzers G, Scuffham P. Public use and perceptions of emergency departments: a population survey. *Emerg Med Australasia (EMA)* 2015;27(4):336–42. <https://doi.org/10.1111/1742-6723.12420>. [Accessed 1 November 2020].
- [70] Prince M, Worth C. A study of 'inappropriate' attendances to a paediatric Accident and Emergency Department. *J Publ Health Med* 1992;14(2):177–82. <https://pubmed.ncbi.nlm.nih.gov/1515201/>. [Accessed 21 July 2021].
- [71] Kalidindi S, Mahajan P, Thomas R, Sethuraman U. Parental perception of urgency of illness. *Pediatr Emerg Care* 2010;26(8):549–53. <https://doi.org/10.1097/PEC.0b013e3181ea71b3>. [Accessed 25 July 2021].
- [72] Pomerantz WJ, Schubert CJ, Atherton HD, Kotagal UR. Characteristics of nonurgent emergency department use in the first 3 months of life. *Pediatr Emerg Care* 2002;18(6):403–8. <https://doi.org/10.1097/00006565-200212000-00001>. [Accessed 28 July 2021].
- [73] Atenstaedt R, Gregory J, Price-Jones C, Newman J, Roberts L, Turner J. Why do patients with nonurgent conditions present to the Emergency Department despite the availability of alternative services? *Eur J Emerg Med* 2015;22(5):370–3. <https://doi.org/10.1097/MEJ.0000000000000224>. [Accessed 23 July 2021].
- [74] Chalder M, Montgomery A, Hollinghurst S, Cooke M, Munro J, Lattimer V, Sharp D, Salisbury C. Comparing care at walk-in centres and at accident and emergency departments: an exploration of patient choice, preference and satisfaction. *Emerg Med J* 2007;24(4):260–4. <https://doi.org/10.1136/emj.2006.042499>. [Accessed 28 October 2020].
- [75] Koce F, Randhawa G, Ochieng B. Understanding healthcare self-referral in Nigeria from the service users' perspective: a qualitative study of Niger state. *BMC Health Serv Res* 2019;19(1):209. <https://doi.org/10.1186/s12913-019-4046-9>. [Accessed 25 July 2021].
- [76] McGuigan T, Watson P. Non-urgent attendance at emergency departments. *J Emerg Nurs* 2010;18(6):34–8. <https://doi.org/10.7748/en.18.6.34.s18>. [Accessed 23 July 2021].
- [77] McKenna G, Rogers A, Walker S, Pope C. The influence of personal communities in understanding avoidable emergency department attendance: qualitative study. *BMC Health Serv Res* 2020;20(1):887. <https://doi.org/10.1186/s12913-020-05705-5>. [Accessed 17 July 2021].
- [78] Chin NP, Goepp JG, Malia T, Harris L, Poordabbagh A. Nonurgent use of a pediatric emergency department: a preliminary qualitative study. *Pediatr Emerg Care* 2006;22(1):22–7. <https://doi.org/10.1097/01.pec.00000195756.74328.21>. [Accessed 24 July 2021].
- [79] Howard MS, Davis BA, Anderson C, Cherry D, Koller P, Shelton D. Patients' perspective on choosing the emergency department for nonurgent medical care: a qualitative study exploring one reason for overcrowding. *J Emerg Nurs* 2005;31(5):429–35. <https://doi.org/10.1016/j.jen.2005.06.023>. [Accessed 17 July 2021].
- [80] Conlon C, Nicholson E, Rodríguez-Martín B, O'Donovan R, De Brún A, McDonnell T, Bury G, McAuliffe E. Factors influencing general practitioners decisions to refer Paediatric patients to the emergency department: a systematic review and narrative synthesis. *BMC Fam Pract* 2020;21(1):210. <https://doi.org/10.1186/s12875-020-01277-9>. [Accessed 28 October 2020].
- [81] Oslislo S, Heintze C, Schmiedhofer M, Möckel M, Schenk L, Holzinger F. How to decide adequately? Qualitative study of GPs' view on decision-making in self-referred and physician-referred emergency department consultations in Berlin, Germany. *BMJ Open* 2019;9(4):e026786. <https://doi.org/10.1136/bmjopen-2018-026786>. [Accessed 31 October 2020].
- [82] Beniu K, Boyle AA, Clarkson PJ. Emergency department crowding: prioritising quantified crowding measures using a Delphi study. *Emerg Med J* 2012;29: 868–71. <https://doi.org/10.1136/emj-2011-200646>. [Accessed 3 August 2021].
- [83] Jacob SL, Jacoby J, Heller M, Stoltzfus J. Patient and physician perspectives on ambulance utilization. *Prehosp Emerg Care* 2008;12(2):176–81. <https://doi.org/10.1080/10903120701710058>. [Accessed 21 October 2020].
- [84] Stanley R, Zimmerman J, Hashikawa C, Clark SJ. Appropriateness of children's nonurgent visits to selected Michigan emergency departments. *Pediatr Emerg Care* 2007;23(8):532–6. <https://doi.org/10.1097/PEC.0b013e318128f84a>. [Accessed 28 July 2021].
- [85] Ng JY, Fatovich DM, Turner VF, Wurmell JA, Skevington SA, Phillips MR. Appropriateness of healthdirect referrals to the emergency department compared with self-referrals and GP referrals. *Med J Aust* 2012;197(9):498–502. <https://doi.org/10.5694/mja12.10689>. [Accessed 21 July 2021].
- [86] Rinderknecht AS, Ho M, Matykievicz P, Grupp-Phelan JM. Referral to the emergency department by a primary care provider predicts severity of illness. *Pediatrics* 2010;126(5):917–24. <https://doi.org/10.1542/peds.2010-0364>. [Accessed 23 July 2021].
- [87] Patel S, Dubinsky I. Outcomes of referrals to the ED by family physicians. *AJEM (Am J Emerg Med)* 2002;20(3):144–50. <https://doi.org/10.1053/ajem.2002.32638>. [Accessed 23 July 2021].
- [88] Cheek C, Allen P, Shires L, Parry D, Ruigrok M. Low-acuity presentations to regional emergency departments: what is the issue? *Emerg Med Australasia (EMA)* 2016;28(2):145–52. <https://doi.org/10.1111/1742-6723.12526>. [Accessed 1 November 2020].
- [89] Stewart B, Fairhurst R, Markland J, Marzouk O. Review of calls to NHS Direct related to attendance in the paediatric emergency department. *Emerg Med J* 2006;23(12):911–4.
- [90] Fourny M, Lucas AS, Belle L, Debatty G, Casez P, Bouvaist H, François P, Vanzetto G, Labarère J. Inappropriate dispatcher decision for emergency medical service users with acute myocardial infarction. *AJEM (Am J Emerg Med)* 2011;29(1):37–42. <https://doi.org/10.1016/j.ajem.2009.07.008>. [Accessed 4 August 2021].
- [91] Gibson Amy, Randall Deborah, Tran Duong T, Byrne Mary, Lawler Anthony, Havard Alys, Robinson Maureen, Louisa R Jorm. Emergency department attendance after telephone triage: a population-based data linkage study. *Health Serv Res* 2018;53(2):1137–62. <https://doi.org/10.1111/1475-6773.12692>. [Accessed 29 October 2020].
- [92] Tran DT, Gibson A, Randall D, Havard A, Byrne M, Robinson M, Lawler A, Jorm LR. Compliance with telephone triage advice among adults aged 45 years and older: an Australian data linkage study. *BMC Health Serv Res* 2017;17:512. <https://doi.org/10.1186/s12913-017-2458-y>. [Accessed 29 October 2020].
- [93] Labarère J, Torres JP, Francois P, Fourny M, Argento P, Gensburger X, Menthonnex P. Patient compliance with medical advice given by telephone. *AJEM (Am J Emerg Med)* 2003;21(4):288–92. [https://doi.org/10.1016/s0735-6757\(03\)00087-1](https://doi.org/10.1016/s0735-6757(03)00087-1). [Accessed 23 July 2021].
- [94] Kempe A, Bunik M, Ellis J, Magid D, Hegarty T, Dickinson LM, Steiner JF. How safe is triage by an after-hours telephone call center? *Pediatrics* 2006;118(2): 457–63. <https://doi.org/10.1542/peds.2005-3073>. [Accessed 18 July 2021].
- [95] Qiong OU. A brief introduction to perception. *Stud Lit Lang* 2017;15(4):18–28. <https://doi.org/10.3968/10055>. [Accessed 3 August 2021].
- [96] Schacter Daniel. *Psychology*. Third European edition published 2020. London: Red Globe Press; 2019.
- [97] Sanders J. A review of health professional attitudes and patient perceptions on 'inappropriate' accident and emergency attendances. The implications for current minor injury service provision in England and Wales. *J Adv Nurs* 2000;31(5): 1097–105. <https://doi.org/10.1046/j.1365-2648.2000.01379.x>. [Accessed 18 July 2021].
- [98] Ekwall A. Acuity and anxiety from the patient's perspective in the emergency department. *J Emerg Nurs* 2013;39(6):534–8. <https://doi.org/10.1016/j.jen.2010.10.003>. [Accessed 4 August 2021].
- [99] Welsh Government. A healthier Wales: our plan for health and social care. Welsh Gov Serv Inf 2019. <https://gov.wales/sites/default/files/publications/2019-10/a-healthier-wales-action-plan.pdf>. [Accessed 3 August 2021].
- [100] NHS Wales. Health in Wales. <https://www.wales.nhs.uk/nhswalesaboutus/theco-reprinciplesofnhswales>. [Accessed 3 August 2021].
- [101] NHS England/Nursing Directorate. "Compassion in practice – one year on." *NHS England*. 26 November. <https://www.england.nhs.uk/wp-content/uploads/2016/05/cip-one-year-on.pdf>. [Accessed 3 August 2021].
- [102] NHS Services. <https://www.nhs.uk/nhs-services/urgent-and-emergency-care-services/when-to-go-to-a-e/>. [Accessed 19 July 2021].
- [103] Olsson M, Hansagi H. Repeated use of the emergency department: qualitative study of the patient's perspective. *Emerg Med J* 2001;18(6):430–4. <https://doi.org/10.1136/emj.18.6.430>. [Accessed 18 July 2021].
- [104] Field S, Lantz A. Emergency department use by CTAS Levels IV and V patients. *Can J Emerg Med* 2006;8(5):317–22. <https://doi.org/10.1017/s1481803500013968>. [Accessed 28 July 2021].
- [105] Heinert SW, Mumford M, Kim SE, Hossain MM, Amashta ML, Massey MA. User characteristics of a low-acuity emergency department alternative for low-income patients. *West J Emerg Med* 2000;21(6):162–71. <https://doi.org/10.5811/westjem.2020.8.47970>. [Accessed 4 August 2021].

- [106] Minderhout RM, Venema P, Vos HMM, Kant J, Bruijnzeels MA, Numans ME. Understanding people who self-referred in an emergency department with primary care problems during office hours: a qualitative interview study at a Daytime General Practice Cooperative in two hospitals in the Hague, The Netherlands. *BMJ Open* 2019;9:e029853. <https://doi.org/10.1136/bmjopen-2019-029853>. [Accessed 31 October 2020].
- [107] Ragin DF, Hwang U, Cydulka RK, Holson D, Jr Haley LL, Richards CF, Becker BM, Richardson LD, Emergency Medicine Patients' Access To Healthcare (EMPATH) Study Investigators. Reasons for using the emergency department: results of the EMPATH Study. *Acad Emerg Med* 2005;12(12):1158–66. <https://doi.org/10.1197/j.aem.2005.06.030>. [Accessed 21 July 2021].
- [108] Lozano K, Ogbu UC, Amin A, Chakravarthy B, Anderson CL, Lotfipour S. Patient motivators for emergency department utilization: a pilot cross-sectional survey of uninsured admitted patients at a university teaching hospital. *J Emerg Med* 2015;49(2):203–210.e3. <https://doi.org/10.1016/j.jemermed.2015.03.019>. [Accessed 25 July 2021].
- [109] Murphy AW. 'Inappropriate' attenders at accident and emergency departments I: definition, incidence and reasons for attendance. *Fam Pract* 1998;15(1):23–32. <https://pubmed.ncbi.nlm.nih.gov/9527294/>. [Accessed 27 July 2021].
- [110] Burchard R, Oikonomou V, Soost C, Zoremba M, Graw JA. Indicated trauma emergency department utilization - a comparison between patients' self-assessment and professional evaluation. *Int Emerg Nurs* 2019;44:30–4. <https://doi.org/10.1016/j.ienj.2019.02.006>. [Accessed 4 August 2021].
- [111] Nelson J. Why patients visit emergency units rather than use primary care services. *Emerg Nurse* 2011;19(1):32–6. <https://doi.org/10.7748/en.2011.04.19.1.32.c8448>. [Accessed 30 October 2020].
- [112] Afilalo M, Guttman A, Colacone A, Dankoff J, Tselios C, Beaudet M, Lloyd J. Emergency department use and misuse. *J Emerg Med* 1995;13(2):259–64.
- [113] Toloo G, Aitken P, Crilly J, FitzGerald G. Agreement between triage category and patient's perception of priority in emergency departments. *Scand J Trauma Resuscitation Emerg Med* 2016;24:126. <https://doi.org/10.1186/s13049-016-0316-2>. [Accessed 31 October 2020].
- [114] Alyasin A, Douglas C. Reasons for non-urgent presentations to the emergency department in Saudi Arabia. *Int Emerg Nurs* 2014;22(4):220–5. <https://doi.org/10.1016/j.ienj.2014.03.001>. [Accessed 1 November 2020].
- [115] Gifford MJ, Franaszek JB, Gibson G. Emergency physicians' and patients' assessments: urgency of need for medical care. *Ann Emerg Med* 1980;9(10):502–7. [https://doi.org/10.1016/s0196-0644\(80\)80187-9](https://doi.org/10.1016/s0196-0644(80)80187-9). [Accessed 18 July 2021].
- [116] Foldes SS, Fischer LR, Kaminsky K. What is an emergency? The judgments of two physicians. *Ann Emerg Med* 1994;23(4):833–40. [https://doi.org/10.1016/s0196-0644\(94\)70322-1](https://doi.org/10.1016/s0196-0644(94)70322-1). [Accessed 19 July 2021].
- [117] Richardson S, Ardagh M, Hider P. New Zealand health professionals do not agree about what defines appropriate attendance at an emergency department. *N Z Med J* 2006;119(1232):U1933. <https://pubmed.ncbi.nlm.nih.gov/16633392/>. [Accessed 23 July 2021].
- [118] Sancton K, Sloss L, Berkowitz J, Strydom N, McCracken R. Low-acuity presentations to the emergency department: reasons for and access to other health care providers before presentation. *Can Fam Physician* 2018;64(8):e354–60. <https://pubmed.ncbi.nlm.nih.gov/30108090/>. [Accessed 24 July 2021].
- [119] Keizer Beaché S, Guell C. Non-urgent accident and emergency department use as a socially shared custom: a qualitative study. *Emerg Med J* 2016;33:47–51. <https://doi.org/10.1136/emmermed-2014-204039>. [Accessed 4 August 2021].
- [120] Stark O, Behrens DA. An evolutionary edge of knowing less (or: on the 'curse' of global information). *J Evol Econ* 2010;20(1):77–94. <https://doi.org/10.1007/s00191-009-0137-9>. [Accessed 16 January 2021].
- [121] Durand A-C, Gentile S, Devictor B, Palazzolo S, Vignally P, Gerbeaux P, Sambuc R. ED patients: how nonurgent are they? Systematic review of the emergency medicine literature. *Am J Emerg Med* 2011;29(3):333–45.
- [122] Petitot C, Chapuis F, Touzet S, Fournier G, Bonnefoy M. Inappropriate consultation of elderly subjects attending an emergency ward of a university hospital: a prospective study. *Revue de Geriatrie* 2008;33(9):761–9. <https://www.scopus.com/record/display.uri?eid=2-s2.0-58149239735&origin=inward&txid=898fa6a78752caa08902294bd92d52f9>. [Accessed 28 July 2021].
- [123] Oktay C, Cete Y, Eray O, Pekdemir M, Gunerli A. Appropriateness of emergency department visits in a Turkish university hospital. *Croat Med J* 2003;44(5):585–91. <https://pubmed.ncbi.nlm.nih.gov/14515418/>. [Accessed 28 July 2021].
- [124] Al Shehr AM, Thomas M, Al Ghulhi AMA. Use and misuse of emergency services at king Fahad hospital, Riyadh, Saudi Arabia. *Saudi Med J* 1992;13(1):21–4. <https://pesquisa.bvsalud.org/portal/resource/pt/emr-26348>. [Accessed 17 July 2021].
- [125] Nagree Y, Camarda VJ, Fatovich DM, Cameron PA, Dey I, Gosbell AD, McCarthy SM, Mountain D. Quantifying the proportion of general practice and low-acuity patients in the emergency department. *Med J Aust* 2013;198(11):612–5. <https://doi.org/10.5694/mja12.11754>. [Accessed 31 October 2020].
- [126] Rissbacher C, Rissbacher C, Röhlich S, Meraner D. Gatekeeping in the health care system: how to predict justified and respective non-justified visits to emergency departments? *J Publ Health* 2011;5. <https://www.springermedizin.de/de/gatkeeping-in-the-health-care-system-how-to-predict-justified-a/8805016>. [Accessed 28 July 2021].
- [127] Tsai JCH, Chenc W-Y, Liang Y-W. Nonemergent emergency department visits under the national health insurance in Taiwan. *Health Pol* 2011;100(2–3):189–95. <https://doi.org/10.1016/j.healthpol.2010.10.007>. [Accessed 28 July 2021].
- [128] Kraaijvanger N, van Leeuwen H, Rijpsma D, Edwards M. Motives for self-referral to the emergency department: a systematic review of the literature. *BMC Health Serv Res* 2016;16(1):685. <https://doi.org/10.1186/s12913-016-1935-z>. [Accessed 31 October 2020].
- [129] Lowe RA, Bindman AB. Judging who needs emergency department care: a prerequisite for policy-making. *AJEM (Am J Emerg Med)* 1997;15(2):133–6. [https://doi.org/10.1016/s0735-6757\(97\)90083-8](https://doi.org/10.1016/s0735-6757(97)90083-8). [Accessed 4 August 2021].
- [130] Afilalo J, Marinovich A, Afilalo M, Colacone A, Léger R, Unger B, Giguère C. Nonurgent emergency department patient characteristics and barriers to primary care. *Acad Emerg Med* 2004;11(12):1302–10. <https://doi.org/10.1197/j.aem.2004.08.03>. [Accessed 17 July 2021].
- [131] Gentile S, Vignally P, Durand AC, Gainotti S, Sambuc R, Gerbeaux P. Nonurgent patients in the emergency department? A French formula to prevent misuse. *BMC Health Serv Res* 2010;10:66. <https://doi.org/10.1186/1472-6963-10-66>. [Accessed 28 July 2021].
- [132] Coster JE, Turner JK, Bradbury D, Cantrell A. Why do people choose emergency and urgent care services? A rapid review utilizing a systematic literature search and narrative synthesis. *Acad Emerg Med* 2017;24(9):1137–49. <https://doi.org/10.1111/aceem.13220>. [Accessed 31 October 2020].
- [133] Rassin M, Nasie A, Bechor Y, Weiss G, Silner D. The characteristics of self-referrals to ER for non-urgent conditions and comparison of urgency evaluation between patients and nurses. *Accid Emerg Nurs* 2006;14(1):20–6. <https://doi.org/10.1016/j.aen.2005.05.005>. [Accessed 21 July 2021].
- [134] Booker MJ, Simmonds RL, Purdy S. Patients who call emergency ambulances for primary care problems: a qualitative study of the decision-making process. *Emerg Med J* 2014;31(6):448–52. <https://doi.org/10.1136/emmermed-2012-202124>. [Accessed 4 August 2021].
- [135] Nicholson E, McDonnell T, De Brún A, Barrett M, Bury G, Collins C, Hensley C, McAuliffe E. Factors that influence family and parental preferences and decision making for unscheduled paediatric healthcare - systematic review. *BMC Health Serv Res* 2007;20(1):663. <https://doi.org/10.1186/s12913-020-05527-5>. [Accessed 28 October 2020].
- [136] Siminski P, Bezzina AJ, Lago LP, Eagar K. Primary care presentations at emergency departments: rates and reasons by age and sex. *Aust Health Rev* 2008;32(4):700–9. <https://doi.org/10.1071/ah080700>. [Accessed 19 July 2021].
- [137] Bengier JR, Jones V. A study of patient actions prior to emergency hospital admission. *Emerg Med J* 2008;25(7):424–7. <https://doi.org/10.1136/emj.2007.050856>. [Accessed 21 July 2021].
- [138] van Uden CJ, Winkens RA, Wesseling G, Fiolet HF, van Schayck OC, Crebolder HF. The impact of a primary care physician cooperative on the caseload of an emergency department: the Maastricht integrated out-of-hours service. *J Gen Intern Med* 2005;20(7):612–7. <https://doi.org/10.1111/j.1525-1497.2005.0091.x>. [Accessed 1 November 2020].
- [139] Davison AG, Hildrey AC, Floyer MA. Use and misuse of an accident and emergency department in the East End of London. *J R Soc Med* 1983;76(1):37–40. <https://pubmed.ncbi.nlm.nih.gov/6827496/>. [Accessed 18 July 2021].
- [140] Kibar CR, Borland ML. Too long in the tooth: a descriptive study of adults presenting to a pediatric emergency department. *Pediatr Emerg Care* 2006;22(5):321–33. <https://doi.org/10.1097/01.pec.00000215140.36662.29>. [Accessed 4 August 2021].
- [141] Cooper A, Carson-Stevens A, Hughes T, Edwards A. Is streaming patients in emergency departments to primary care services effective and safe? *BMJ* 2020;368:m462.
- [142] Billittier AJ, Lerner EB, Moscati RM, Young G. Triage, transportation, and destination decisions by out-of-hospital emergency care providers. *Prehospital Disaster Med* 1998;13(2–4):22–7. <https://pubmed.ncbi.nlm.nih.gov/10346404/>. [Accessed 3 August 2021].
- [143] Lega F, Mengoni A. Why non-urgent patients choose emergency over primary care services? Empirical evidence and managerial implications. *Health Pol* 2008;88(2–3):326–38. <https://doi.org/10.1016/j.healthpol.2008.04.005>. [Accessed 19 July 2021].
- [144] Attenstaed K, Evans K. Emergency departments: better safe than sorry? *Emerg Nurse* 2015;23(4):20–2. <https://doi.org/10.7748/en.23.4.20.e1461>. [Accessed 2 August 2021].
- [145] de Valk J, Taal EM, Nijhoff MS, Harms MH, Lieshout EM, Patka P, Rood PP. Self-referred patients at the Emergency Department: patient characteristics, motivations, and willingness to make a copayment. *Int J Emerg Med* 2014;7:30. <https://doi.org/10.1186/s12245-014-0030-7>. [Accessed 21 July 2021].
- [146] Vázquez Quiroga B, Pardo Moreno G, Fernández Cantalejo G, Canals Aracil M, Delgado Nicolás MA, Navas Alonso M. "¿Por qué acuden nuestros pacientes a urgencias del hospital? Why do our Patients Attend Hospital Emergency Departments?". *Atención Primaria* 2000;25(3):172–5. [https://doi.org/10.1016/S0212-6567\(00\)78482-4](https://doi.org/10.1016/S0212-6567(00)78482-4). [Accessed 23 July 2021].
- [147] Northington WE, Brice JH, Zou B. Use of an emergency department by nonurgent patients. *Am J Emerg Med* 2005;23(2):131–7. <https://doi.org/10.1016/j.ajem.2004.05.006>. [Accessed 28 October 2020].
- [148] Shearer FM, Bailey PM, Hicks BL, Harvey BV, Monterosso L, Rogers G, Ross-Adjie IR. Why do patients choose to attend a private emergency department? *Emerg Med Australasia (EMA)* 2015;27(1):62–5. <https://doi.org/10.1111/1742-6723.12330>. [Accessed 23 July 2021].
- [149] Koziol-McLain J, Price DW, Weiss B, Quinn AA, Honigman B. Seeking care for nonurgent medical conditions in the emergency department: through the eyes of the patient. *J Emerg Nurs* 2000;26(6):554–63. <https://doi.org/10.1067/men.2000.11090>. [Accessed 18 July 2021].
- [150] Rieffe C, Oosterveld P, Wijkkel D, Wiefferink C. Reasons why patients bypass their GP to visit a hospital emergency department. *Accid Emerg Nurs* 1999;7(4):217–25. [https://doi.org/10.1016/s0965-2302\(99\)80054-x](https://doi.org/10.1016/s0965-2302(99)80054-x). [Accessed 1 November 2020].

- [151] Smith V, Mustafa M, Grafstein E, Doan Q. Factors influencing the decision to attend a pediatric emergency department for Nonemergent complaints. *Pediatr Emerg Care* 2015;31(9):640–4. <https://doi.org/10.1097/PEC.0000000000000392>. [Accessed 4 August 2021].
- [152] Guttman N, Zimmerman DR, Nelson MS. The many faces of access: reasons for medically nonurgent emergency department visits. *J Health Polit Pol Law* 2003;28(6):1089–120. <https://doi.org/10.1215/03616878-28-6-1089>. [Accessed 18 July 2021].
- [153] Allen P, Cheek C, Foster S, Ruigrok M, Wilson D, Shires L. Low acuity and general practice-type presentations to emergency departments: a rural perspective. *Emerg Med Australasia (EMA)* 2005;27(2):113–8. <https://doi.org/10.1111/1742-6723.12366>. [Accessed 17 July 2021].
- [154] Steele S, Anstett D, Milne WK. Rural emergency department use by CTAS IV and V patients. *Can J Emerg Med* 2008;10(3):209–14. <https://doi.org/10.1017/s1481803500010125>. [Accessed 28 July 2021].
- [155] Palmer CD, Jones KH, Jones PA, Polacz SV, Evans GWL. Urban legend versus rural reality: patients' experience of attendance at accident and emergency departments in west Wales. *Emerg Med J* 2005;22(3):165–70. <https://doi.org/10.1136/emj.2003.007674>. [Accessed 21 July 2021].
- [156] Krug SE. Access and use of emergency services: inappropriate use versus unmet need. *Clin Pediatr Emerg Med* 1999;1(1):35–44. [https://doi.org/10.1016/S1522-8401\(99\)90007-1](https://doi.org/10.1016/S1522-8401(99)90007-1). [Accessed 18 July 2021].
- [157] Cheek JA, Braitberg G, West SCA. Why do children present to emergency departments? Exploring motivators and measures of presentation appropriateness for children presenting to a paediatric emergency department. *J Paediatr Child Health* 2017;53(5):451–7. <https://doi.org/10.1111/jpc.13482>. [Accessed 31 October 2020].
- [158] Krebs LD, Kirkland SW, Chetram R, Nikel T, Voaklander B, Davidson A, Holroyd B, et al. Low-acuity presentations to the emergency department in Canada: exploring the alternative attempts to avoid presentation. *J Emerg Med* 2017;34(4):249–55. <https://doi.org/10.1136/emj.2016-205756>. [Accessed 25 July 2021].
- [159] Ablard S, Kuczwski M, Sampson FC, Mason SM. What does the ideal urgent and emergency care system look like? A qualitative study of service user perspectives. *Emerg Med J* 2020;37(4):200–5. <https://doi.org/10.1136/emj.2019-208921>. [Accessed 3 August 2021].
- [160] Rajpar SF, Smith MA, Cooke MW. Study of choice between accident and emergency departments and general practice centres for out of hours primary care problems. *J Accid Emerg Med* 2000;17:18–21. <https://doi.org/10.1136/emj.17.1.18>. [Accessed 19 July 2021].
- [161] Ludwick A, Fu R, Warden C, Lowe RA. Distances to emergency department and to primary care provider's office affect emergency department use in children. *Acad Emerg Med* 2009;16(5):411–7. <https://doi.org/10.1111/j.1553-2712.2009.00395.x>. [Accessed 19 July 2021].
- [162] Institute of Medicine (US) Committee on Quality of Health Care in America. Crossing the quality chasm: a new health system for the 21st century. Washington, DC: National Academies Press (US); 2001. <https://doi.org/10.17226/10027>. [Accessed 7 November 2020].
- [163] Senge Peter M. *The Fifth Discipline: the art and practice of the learning organization*. 2nd. London, UK: Random House Business; 2006.
- [164] Boushy D, Dubinsky I. Primary care physician and patient factors that result in patients seeking emergency care in a hospital setting: the patient's perspective. *J Emerg Med* 1999;17(3):405–12. [https://doi.org/10.1016/s0736-4679\(99\)00015-3](https://doi.org/10.1016/s0736-4679(99)00015-3). [Accessed 28 July 2021].
- [165] LaCalle E, Rabin E. Frequent users of emergency departments: the myths, the data, and the policy implications. *Ann Emerg Med* 2010;56(1):42–8. <https://doi.org/10.1016/j.annemergmed.2010.01.032>. [Accessed 1 November 2020].
- [166] O' Cathain A, Connell J, Long J, Coster J. 'Clinically unnecessary' use of emergency and urgent care: a realist review of patients' decision making. *Health Expect* 2020;23(1):19–40. <https://doi.org/10.1111/hex.12995>. [Accessed 28 October 2020].
- [167] Zandieh SO, Gershel JC, Briggs WM, Mancuso CA, Kuder JM. Revisiting predictors of parental health care-seeking behaviors for nonurgent conditions at one inner-city hospital. *Pediatr Emerg Care* 2009;25(4):238–43. <https://doi.org/10.1097/pec.0b013e31819e350e>. [Accessed 28 October 2020].
- [168] O' Cathain A, Knowles E, Munro J, Nicholl J. Exploring the effect of changes to service provision on the use of unscheduled care in England: population surveys. *BMC Health Serv Res* 2007;7:61. <https://doi.org/10.1186/1472-6963-7-61>. [Accessed 28 October 2020].
- [169] Neil Amanda, de Graaff Barbara. Need, want and demand: what is really happening with low-acuity presentations? *Emerg Med Australasia (EMA)* 2016;28(3):363–4. <https://doi.org/10.1111/1742-6723.12591>. [Accessed 28 July 2021].
- [170] Morgans A, Burgess S. Judging a patient's decision to seek emergency healthcare: clues for managing increasing patient demand. *Aust Health Rev* 2012;36(1):110–4. <https://doi.org/10.1071/AH10921>. [Accessed 28 October 2020].
- [171] Selasawati HG, Naing L, Wan Aasim WA, Winn T, Rusli BN. Factors associated with inappropriate utilisation of emergency department services. *Asia Pac J Publ Health* 2007;19(2):29–36. <https://doi.org/10.1177/10105395070190020601>. [Accessed 28 July 2021].
- [172] Şimşek P, Gürsoy A. Turkish health care providers' views on inappropriate use of emergency department: who, when and why? *Int Emerg Nurs* 2016;27:31–6. <https://doi.org/10.1016/j.ienj.2015.11.004>. [Accessed 28 July 2021].
- [173] Salami O, Salvador J, Vega R. Reasons for nonurgent pediatric emergency department visits: perceptions of health care providers and caregivers. *Pediatr Emerg Care* 2012;28(1):43–6. <https://doi.org/10.1097/PEC.0b013e31823f2412>. [Accessed 30 October 2020].
- [174] Breen BM, McCann M. Healthcare providers attitudes and perceptions of 'inappropriate attendance' in the Emergency Department. *Int Emerg Nurs* 2013;21(3):180–5. <https://doi.org/10.1016/j.ienj.2012.08.006>. [Accessed 30 October 2020].
- [175] Masso M, Bezzina AJ, Siminski P, Middleton R, Eagar K. Why patients attend emergency departments for conditions potentially appropriate for primary care: reasons given by patients and clinicians differ. *Emerg Med Australasia (EMA)* 2007;19(4). <https://doi.org/10.1111/j.1742-6723.2007.00968.x>. [Accessed 30 October 2020].
- [176] Morris DL, Cross AB. Is the emergency ambulance service abused? *Br Med J* 1980;281(6233):121–3. <https://doi.org/10.1136/bmj.281.6233.121>. [Accessed 19 July 2021].
- [177] Callen JL, Blundell L, Prigmet M. Emergency department use in a rural Australian setting: are the factors prompting attendance appropriate? *Aust Health Rev* 2008;32(4):710–20. <https://doi.org/10.1071/ah080710>. [Accessed 21 July 2021].
- [178] Badura A. *Foundations of Thought and Action. A social cognitive theory*. Englewood Cliffs, N.H.: Prentice Hall; 1986.
- [179] Baranowski T, Perry CL, Parcel GS. In: Glanz K, Rimer BK, Vols FM Lewis, editors. *How individuals, environments, and health behavior interact. Health behavior and health education: theory, research, and practice*. 3rd. San Francisco, CA: Jossey-Bass; 1997.
- [180] Behrens DA, Rauner MS, Sommersguter-Reichmann M. Why resilience in health care systems is more than coping with disasters: implications for health care policy. *Schmalenbach Journal of Business Research* 2022;74:465–95. <https://doi.org/10.1007/s41471-022-00132-0>. [Accessed 10 May 2022].
- [181] Lippi Bruni M, Mammi I, Ugolini C. Does the extension of primary care practice opening hours reduce the use of emergency services? *J Health Econ* 2016;50:144–55. <https://doi.org/10.1016/j.jhealeco.2016.09.011>. [Accessed 25 July 2021].
- [182] Dolton P, Pathania V. Can increased primary care access reduce demand for emergency care? Evidence from England's 7-day GP opening. *J Health Econ* 2016;49:193–208. <https://doi.org/10.1016/j.jhealeco.2016.05.002>. [Accessed 25 July 2021].
- [183] Cowling TE, Cecil EV, Soljak MA, Lee JT, Millett C, Majeed A, Wachter RM, Harris MJ. Access to primary care and visits to emergency departments in England: a cross-sectional, population-based study. *PLoS One* 2013;8(6):e66699. <https://doi.org/10.1371/journal.pone.0066699>. [Accessed 25 July 2021].
- [184] Robertson DA, Franco A. An Agent-Based Model of knowledge transferral: exploring the need for closure and cognition. In: Anagnostou A, Hoad K, Kunc M, editors. *Proceedings of the 2016 operational research society simulation workshop (SW16)*. Ettington chase Hotel. Warwickshire: The Operational Research Society; 2016. p. 64–71. https://clahrc-wessex.nihr.ac.uk/img/publications/SW16_ProceedingsBook-FINAL_RC_-HW_20042016102810.pdf. [Accessed 3 August 2021].
- [185] Manzi S, Chalk D, Pearson M, Day J, Stein K, Lang I, Pitt M. Opening the black box: combining Agent Based Simulation and realism in intervention development. In: Anagnostou A, Hoad K, Kunc M, editors. *Proceedings of the 2016 operational research society simulation workshop (SW16)*. Ettington chase Hotel. Warwickshire: The Operational Research Society; 2016. p. 155–64. https://clahrc-wessex.nihr.ac.uk/img/publications/SW16_ProceedingsBook-FINAL_RC_-HW_20042016102810.pdf. [Accessed 3 August 2021].
- [186] Martin A, Martin C, Martin PB, Martin PA, Green G, Eldridge S. 'Inappropriate' attendance at an accident and emergency department by adults registered in local general practices: how is it related to their use of primary care? *J Health Serv Res Policy* 2002;7(3):160–5. <https://doi.org/10.1258/135581902760082463>. [Accessed 18 July 2021].
- [187] Oterino de la Fuente D, Baños Pino JF, Blanco VF, Alvarez AR. Does better access to primary care reduce utilization of hospital accident and emergency departments? A time-series analysis. *Eur J Publ Health* 2007;17(2):186–92. <https://doi.org/10.1093/eurpub/ckl085>. [Accessed 20 July 2021].
- [188] Hong M, Thind A, Zaric GS, Sarma S. The impact of improved access to after-hours primary care on emergency department and primary care utilization: a systematic review. *Health Pol* 2020;124(8):812–8. <https://doi.org/10.1016/j.healthpol.2020.05.015>. [Accessed 2 August 2021].
- [189] Cowling TE, Majeed A, Harris MJ. Importance of accessibility and opening hours to overall patient experience of general practice: analysis of repeated cross-sectional data from a national patient survey. *Br J Gen Pract* 2018;68(672):e469–77. <https://doi.org/10.3399/bjgp18X697673>. [Accessed 25 July 2021].
- [190] Rantala A, Ekwall A, Forsberg A. The meaning of being triaged to non-emergency ambulance care as experienced by patients. *Int Emerg Nurs* 2016;25:65–70. <https://doi.org/10.1016/j.ienj.2015.08.001>. [Accessed 25 July 2021].
- [191] Lee A, Hazlett CB, Chow S, Lau FL, Kam CW, Wong P, Wong TW. How to minimize inappropriate utilization of Accident and Emergency Departments: improve the validity of classifying the general practice cases amongst the A&E attendees. *Health Pol* 2003;66(2):159–68. [https://doi.org/10.1016/s0168-8510\(03\)00023-x](https://doi.org/10.1016/s0168-8510(03)00023-x). [Accessed 19 July 2021].
- [192] Bosmans JE, Boeke AJ, van Randwijck-Jacobze ME, Grol SM, Kramer MH, van der Horst HE, van Tulder MW. Addition of a general practitioner to the accident and emergency department: a cost-effective innovation in emergency care, 29; 2012. p. 192–6. <https://doi.org/10.1136/emj.2010.101949>. 3. . [Accessed 27 July 2021].
- [193] Behrens DA, Morgan JS. Modelling the unscheduled care system for Aneurin Bevan university health board. In: *Poster at the cumberland Festival of evidence*. London: cumberland initiative, October; 2016. <https://systemdynamics.org.uk/wp-content/uploads/2017-Day2-Behrens2-Poster.pdf>. [Accessed 3 August 2021].

- [194] Behrens DA, Waites B, Morgan JS, Jones R. How to avoid health acquired pressure ulcers (HAPUs): using system dynamics to identify the leverage point. *UK Chapter of the System Dynamics Society - Success Stories*. 8 July, <https://systemdynamics.org.uk/wp-content/uploads/2020-07-08-SD-SuccessStories-ABUHB-HAPU-v14.pdf>. [Accessed 31 July 2021].
- [195] Sun Wu. *The art of war*. Tribeca Books; 2010.
- [196] Su Y, Sharma S, Ozdemir S, Chow WL, Oh HC, Tiah L. Nonurgent patients' preferences for emergency department versus general practitioner and effects of incentives: a discrete choice experiment. *MDM Policy Pract* 2021;6(2). <https://doi.org/10.1177/23814683211027552>. 23814683211027552.
- [197] Adie JW, Graham W, O'Donnell R, Wallis M. Patient presentations to an after-hours general practice, an urgent care clinic and an emergency department on Sundays: a comparative, observational study. *J Health Organ Manag*. 2023. <https://doi.org/10.1108/JHOM-08-2021-0308>. ahead-of-print.
- [198] Siggers A, Wand BM, Bulsara C, Truter P. 'I'm not in GP pain, I'm in hospital pain': qualitative study regarding patient decision-making factors in seeking care in the emergency department with non-specific low back pain. *Emerg Med Australas* 2021;33(6):1013–20. <https://doi.org/10.1111/1742-6723.13792>.
- [199] Korczak V, Yakubu K, Angell B, Middleton P, Dinh M, Lung T, et al. Understanding patient preferences for emergency care for lower triage acuity presentations during GP hours: a qualitative study in Australia. *BMC Health Serv Res* 2022;22:1442. <https://doi.org/10.1186/s12913-022-08857-8>.

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