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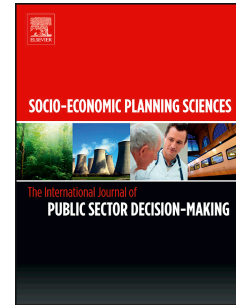
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Still looking in the wrong place: Literature-based evidence of why patients really attend an Emergency Department

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Abstract

Presenting complaints at an Emergency Department (ED) that could (and should) have been seen in primary care are 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 recursively 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 presented 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.

Keywords

Behavioural OR, OR in health services, System Dynamics, Patient choice, Inappropriate emergency department use

1 Introduction

Emergency Departments (EDs) are one of the healthcare system's most studied (and simulated) entities (Salmon, Rachuba and Pitt 2018, Mohiuddin, et al. 2017, Hulshof, et al. 2012). 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) (Günal and Pidd 2010). 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 (Salmon, Rachuba and Pitt 2018, Mohiuddin, et al. 2017).

Lane et al. (2000) 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, Lane et al. (2000) 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 (Brailsford, et al. 2004). While DES is helpful to develop 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 four-hour target. Firstly, comprehensive healthcare-modelling literature reviews, such as those by Fone et al. (2003) and Brailsford et al. (2009), highlight lacking implementation and impact of the insight generated by simulation studies. Secondly, Salmon et al. (2018) 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 Research (BOR) in recent years (Hämäläinen, Luoma and Saarinen 2013). 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 (Franco and Hämäläinen 2016). A recent review of BOR in healthcare (Kunc, Harper and Katsikopoulos 2018) revealed that a third of the papers identified in the literature review include behavioural aspects but do not acknowledge that they did so (Kunc, Harper and Katsikopoulos 2018, 13). Given these literature-based appeals for further work on ED patient behavioural issues, our paper seeks to provide 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 Lane et al. (2000) 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 ED throughput). Recently, discussions have appeared around telephone triaging, supplying 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 qualitative system dynamics workshop to develop our core concepts. Following on from these, we carried out a literature search to provide supporting evidence for the model. 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 takeaways for modellers and healthcare planners in section 4.

2 Methods

We approached the development of core concepts in two stages: First, a workshop was carried out using a qualitative system dynamics approach. Second, a literature review was carried out to provide supporting evidence for the qualitative system dynamics model.

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 Figure 1). A structured literature analysis identified the core system entities and the existence of relationships between them to create the first model (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 the second model (model B). These experts ranged from secondary care, primary care, 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 focus on model A while future work may link both models.

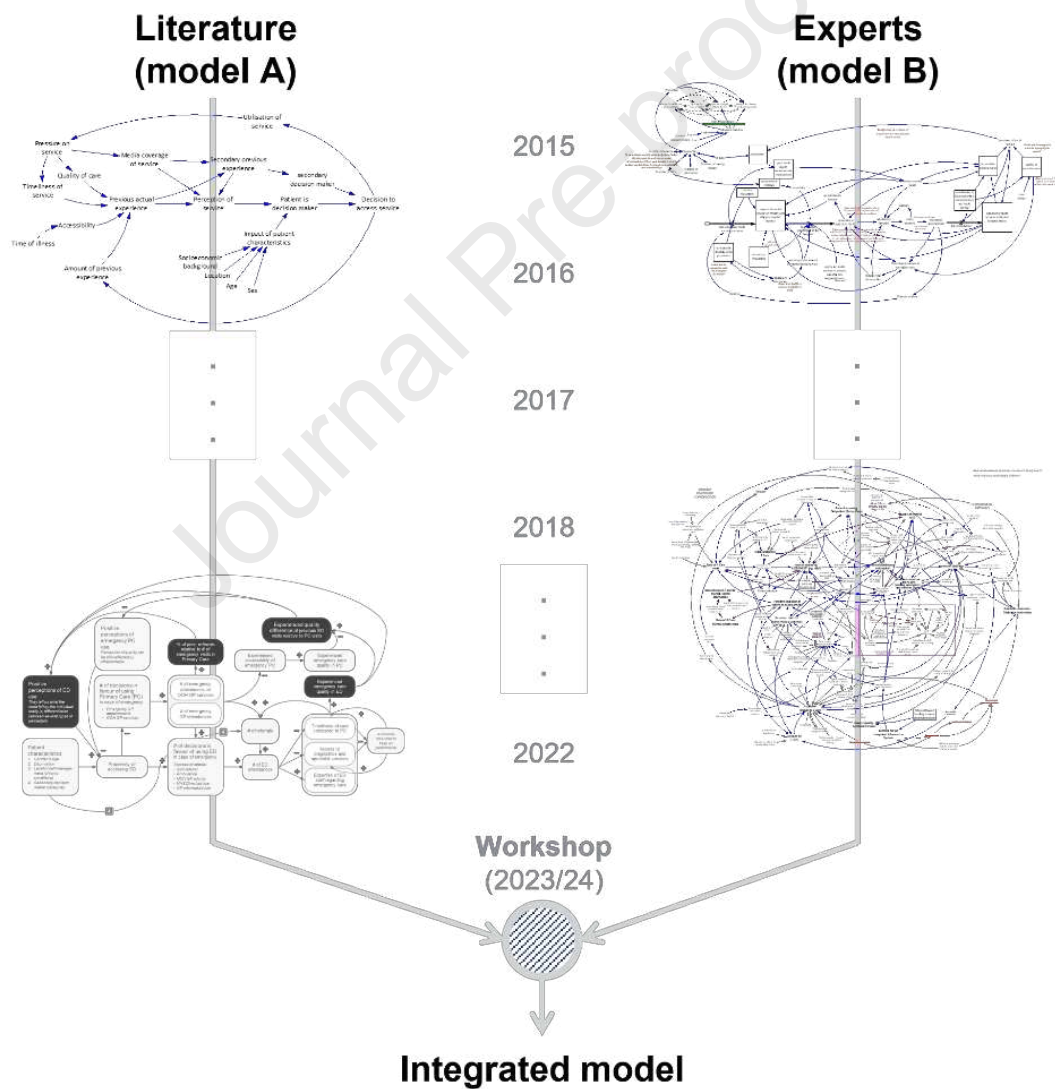


Figure 1: Methodology of building a model of unscheduled health and social care

To evaluate relevant literature, we followed the approach from Howick and Ackermann, 2011. Before executing 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 (Behrens and Morgan, Modelling the Unscheduled Care System for Aneurin Bevan University Health Board 2016). In doing so, we identified search terms, 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.

Table 1: Studies on patients' motives and patients' characteristics in emergency settings (excerpt)

Paper	Country	Study Design	Population	Motives for attending EDs
Agarwal et al., 2012	UK	Qualitative study (interviews)	Patients presenting at hospital ED and linked urgent care center	Anxiety or concern about the presenting problem Range of services available to the ED Perceived efficacy of ED services Lack of alternative services
Berry et al., 2008	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 Convenience ED resources Quality of care ED expertise with children
Durand et al., 2012	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 appointment with various specialists

Göransson, De Waern and Lindmarker, 2013	SWE	Prospective descriptive study (Questionnaire)	Patients presenting at ED by their own means or by ambulance	Male gender Other caregivers' referral (60.1-87.9%)
Grafstein et al., 2013	CAN	Cross-sectional survey	Ambulatory patients with a Canadian Triage and Acuity Scale (CTAS) level 3-5; age 19+	Distance travelled to reach the ED Perceived ED waiting time
Hunter et al, 2013	UK	Qualitative study (interviews)	Patients with long-term conditions using emergency care	Previous experiences with care providers, accessibility of service, practitioners' perceived expertise
Lobachova et al., 2014	USA	Cross-sectional (web-based) survey	Patients presenting to an ED	Belief that their problem was serious (61%) Other caregivers' referral (35%) Advice of a provider, family member, friend (48%)
Lowe et al., 2011	UK	Population-based (postal) survey	Patients using unscheduled health care (ED, family doctor consultations, pharmacist)	Patients who regarded their condition as serious, unambiguous, distressing, and difficult to manage
Lowthian et al., 2013	AUS	Qualitative study (interviews)	Older lower urgency patients presenting at ED	Referral by a third party Difficulty with accessibility to primary care Patient preferences for timely care Fast-track access to specialist care
Moll van Charante, Riet and Bindels, 2008	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 problem
Brice and Zou, 2005	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

Weiss, D'Angelo and Rucker, 2014	USA	Online survey	Adolescents ages 12 to 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%)
Wong et al., 2009	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
Zickafoose, DeCamp, Prosser, 2013	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 pm on 5 nights or more a week)
Chan and Ovens, 2002	CAN	Population-based, observational, cross-sectional study	Frequent ED users	Low socioeconomic neighborhoods Diagnosed with psychosocial conditions
Chmiel et al., 2011	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
Göransson, De Waern and Lindmarker, 2013	SWE	Prospective descriptive study (Questionnaire)	Patients presenting at ED by their own means or by ambulance	Male gender Shorter symptom duration
Moll van Charante, Riet and Bindels, 2008	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
Moll van Charante	NLD	Population-based, prospective cross-sectional	Group 1: AED self-referrals	Younger age Male gender

and Bindels, 2007		comparison study	Group 2: GP cooperative patients	Injury related medical problems, fracture (19%)
Philips et al., 2010	BEL	Prospective comparison survey	Group 1: Patients presenting at ED Group 2: Patients using the GP (on call)	Male gender Having visited the ED during the past 12 months at least once 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
Weiss, D'Angelo and Rucker, 2014	USA	Online survey	Adolescents ages 12 to 21 years and their parents/guardians presenting at urban ED at an academic children's hospital	Public insurance or no insurance/unknown insurance status
Willems et al., 2013	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

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 Figure 1). 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 Figure 2): **((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 now 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, or hospital-based emergency departments. In total, five researchers undertook the initial scoping review to aid the reproducibility of results (see Figure). 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 (C. Hart 2018) 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-Out-Of-Hours) but left out the social care literature. Furthermore, we found that the search terms around 'choice' (see Figure) 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 Figure) was critical. Patient choice in emergency care settings focusing on the patients' 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 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 Figure . 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/or 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 (see Figure). 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.

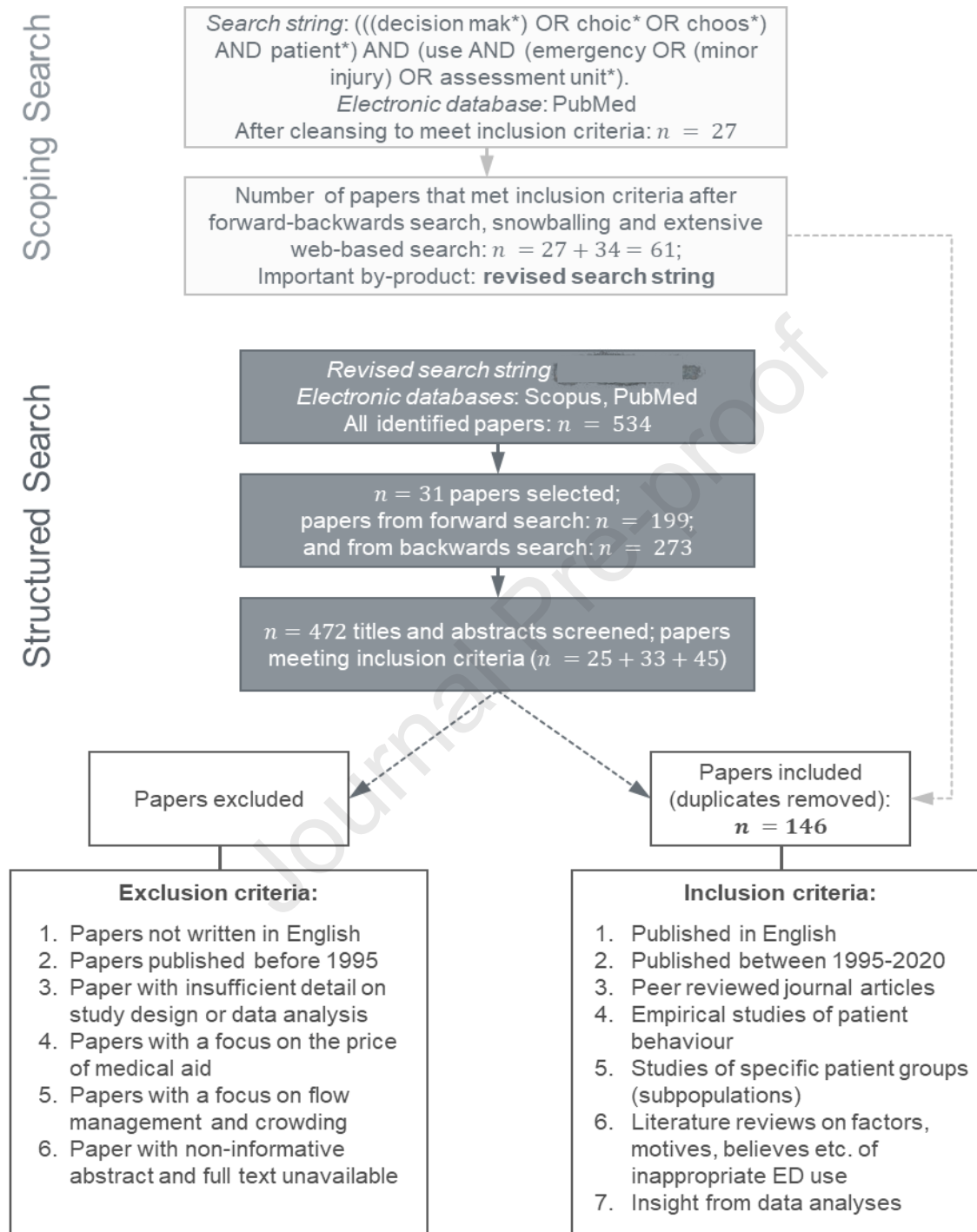


Figure 2: Structure of the literature research (Webster and Watson 2002)

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 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 '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 4 from the narrowed down viewpoint of Operational Research and Mathematical Modelling.

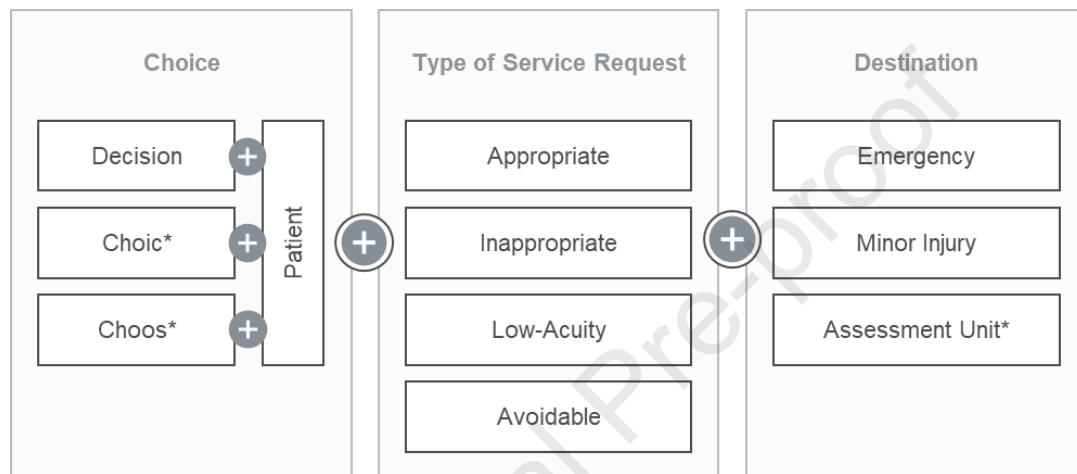


Figure 3: Search criteria used for the literature search described in this paper.

Causal diagrams structure the core concepts and the causal links identified from the literature (see section 4). 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 (Howick, Eden, et al. 2008).

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. Figure 3 provides an overview of the corresponding relationship. We will discuss ED patients' profiles 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 (OOH GP) service reveals pervasive patterns (see, e.g., (Lowthian, Curtis, et al. 2011)). Both attendance and self-referral to a hospital-based emergency service are positively associated with younger age (15-64) (Moll van Charante, ter Riet and Bindels 2008, Walsh 1990, Carret, Fassa and Domingues 2009, Uscher-Pines, et al. 2013, Guimarães, et al. 2015). 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. Note that planned attendances are excluded from Table 1; so are data from the period dominated by the NHS response to COVID-19.

Table 1: 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

Source: (NHS Digital 2020)

Older people who attend hospital-based emergency services are smaller in numbers versus other age groups (see Table 1). 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 (George, Jell and Todd 2006, Aminzadeh and Dalziel 2002, Chu, Brown and Pillay 2001, Singal, et al. 1992, Clark, et al. 1999, Gruneir, Silver and Rochon 2011). They also have a higher rate of return visits to the ED (Aminzadeh and Dalziel 2002). For example, Lowthian et al. (2013) 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

¹ While advanced age is a factor associated with frequent readmission, gender, time, day or season of presentation and country of birth are not (Kirby, et al. 2010).

and patient preferences for fast-track access to specialist care were other reasons for more frequent ED attendances of older patients (Lowthian, Smith, et al. 2013). The formation of perceptions that may have reinforced this behaviour will be addressed in section 4.3. Still, several studies identify older patients as 'appropriate' ED users (Kraaijvanger, Rijpsma, et al. 2015, Eagle, et al. 1993, Pereira, et al. 2001, Carret, Fassa and Kawachi 2007).

One explanation for the phenomenon that the age distribution (displayed in Table 1) is disproportionate is that patients under 25 have a high attendance rate for medically non-urgent conditions (Unwin, Kinsman and Rigby 2016, van der Linden, et al. 2014, Sempere-Selva, et al. 2001). According to Guimarães et al. (2015), 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 (Moll van Charante, van Steenwijk-Opdam and Bindels 2007, Guimarães, et al. 2015). Philips et al. (2010) 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 (Bianco, Pileggi and Angelillo 2003, Carret, Fassa and Domingues 2009, Williams and Haffizulla 2021) – despite women seeking their healthcare providers' support for their emergency complaints before ED attendance more often than males (Göransson, De Waern and Lindmarker 2013, Bankart, et al. 2011, Chmiel, et al. 2011).

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 (Public Health Information for Scotland 2018, Tinson and Tallack 2020).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%) (Barnett, et al. 2012). Also, residents of deprived areas are more likely to be diagnosed with psychosocial conditions (24.1% vs 11.1%) (Chan and Ovens 2002). All this translates into 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 (Naouri, et al. 2020). Patients living in socially deprived areas have a higher propensity to attend an ED than their counterparts living in more affluent neighbourhoods (Willems, et al. 2013, Hull, Jones and Moser 1997, Baker, et al. 2011, Walsh 1990, Hong, Baumann and Boudreaux 2007) and are more likely frequent ED users (Hunt, et al. 2006, Chan and Ovens 2002, Purdey and Huntley 2013, Johnson, et al. 2019). The NHS England counted nearly twice as many ED attendances for the 10% of the population living in the most deprived areas (3.1M), compared to the least 10% (NHS Digital 2020).

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 (Lorig, et al. 2001). They are also identified as knowledgeable, discriminating users of healthcare services and choose in an informed way among the available resources (Hunter, et al. 2013). 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 (Lowe, et al. 2011, 862). (Consult Footnote 5 for the motivation behind the observed type of behaviour.)

² This result may be partly explained by the inverse correlation between the availability of healthcare and the people who require it most (J. Hart 1971).

3.1.4 Caregiver decision

More often than we think, the patient is not the primary decision-maker: FitzGerald et al. (2015) report that patients (51%), health and medical professionals (31%) and others (18%) decide whether to attend an ED. The 'other' secondary decision-maker is mostly a caregiver, for example, a parent (Berry, et al. 2008). For young children, ED attendances are informed by the adult taking the child to the emergency department (Prince and Worth 1992, Kalidindi, et al. 2010). In this context, younger maternal age was associated with a higher frequency of presenting infants to an ED for medically 'inappropriate' conditions (Pomerantz, et al. 2002). Moreover, Altenstaed and Kelly (2015) report 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 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 (Berry, et al. 2008). Moreover, caregivers can resist new initiatives, like walk-in-centres (Chalder, et al. 2007) 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) knowledge (Koce, Randhawa and Ochieng 2019). For example, McGuigan and Watson (2010) 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 4.3.7 will revisit the 'experience' theme and discuss it more thoroughly.

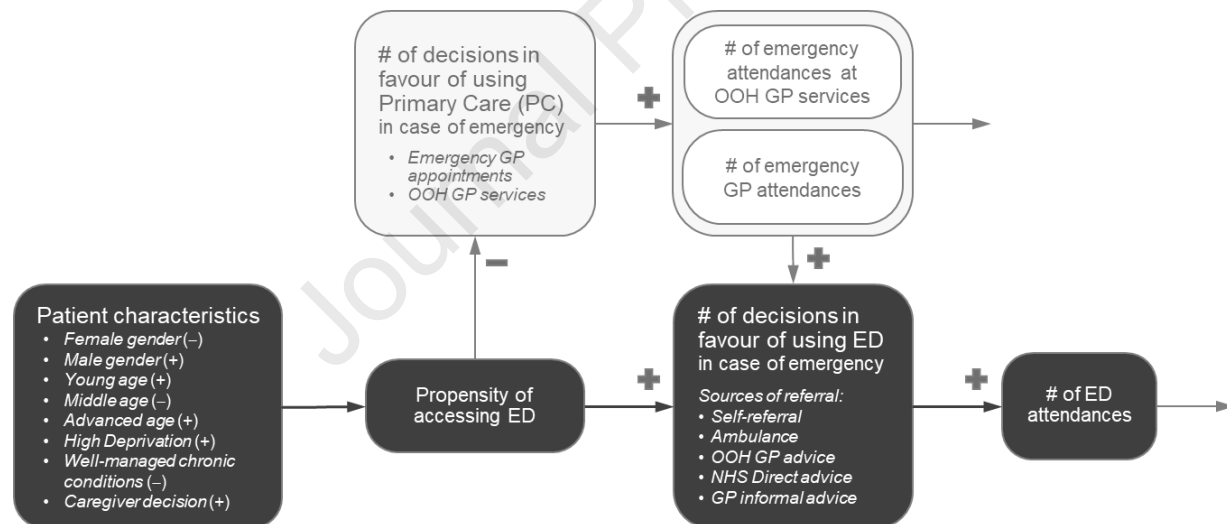


Figure 4: Impact of patient characteristics on the propensity of accessing an ED and ED attendance

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

In section 4.1.4, we have already alluded that healthcare professionals may perceive it as adequate to direct patients to an ED (McKenna, et al. 2020, Chin, et al. 2006, Uscher-Pines, et al. 2013). Both clinical and non-clinical factors influence the referral decision (Howard, et al. 2005). 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 Figure). If the latter perceive their child's illness as severe, an ED referral will come about (Conlon, et al. 2020).

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 (Conlon, et al. 2020, Oslislo, et al. 2019). 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, epitomised in extended periods till triage or seeing a physician (Beniuk, Boyle and Clarkson 2012), no longer reduces an ED's attractiveness because of ongoing 'ED fixes' to meet performance targets (Salmon, Rachuba and Pitt 2018, Mohiuddin, et al. 2017). Altogether, this results in a reinforcing loop that gradually pulls patients from primary care into hospital-based emergency services (see Figure).

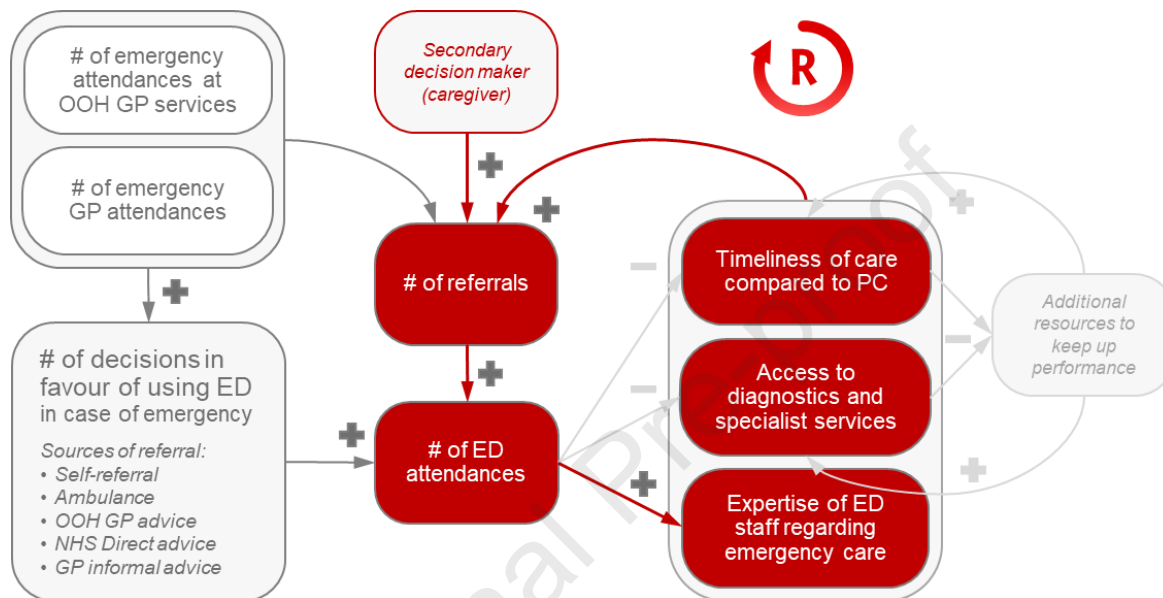


Figure 5: Quality-referral dynamic pulling patients from primary care into an ED

Lobachova et al. (2014) 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. Thirty-three percent of ED patients tried to reach their primary care physician before presenting at the ED (with an 80% success rate) (Lobachova, et al. 2014). 29% of ED patients had contacted their GPs before presenting at the emergency department (Göransson, De Waern and Lindmarker 2013). If a caregiver was involved, the probability that a patient accessed an ED increased (Berry, et al. 2008, Göransson, De Waern and Lindmarker 2013, Conlon, et al. 2020). The caregiver's anxiety and risk aversion are prompting the outcome. Consequently, elderly patients (70+) often attend ED because a third party referred them (Lowthian, Smith, et al. 2013) or called an ambulance (Jacob, et al. 2008). 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 (Stanley, et al. 2007).

Altogether, emergency ambulance, General Practitioner, and GP-OOH services are the primary sources of referral (Agarwal, et al. 2012). Both GPs (Ng, et al. 2012, Rinderknecht, et al. 2010, Patel and Dubinsky 2002, Cheek, et al. 2016, Moll van Charante, van Steenwijk-Opdam and Bindels 2007) and ambulance services (Moll van Charante, van Steenwijk-Opdam and Bindels 2007) effectively select the patients/conditions suitable for presentation to an emergency department – with the odd 'inappropriate'

³ A smaller proportion of paediatric (and younger) patients is referred to ED. For example, Weiss et al. (2014) state that primary care providers referred 21% of ED patients between 14 and 24 years.

exception (Sempere-Selva, et al. 2001). 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 increasingly gained importance in our COVID-19-shaken healthcare system is telephone triage. It is difficult to assess a disease's severity via telephone (Stewart, et al. 2006, Fourny, et al. 2011). Still, for the patient, it is vital to follow the advice given. However, only around two-thirds (68.4% CI 66.4-70.4%) of those instructed to attend ED are compliant with guidance (Gibson, et al. 2018, Tran, et al. 2017, Stewart, et al. 2006, Labarère, et al. 2003). The proportion rises to 74% for paediatric OOH services (Kempe, et al. 2006). On the other hand, 3.8% (3.8% CI 0-9.1%) of those explicitly advised by telephone triage not to attend ED ignore the advice and show up at the hospital (Gibson, et al. 2018, Stewart, et al. 2006). 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, e.g., (Qiong 2017). 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. (Schacter 2019, Hämäläinen, Luoma and Saarinen 2013)

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 (Sanders 2000, Ekwall 2013)) as perceptions guide decisions and drive behaviour (see Figure).

Understanding these perceptions enables the supply of prudent healthcare (Welsh Government 2019) – and even more critical: compassionate healthcare (NHS Wales 2021, NHS England/Nursing Directorate 2013). 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 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.

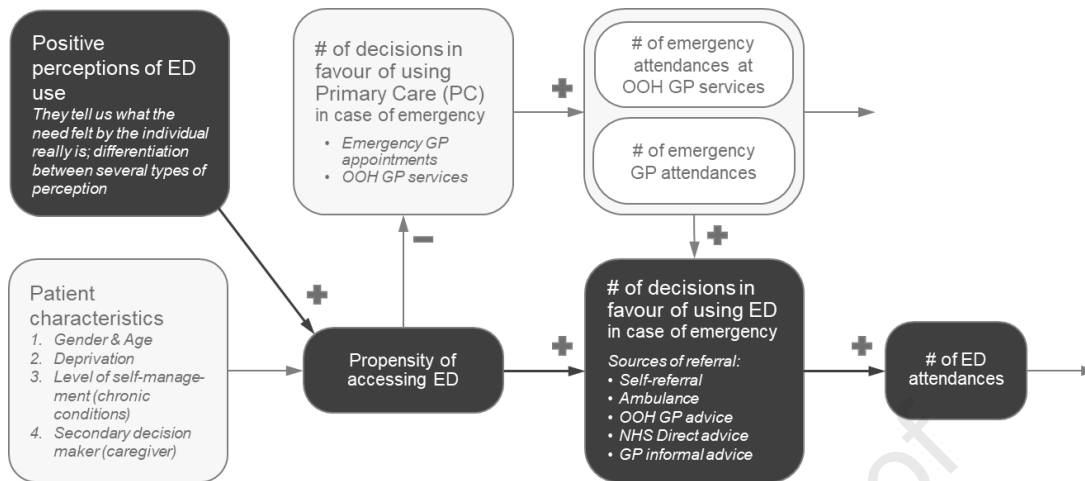


Figure 6: Relationship between the perception of ED use and its actual use

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 resources (Hunter, et al. 2013).⁴ When they decide to present to an emergency department, they do it with good cause (Lowe, et al. 2011). In this context, confidence and self-managing ability are critical (Lorig, et al. 2001).⁵

⁴ Patients' health competency is usually quite limited, with the internet as an important influencing factor (Oslislo, et al. 2019).

⁵ The right-place perception also explains an interesting phenomenon that was already mentioned in section 4.1.3 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 (Lowe, et al. 2011, 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 (Phillips, et al. 2010). 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.

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 such as a road traffic accident (NHS Servies 2021). They also are aware of the alternative services. However, they misperceive their attendance of hospital-based emergency services as appropriate (Olsson and Hansagi 2001, Field and Lantz 2006, Heinert, et al. 2000, Su, et al. 2021), i.e., a medical necessity (Minderhout, et al. 2019, Ragin, et al. 2005, McGuigan and Watson 2010, Lozano, et al. 2015, Murphy 1998, Burchard, et al. 2019) requiring immediate attention (Nelson 2011) (cf. sections 4.3.2 and 4.3.8).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 (Weiss, D'Angelo and Rucker 2014). Half of the respondents of an Australian study expected a higher priority than the actual triage category they were assigned (Toloo, et al. 2016). 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 (Alyasin and Douglas 2014). Another US study reported that ED physicians triaged no more than 67% of ED presentations as medically appropriate (Gifford, Franaszek and Gibson 1980).⁷

In comparison, around 88% of the patients perceived their condition to be a medical emergency (Gifford, Franaszek and Gibson 1980, Sancton, et al. 2018) – the flip side being that between 12% (Gifford, Franaszek and Gibson 1980) and 20% (Toloo, et al. 2016) 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 (Gifford, Franaszek and Gibson 1980). 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 (Keizer Beache and Guell 2016) (cf. sections 4.2, 4.3.7 and 4.3.8). 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 (Howard, et al. 2005). This behaviour corresponds to the balancing loop displayed in Figure . 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 economics, we know that decisions solely based on outcome knowledge (neglecting context information) often produce inferior results for both the individual and the system (Stark and Behrens 2010). The same applies to healthcare.

⁶ Between 47% and 61% of ED patients self-classify their presenting complaints as severe (Lobachova, et al. 2014, FitzGerald, et al. 2015) – and many of them may be right as 68% of ED patients are clinically assessed as 'to be seen only in the emergency department' (Afilalo, et al. 1995).

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 (Foldes, Fischer and Kaminsky 1994, Richardson, Ardagh and Hider 2006) and the categorisation depends, among others, on physician training, speciality, and beliefs rather than on some objective criteria.

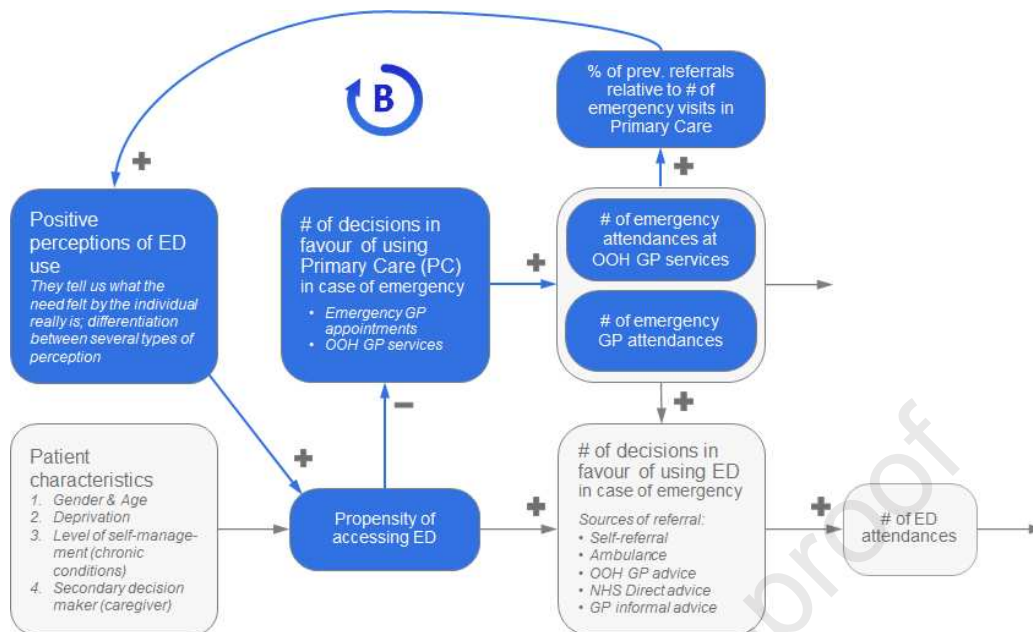


Figure 7: Reinforcing the perception that secondary emergency care is superior to primary emergency care. In the diagram, the B with a circle means a balancing feedback loop. They counter change in one direction with change in the opposite direction. The "+" or "-" mean that variables effect one another in a positive or negative sense, respectively.

Having said all this, it is remarkable that 'only' around a third of ED patients get it wrong when presenting to an emergency department (Afilalo, et al. 1995, Durand, Gentile, et al. 2011, Gifford, Franaszek and Gibson 1980, Petitot, et al. 2008, Oktay, et al. 2003).⁸ The variation of this proportion across a multitude of studies is, however, enormous. I.e., it fluctuates between roughly 5% and 90% (Al Shehr, Thomas and Al Ghuli 1992, Bianco, Pileggi and Angelillo 2003, Carret, Fassa and Kawachi 2007, Durand, Gentile, et al. 2011, Nagree, et al. 2013, Rissbacher, et al. 2011, Tsai, Chenc and Liang 2011, Kraaijvanger, van Leeuwen, et al. 2016, Lowe and Bindman 1997). 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 4.3.1). 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 (Afilalo, et al. 2004, Burchard, et al. 2019). In this case, the patient does not perceive the condition as life-threatening – but as something slightly scary where they would feel better when being instantly examined.

⁸ 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 (Foldes, Fischer and Kaminsky 1994, Richardson, Ardagh and Hider 2006) and the categorisation depends, among others, on physician training, speciality, and beliefs rather than on some objective criteria.

An example would be an acute illness (usually triggering a feeling of urgency (Hunter, et al. 2013, Weiss, D'Angelo and Rucker 2014)). The same applies when patients are in pain (Gentile, et al. 2010, Siggers, et al. 2021), stressed or anxious about the presenting problem (Agarwal, et al. 2012, Oslislo, et al. 2019, Coster, et al. 2017, Olsson and Hansagi 2001, Rassin, et al. 2006, Booker, Simmonds and Purdy 2014) or when people must decide on behalf of someone else (Nicholson, et al. 2007, Booker, Simmonds and Purdy 2014). A yearning for fast-paced reassurance then generates self-referral (Coster, et al. 2017, Oslislo, et al. 2019, Siminski, et al. 2008, Bengner and Jones 2008, Vázquez Quiroga, et al. 2000, Koce, Randhawa and Ochieng 2019) and physician-initiated ED visits (Oslislo, et al. 2019).⁹ 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 (Moll van Charante, ter Riet and Bindels 2008, van der Linden, et al. 2014, Kibar and Borland 2006, Adie, et al. 2023). 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%) (Chmiel, et al. 2011). 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 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% to 43% of the patients presenting to an emergency department are eligible for management in primary care or elsewhere (Cooper, et al. 2020).¹⁰ 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 superior to the care provided elsewhere – and there is some truth in it.¹¹ A wide range of services is available (only) within an emergency department (Agarwal, et al. 2012), *de facto* serving urgent *and* non-urgent patients (Durand, Gentile, et al. 2011). Specialist consultation and diagnostic imaging attract patients in perceived need of immediate attention (Wong, et al. 2009, Minderhout, et al. 2019, Coster, et al. 2017, Lega and Mengoni 2008, Siminski, et al. 2008, Atenstaedt, et al. 2015, Koce, Randhawa and Ochieng 2019, Siggers, et al. 2021, Su, et al. 2021). Also, prompt availability of an extensive spectrum of diagnostic and therapeutic options makes ED services attractive for patients (Lega and Mengoni 2008, Kraaijvanger, Rijpsma, et al. 2015, de Valk, et al. 2014, Vázquez Quiroga, et al. 2000, Korczak, et al. 2022) and referring GPs (Oslislo, et al. 2019, Minderhout, et al. 2019).

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

⁹ The most frequent reason given by patients for their visit to the emergency department was that they felt their problem was an emergency (Bianco, Pileggi and Angelillo 2003) and needed immediate attention (Davison, Hildrey and Floyer 1983). This is where the acuity of the presenting complaint and anxiety blur the boundary to the 'right place' perception.

¹⁰ Medically non-urgent conditions account for 58% to 82% of paediatric emergency department visits (Berry, et al. 2008).

¹¹ Billittier et al. (1998) identified a need for further education of out-of-hospital emergency care providers (concerning triage, transportation, and destination decisions).

example, what increases self-presentations (Moll van Charante, ter Riet and Bindels 2008, Northington, Brice and Zou 2005, FitzGerald, et al. 2015, Rassin, et al. 2006, Shearer, et al. 2015, Koziol-McLain, et al. 2000). Patients prefer the alleged expertise and diagnostic facilities provided by an emergency department (Rieffe, et al. 1999, Moll van Charante, ter Riet and Bindels 2008, Lega and Mengoni 2008, Atenstaedt, et al. 2015). Parents bring their children to an ED for non-urgent care because of the supposed advantages of ED care like efficiency, availability of resources, quality of care and expertise with children (Berry, et al. 2008, Smith, et al. 2015). Elderly patients (70+) attend an ED because of specialist care expectations (Lowthian, Smith, et al. 2013). In many cases, expected investigations and no confidence in general practitioner/primary care were identified as motives of self-referred ED patients (Kraaijvanger, van Leeuwen, et al. 2016) – an argument opening the floor to the following motivation for ED use.

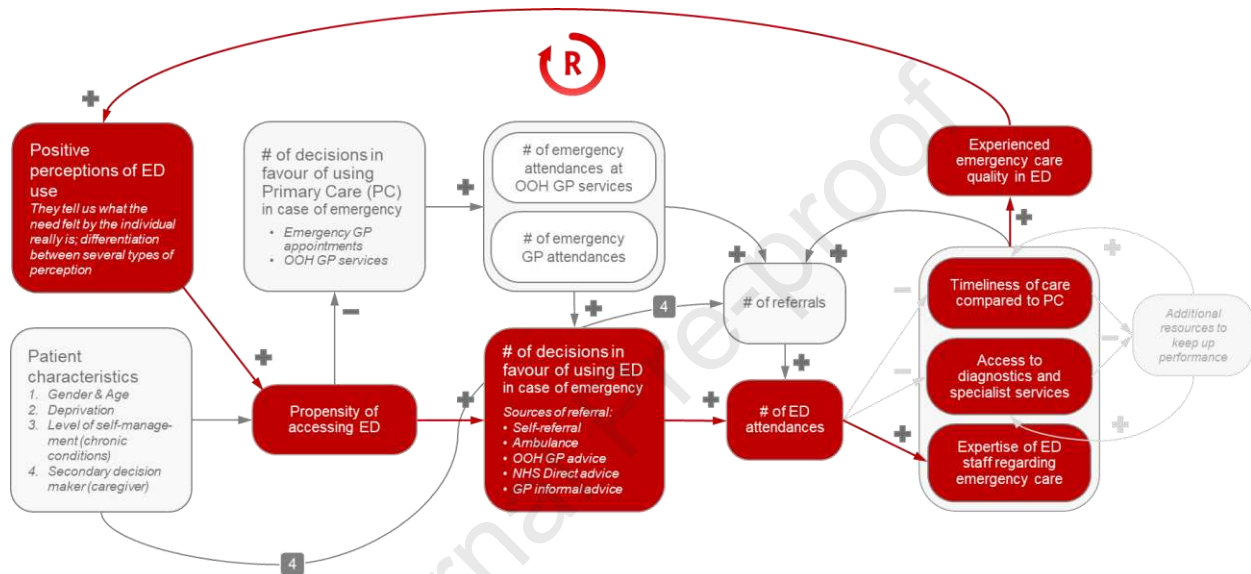


Figure 8: The reinforcing power of the (perceived) quality of care at an ED. In the diagram, the R with a circle means a reinforcing loop which means that change in one direction is compounded by more change. Again, the “+” or “-” mean that variables effect one another in a positive or negative sense, respectively.

3.3.4 'In theory, I have other options, but no one 's 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., (Agarwal, et al. 2012, Durand, Gentile, et al. 2011, FitzGerald, et al. 2015, van der Linden, et al. 2014, Sempere-Selva, et al. 2001, Carret, Fassa and Domingues 2009, Atenstaedt, et al. 2015, Koziol-McLain, et al. 2000, Murphy 1998) and in particular OOH services (Guttman, Zimmerman and Nelson 2003). For 32% of non-urgent ED patients, lacking accessibility is why they did not present to a primary care physician (Afilalo, et al. 2004). In rural areas, with a shortage of GPs, this proportion may be even higher (Allen, et al. 2005, Purdey and Huntley 2013, Steele, Anstett and Milne 2008), reinforced by considering this scarce GP resource inaccessible to patients' emergency needs (Palmer, et al. 2005). In non-public healthcare systems, alternative services may be available but non-affordable for underinsured patients. Then, an ED additionally becomes a last resort (Krug 1999, Ragin, et al. 2005).

Parents bring their children to an emergency department for non-urgent care because of problems accessing their primary care provider (Berry, et al. 2008, Cheek, Braitberg and West 2017). Bankart et al. (2011) report 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 (Wong, et al. 2009). Older (70+) patients of lower clinical urgency attend an ED because of a perceived access block to primary or specialist

services (Lowthian, Smith, et al. 2013). 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 (Cheek, et al. 2016). On the one hand, this incorporates that a patient could not obtain an appointment with a primary care provider (Howard, et al. 2005, Koziol-McLain, et al. 2000, Bengner and Jones 2008, Krebs, et al. 2017). On the other hand, it includes that the accessibility of radiologic and laboratory investigations sways the decision in favour of an ED (Kraaijvanger, Rijpsma, et al. 2015).

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 (Cheek, et al. 2016). It spares the patient from being overwhelmed with appointments with various specialists (Durand, Palazzolo, et al. 2012). Also, patients seem to like single point-of-access conveniences, where health professionals pick the right service (Ablard, et al. 2020).

Other convenience-related factors for ED attendance include expected wait times (Berry, et al. 2008, Durand, Gentile, et al. 2011, Grafstein, et al. 2013, Minderhout, et al. 2019, Guttman, Zimmerman and Nelson 2003, Rajpar, Smith and Cooke 2000, Shearer, et al. 2015, Vázquez Quiroga, et al. 2000, Carret, Fassa and Domingues 2009), proximity (Grafstein, et al. 2013, Minderhout, et al. 2019, Coster, et al. 2017, Ludwick, et al. 2009, Baker, et al. 2011, Purdey and Huntley 2013, Walsh 1990) and/or convenient location (Shearer, et al. 2015). In this context, it is not only the physical distance¹² between the patient 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 (Moll van Charante, ter Riet and Bindels 2008, Bankart, et al. 2011, Ludwick, et al. 2009).¹³

Also, opening hours matter (Coster, et al. 2017, Carret, Fassa and Domingues 2009).¹⁴ Moreover, younger patients and those with painful conditions appear to place greater priority on wait times (Grafstein, et al. 2013). 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 (NHS Digital 2020). Also, an ED provides access to medical care 24/7 (Alyasin and Douglas 2014), which brings us back to the quality aspect discussed in section 4.3.3 (cf. Figure) in the following way. The Institute of Medicine (2001) 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 (Kraaijvanger, Rijpsma, et al. 2015, Alyasin and Douglas 2014), 'accessibility', 'convenience', 'efficacy' and 'urgency' blend into each other as the single guiding motive for seeking ED care in case of a perceived emergency.

Figure 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

¹² Note that Grafstein et al. (2013) report that 44% of respondents to their survey stated proximity as the primary reason for accessing an unscheduled secondary care service.

¹³ In this context, it also makes sense that meteorological factors matter (Purdey and Huntley 2013).

¹⁴ 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% (van Uden, et al. 2005).

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. Figures 4 and 6). 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 (Senge 2006).

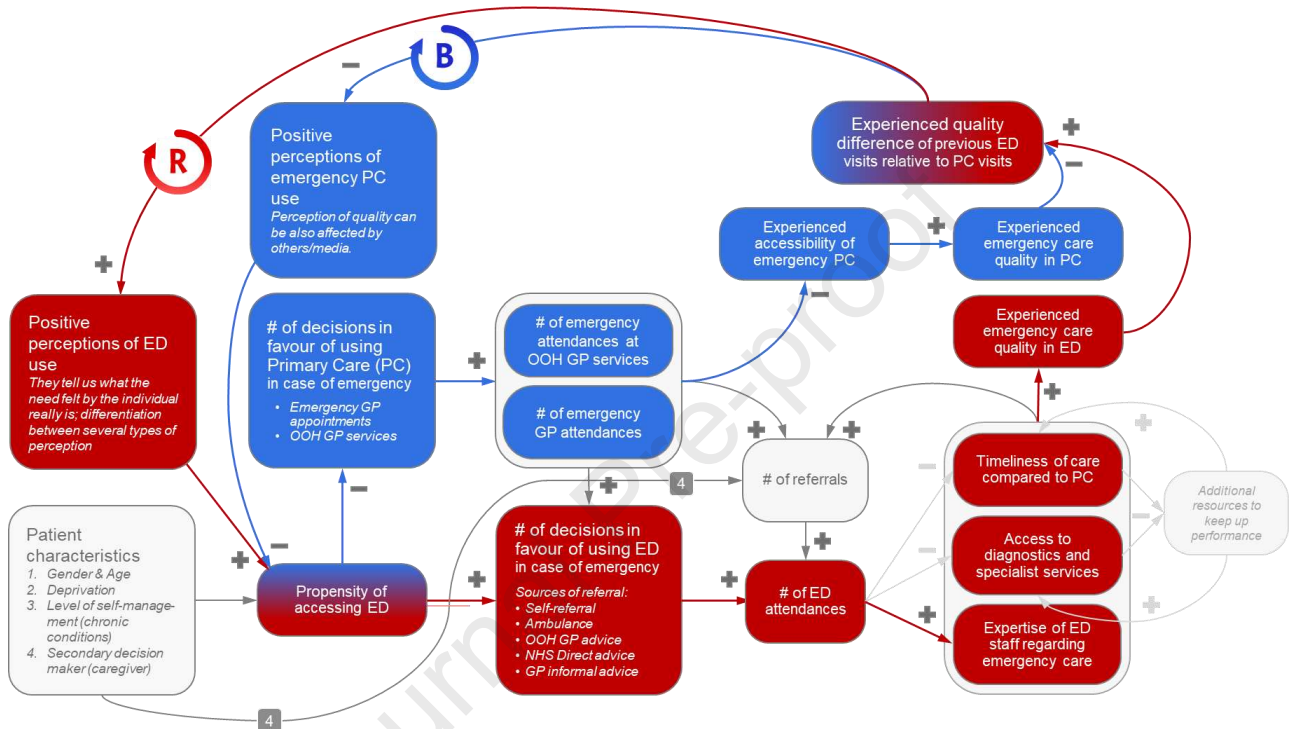


Figure 9: Dynamics generated by the perceived quality gap between primary care (PC) and ED. In the diagram, the R with a circle means a reinforcing loop which means that change in one direction is compounded by more change. The B with a circle means a balancing feedback loop. They counter change in one direction with change in the opposite direction. Again, the “+” or “-” mean that variables effect one another in a positive or negative sense, respectively.

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 (Vázquez Quiroga, et al. 2000). Many patients (7%-56%) see an emergency department as the only place to present health concerns outside regular office hours (Zickafoose, DeCamp and Prosser 2013, Bengner and Jones 2008). I.e., patients perceive a lack of options (Agarwal, et al. 2012) and/or do not know where to go (with their medical complaint) (Minderhout, et al. 2019). For example, Northington et al. (2005) report that for 66% of self-referred non-urgent patients in a university ED, the emergency department was reported to be the only service they knew. 27% of these patients said they depended on the ED for all medical care (Northington, Brice and Zou 2005). 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 (Atenstaedt, et al. 2015). 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 (Boushy and Dubinsky 1999). 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 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 (Berry, et al. 2008). They do not have enough information to make an informed decision.¹⁵ 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 (Weiss, D'Angelo and Rucker 2014). 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.

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 determinant of ED attendance (Philips, et al. 2010).¹⁶ Long-term patients who often use healthcare services develop a refined sense of which service to use and when (Hunter, et al. 2013). Earlier experiences on accessibility and the practitioner's perceived responsiveness and expertise guide a person's judgment of urgency and service choice (Hunter, et al. 2013, O'Cathain, Connell, et al. 2020, Berry, et al. 2008, Shearer, et al. 2015, Booker, Simmonds and Purdy 2014, Korczak, et al. 2022). Once formed, negative perceptions about alternatives to an ED (such as primary care providers) play a vital role in driving non-urgent ED use (Uscher-Pines, et al. 2013).

Experience **recursively shapes (patients') perception of ED use** (see Figure and Table 2). It is, however, not only the personal experience that matters in this context. Information conveyed by a healthcare provider, family member, friend (Lobachova, et al. 2014, Coster, et al. 2017) or another caregiver (Göransson, De Waern and Lindmarker 2013) also shapes a person's perception of ED use (Booker, Simmonds and Purdy 2014). 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.¹⁷

¹⁵ 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.

¹⁶ The proportion of frequent users includes between 4.5%-8% (LaCalle and Rabin 2010) and 20% (Kirby, et al. 2010) of all ED patients. On average, frequent ED users have higher-acuity complaints and are at greater risk for hospitalisation than occasional ED users (LaCalle and Rabin 2010). 75% of frequent users of EDs visited GPs at least six times yearly, and more than 50% visited at least twelve times yearly (Chan and Ovens 2002).

¹⁷ 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 (Zandieh, et al. 2009). 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 (Berry, et al. 2008, Nicholson, et al. 2007). 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. (Berry, et al. 2008)

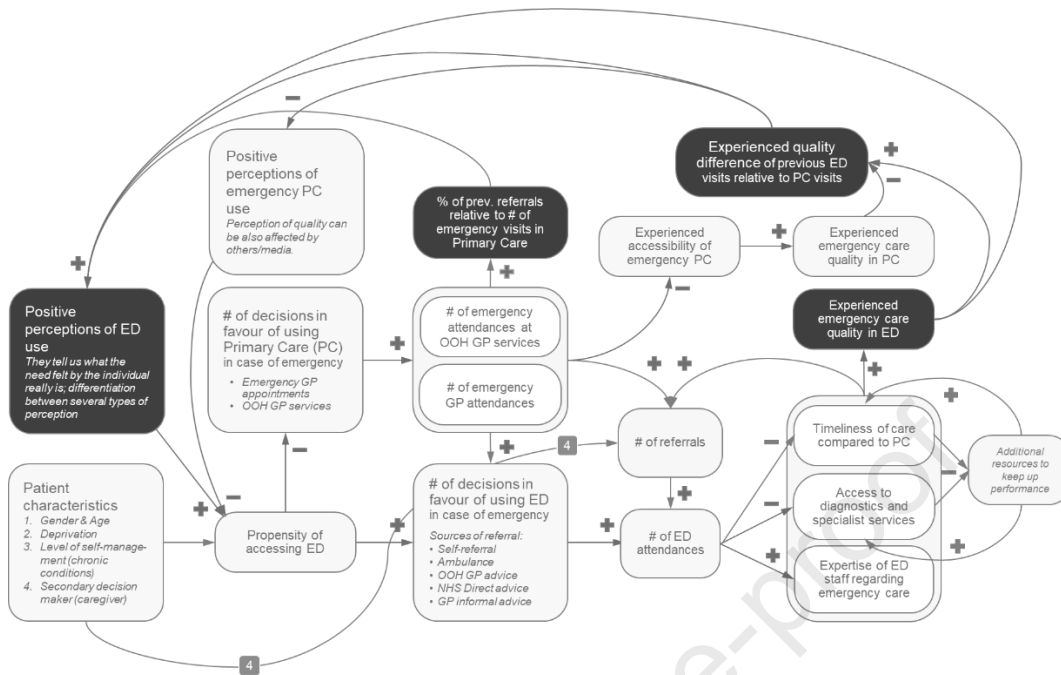


Figure 10: Key elements of the recursive process of shaping perceptions of ED use. The “+” or “-“ mean that variables effect one another in a positive or negative sense, respectively.

Table 2: Links between concepts supported by the medical literature

From	To	Evidenced by
Experience gathered about ED relative to primary care	Perceptions of ED use	<ul style="list-style-type: none"> • 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 (Hunter, et al. 2013) • Past experiences made within the health care system influences patient choice (recursively shaped) for or against self-presentation at an Emergency Department (Hunter, et al. 2013, Booker, Simmonds and Purdy 2014) • ED Patients with long-term conditions are knowledgeable, discriminating users of services, and choose in an informed way between services (Hunter, et al. 2013) • 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. (Berry, et al. 2008)

Despite all the learning that happens over time, people 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., (Philips, et al. 2010, O'Cathain, Knowles, et al. 2007, Chalder, et al. 2007)). 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 (Chan and Ovens 2002), and around 10% of non-urgent ED patients prefer their trusted ED over a primary care provider (Afilalo, et al. 2004). 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 4.2). 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 attendances at an ED are 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 (Nagree, et al. 2013). Moreover, especially in rural areas, GP and ED services compete during office hours (based on wait times, not price) for patient attention (Neil and de Graaff 2016).

It seems unclear whether patients genuinely know/understand the role and functions of an ED (Morgans and Burgess 2012, Selasawati, et al. 2007). For example, Şimşek and Gürsoy (2016) 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 caregivers, primary care providers, and ED personnel (Salami, Salvador and Vega 2012). This is reflected by substantial differences in the opinions on inappropriate ED use between health professionals (ED nurses, doctors, and paramedics) and patients (Breen and McCann 2013, Masso, et al. 2007, Morgans and Burgess 2012, Weiss, D'Angelo and Rucker 2014). 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% (Jacob, et al. 2008, Morris and Cross 1980).

4 Takeaways 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, Callen et al. (2008) 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 4.3.1). 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.

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 (compared to 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 4.3.3). 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, 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.

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 4.3.3 and summarised in Figure), which resonates with social cognitive theory (Badura 1986). As a consequence, reciprocal interaction among personal factors, behavioural elements and environmental influences shape perceptions of quality and govern human behaviour (Baranowski, Perry and Parcel 1997). In this context, the perceived gap between ED performance and urgent primary care performance is crucial for patient choice and behaviour (see Figure).

A (relatively) higher reputation of an ED as an emergency care facility draws in more patients. Consequently, 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 is 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 still constrained. However, with a nearly 'automated' allocation of additional funds (for ED resources) preventing exhaustive breaches of the four-hour target, there will be no increased wait times and insufficient access to diagnostics deterring potential patients. The balancing loop that keeps up performance (four-hour target) contributes to the emergence of the reinforcing 'ED use' loop (see Figure 4). 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 offer 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.

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.

How to utilise our BOR framework to redesign services

Patient flows interact with information flows and behaviours and form a complex system (Behrens, Rauner and Sommersguter-Reichmann 2021). 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, Lippi Bruni et al. (2016) estimated that improved accessibility of primary care services could reduce inappropriate ED admissions by 10%-15%. This is not a single result. Dolton and Pathania (2016) 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 attendances of patients registered in a pilot practice even fell by 17.9%. Cowling et al. (2013) 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 (Chin, et al. 2006). 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 Robertson and Franco (2016), and for intervention appraisal (Manzi, et al. 2016).

Unfortunately, supplying directly and extensively accessible primary care services is not the magic bullet to significantly reducing ED use (Martin, et al. 2002, Guttman, Zimmerman and Nelson 2003, Oterino de la Fuente, et al. 2007). For example, Hong et al. (2020) 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 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 (Cowling, Majeed and Harris 2018) such that patients feel taken seriously would improve patient satisfaction (Rantala, Ekwall and Forsberg 2016). 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 (Rantala, Ekwall and Forsberg 2016, Ablard, et al. 2020). The effect of these changes on ED usage through the associated shift of patient experience/satisfaction would increase trust and improve service reputation 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 of 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. Lee et al. (2003) 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 invites 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 (Bosmans, et al. 2012). 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.

How to make primary care truly attractive

We believe that a whole-system approach of 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 additionally give clues derived from observing patients and clinicians in an emergency setting. 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, deprivation turned out from the literature review as a sociodemographic factor increasing ED activity (cf. section 4.1.2). Let us assume analysis of ED service users revealed a considerable number of patients from communities characterised by low income and educational level 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. As mentioned in section 4.2, 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 on 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 (Behrens and Morgan 2016). Later, the causal loop representation guided decision-making and intra-hospital Quality Improvement (QI) programmes around patient safety, see, e.g., (Behrens, Waites, et al. 2020). However, the core mechanism that drives ED attendances (at the front end of a hospital) has received less attention for decision-making in practice.

5.2. Conclusions

Health care 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 of 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'* (Sun 2010).

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 5 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 to access 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 four-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'*.

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References

- Ablard, S., M. Kuczawski, F.C. Sampson, and S.M. Mason. 2020. "What does the ideal urgent and emergency care system look like? A qualitative study of service user perspectives." *Emergency Medicine Journal* 37 (4): 200-205. Accessed August 3, 2021. doi:10.1136/emmermed-2019-208921.
- Afilalo, J., A. Marinovich, M. Afilalo, A. Colacone, R. Léger, B. Unger, and C. Giguère. 2004. "Nonurgent emergency department patient characteristics and barriers to primary care." *Academic Emergency Medicine* 11 (12): 1302-1310. Accessed July 17, 2021. doi:10.1197/j.aem.2004.08.03.
- Afilalo, M., A. Guttman, A. Colacone, J. Dankoff, C. Tselios, M. Beaudet, and J. Lloyd. 1995. "Emergency department use and misuse." *The Journal of Emergency Medicine* 13 (2): 259-264.
- Agarwal, S., J. Banerjee, R. Baker, S. Conroy, R. Hsu, A. Rashid, J. Camosso-Stefinovic, P. Sinfield, and M. Habiba. 2012. "Potentially avoidable emergency department attendance: interview study of patients' reasons for attendance." *Emergency Medicine Journal* 29 (12): e3. Accessed October 21, 2020. doi:10.1136/emmermed-2011-200585.
- Al Shehr, A.M., M. Thomas, and A.M.A. Al Ghuli. 1992. "Use and misuse of emergency services at King Fahad hospital, Riyadh, Saudi Arabia." *Saudi Medical Journal* 13 (1): 21-24. Accessed July 17, 2021. <https://pesquisa.bvsalud.org/portal/resource/pt/emr-26348>.
- Allen, P., C. Cheek, S. Foster, M. Ruigrok, D. Wilson, and L. Shires. 2005. "Low acuity and general practice-type presentations to emergency departments: a rural perspective." *Emergency Medicine Australasia* 27 (2): 113-118. Accessed July 17, 2021. doi:10.1111/1742-6723.12366.
- Alyasin, A., and C. Douglas. 2014. "Reasons for non-urgent presentations to the emergency department in Saudi Arabia." *International Emergency Nursing* 22 (4): 220-225. Accessed November 01, 2020. doi:10.1016/j.ienj.2014.03.001.
- Aminzadeh, F., and W.B. Dalziel. 2002. "Older adults in the emergency department: a systematic review of patterns of use, adverse outcomes, and effectiveness of interventions." *Annals of Emergency Medicine* 39 (3): 238-247. Accessed July 17, 2021. doi:10.1067/mem.2002.121523.
- Atenstaed, K., and K. Evans. 2015. "Emergency departments: better safe than sorry?" *Emergency Nurse* 23 (4): 20-22. Accessed August 2, 2021. doi:10.7748/en.23.4.20.e1461.
- Atenstaedt, R., J. Gregory, C. Price-Jones, J. Newman, L. Roberts, and J. Turner. 2015. "Why do patients with nonurgent conditions present to the Emergency Department despite the availability of alternative services?" *European Journal of Emergency Medicine* 22 (5): 370-373. Accessed July 23, 2021. doi:10.1097/MEJ.0000000000000224.

- Badura, A. 1986. *Foundations of Thought and Action. A social cognitive theory*. Englewood Cliffs. N.H.: Prentice Hall.
- Baker, R., M.J. Bankart, A. Rashid, J. Banerjee, S. Conroy, M. Habiba, R. Hsu, A. Wilson, S. Agarwal, and J. Camosso-Stefinovic. 2011. "Characteristics of general practices associated with emergency-department attendance rates: a cross-sectional study." *BMJ Quality & Safety* 20 (11): 953-958. Accessed July 20, 2021. doi:10.1136/bmjqs.2010.050864.
- Bankart, M.J., R. Baker, A. Rashid, M. Habiba, J. Banerjee, R. Hsu, S. Conroy, S. Agarwal, and A. Wilson. 2011. "Characteristics of general practices associated with emergency admission rates to hospital: a cross-sectional study." *Journal of Emergency Medicine* 28 (7): 558-563. Accessed July 18, 2021. doi:10.1136/emj.2010.10854.
- Baranowski, T, C.L. Perry, and G.S. Parcel. 1997. *How individuals, environments, and health behavior interact*. 3rd. Edited by K. Glanz, B.K. Rimer and F.M. Lewis. Vols. Health behavior and health education: theory, research, and practice. San Francisco, CA: Jossey-Bass.
- Barnett, K., S.W. Mercer, M. Norbury, G. Watt, S. Wyke, and B. Guthrie. 2012. "Epidemiology of multimorbidity and implications for health care, research, and medical education: a cross-sectional study." *The Lancet* 380 (9836): 37-43. Accessed January 24, 2021. doi:10.1016/S0140-6736(12)60240-2.
- Behrens, D.A., and J.S. Morgan. 2016. "Modelling the Unscheduled Care System for Aneurin Bevan University Health Board." *Poster at the Cumberland Festival of Evidence*. London: Cumberland Initiative, October. Accessed August 3, 2021. <https://systemdynamics.org.uk/wp-content/uploads/2017-Day2-Behrens2-Poster.pdf>.
- Behrens, D.A., B. Waites, J.S. Morgan, and R. Jones. 2020. "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. Accessed July 31, 2021. <https://systemdynamics.org.uk/wp-content/uploads/2020-07-08-SD-SuccessStories-ABUHB-HAPU-v14.pdf>.
- Behrens, D.A., M.S. Rauner, and M. Sommersguter-Reichmann. 2021. "Why Resilience in Health Care Systems is More than Coping with Disasters: Implications for Health Care Policy." *Working Paper*. Krems/Donau: Danube University Krems, mimeo, July.
- Benger, J.R., and V. Jones. 2008. "A study of patient actions prior to emergency hospital admission." *Emergency Medicine Journal* 25 (7): 424-427. Accessed July 21, 2021. doi:10.1136/emj.2007.050856.
- Beniuk, K., A.A. Boyle, and P.J. Clarkson. 2012. "Emergency department crowding: prioritising quantified crowding measures using a Delphi study." *Emergency Medicine Journal* 29: 868-871. Accessed August 3, 2021. doi:10.1136/emmermed-2011-200646.
- Berry, A., D. Brousseau, J.M. Brotanek, S. Tomany-Korman, and G. Flores. 2008. "Why do parents bring children to the emergency department for non-urgent conditions? A qualitative study." *Ambulatory Pediatrics* 8 (6): 360-367.
- Bianco, A., C. Pileggi, and I.F. Angelillo. 2003. "Non-urgent visits to a hospital emergency department in Italy." *Public Health* 117 (4): 250-255. Accessed July 18, 2021. doi:10.1016/S0033-3506(03)00069-6.
- Billittier, A.J., E.B. Lerner, R.M. Moscati, and G. Young. 1998. "Triage, transportation, and destination decisions by out-of-hospital emergency care providers." *Prehospital and Disaster Medicine* 13 (2-4): 22-27. Accessed August 3, 2021. <https://pubmed.ncbi.nlm.nih.gov/10346404/>.

- Booker, M.J., R.L. Simmonds, and S. Purdy. 2014. "Patients who call emergency ambulances for primary care problems: a qualitative study of the decision-making process." *Emergency Medicine Journal* 31 (6): 448-452. Accessed August 4, 2021. doi:10.1136/emered-2012-202124.
- Bosmans, J.E., A.J. Boeke, M.E. van Randwijck-Jacobze, S.M. Grol, M.H. Kramer, H.E. van der Horst, and M.W. van Tulder. 2012. "Addition of a general practitioner to the accident and emergency department: a cost-effective innovation in emergency care." 29 (3): 192-196. Accessed July 27, 2021. doi:10.1136/emj.2010.101949.
- Boushy, D., and I. Dubinsky. 1999. "Primary care physician and patient factors that result in patients seeking emergency care in a hospital setting: the patient's perspective." *Journal of Emergency Medicine* 17 (3): 405-412. Accessed July 28, 2021. doi:10.1016/s0736-4679(99)00015-3.
- Brailsford, S., P.R. Harper, B. Patel, and M. Pitt. 2009. "An Analysis of the Academic Literature on Simulation and Modeling in Healthcare." *Journal of Simulation* 3 (3: Special Issue: Simulation in Healthcare: Part 1): 130-140. Accessed January 16, 2021. doi:10.1057/jos.2009.10.
- Brailsford, S.C., V.A. Lattimer, P. Tarnaras, and J.C. Turnbull. 2004. "Emergency and on-demand health care: modelling a large complex system." *Journal of the Operational Research Society* 55 (1): 34-42. Accessed January 16, 2021. doi:10.1057/palgrave.jors.2601667.
- Breen, B.M., and M. McCann. 2013. "Healthcare providers attitudes and perceptions of 'inappropriate attendance' in the Emergency Department." *International Emergency Nursing* 21 (3): 180-185. Accessed October 30, 2020. doi:10.1016/j.ienj.2012.08.006.
- Burchard, R., V. Oikonomoulas, Soost. C., M. Zoremba, and J.A. Graw. 2019. "Indicated trauma emergency department utilization - A comparison between patients' self-assessment and professional evaluation." *International Emergency Nursing* 44: 30-34. Accessed August 4, 2021. doi:10.1016/j.ienj.2019.02.006.
- Callen, J.L., L. Blundell, and M. Prgomet. 2008. "Emergency department use in a rural Australian setting: are the factors prompting attendance appropriate?" *Australian Health Review* 32 (4): 710-720. Accessed July 21, 2021. doi:10.1071/ah080710.
- Carret, M.L., A.C. Fassa, and M.R. Domingues. 2009. "Inappropriate use of emergency services: a systematic review of prevalence and associated factors." *Cadernos de Saúde Pública* 25 (1): 7-28. Accessed July 23, 2021. doi:10.1590/s0102-311x2009000100002.
- Carret, M.L., A.G. Fassa, and I. Kawachi. 2007. "Demand for emergency health service: factors associated with inappropriate use." *BMC Health Services Research* 7: 131. Accessed August 2, 2021. doi:10.1186/1472-6963-7-131.
- Chalder, M., A. Montgomery, S. Hollinghurst, M. Cooke, J. Munro, V. Lattimer, D. Sharp, and C. Salisbury. 2007. "Comparing care at walk-in centres and at accident and emergency departments: an exploration of patient choice, preference and satisfaction." *Emergency Medicine Journal* 24 (4): 260-264. Accessed October 28, 2020. doi:10.1136/emj.2006.042499.
- Chan, B.T.B., and H.J. Ovens. 2002. "Frequent users of emergency departments. Do they also use family physicians' services?" *Canadian Family Physician* 48: 1654-1660. Accessed October 30, 2020. <https://pubmed.ncbi.nlm.nih.gov/12449550/>.
- Cheek, C., P. Allen, L. Shires, D. Parry, and M. Ruigrok. 2016. "Low-acuity presentations to regional emergency departments: What is the issue?" *Emergency Medicine Australasia* 28 (2): 145-152. Accessed November 01, 2020. doi:10.1111/1742-6723.12526.
- Cheek, J.A., G. Braitberg, and S.C.A. West. 2017. "Why do children present to emergency departments? Exploring motivators and measures of presentation appropriateness for children presenting to a

- paediatric emergency department." *Journal of Paediatrics and Child Health* 53 (5): 451-457. Accessed October 31, 2020. doi:10.1111/jpc.13482.
- Chin, N.P., J.G. Goepf, T. Malia, L. Harris, and A. Poordabagh. 2006. "Nonurgent use of a pediatric emergency department: a preliminary qualitative study." *Pediatric Emergency Care* 22 (1): 22-27. Accessed July 24, 2021. doi:10.1097/01.pec.0000195756.74328.21.
- Chmiel, C., C.A. Huber, T. Rosemann, M. Zoller, K. Eichler, Sidler P., and O. Senn. 2011. "Walk-ins seeking treatment at an emergency department or general practitioner out-of-hours service: a cross-sectional comparison." *BMC Health Services Research* 11: 94.
- Chu, K., A. Brown, and R. Pillay. 2001. "Older patients' utilisation of emergency department resources: a cross-sectional study." *Australian Health Review* 24 (3): 44-52. Accessed July 17, 2021. doi:10.1071/ah010044.
- Clark, M.J., J. Purdie, G.J. FitzGerald, N.G. Bischoff, and P.K. O'Rourke. 1999. "Predictors of demand for emergency prehospital care: an Australian study." *Prehospital and Disaster Medicine* 14 (3): 167-173. Accessed July 21, 2021. <https://pubmed.ncbi.nlm.nih.gov/10724741/>.
- Conlon, C., E. Nicholson, B. Rodríguez-Martin, R. O'Donovan, A. De Brún, T. McDonnell, G. Bury, and E. McAuliffe. 2020. "Factors influencing general practitioners decisions to refer Paediatric patients to the emergency department: a systematic review and narrative synthesis." *BMC Family Practice* 21 (1): 210. Accessed October 28, 2020. doi:10.1186/s12875-020-01277-9.
- Cooper, A., A. Carson-Stevens, T. Hughes, and A. Edwards. 2020. "Is streaming patients in emergency departments to primary care services effective and safe?" *BMJ* 368: m462.
- Coster, J.E., J.K. Turner, D. Bradbury, and A. Cantrell. 2017. "Why Do People Choose Emergency and Urgent Care Services? A Rapid Review Utilizing a Systematic Literature Search and Narrative Synthesis." *Academic Emergency Medicine* 24 (9): 1137-1149. Accessed October 31, 2020. doi:10.1111/acem.13220.
- Cowling, T.E., A. Majeed, and M.J. Harris. 2018. "Importance of accessibility and opening hours to overall patient experience of general practice: analysis of repeated cross-sectional data from a national patient survey." *British Journal of General Practice* 68 (672): e469-e477. Accessed July 25, 2021. doi:10.3399/bjgp18X697673.
- Cowling, T.E., E.V. Cecil, M.A. Soljak, J.T. Lee, C. Millett, A. Majeed, R.M. Wachter, and M.J. Harris. 2013. "Access to primary care and visits to emergency departments in England: a cross-sectional, population-based study." *PLoS One* 8 (6): e66699. Accessed July 25, 2021. doi:10.1371/journal.pone.0066699.
- Davison, A.G., A.C. Hildrey, and M.A. Floyer. 1983. "Use and misuse of an accident and emergency department in the East End of London." *Journal of the Royal Society of Medicine* 76 (1): 37-40. Accessed July 18, 2021. <https://pubmed.ncbi.nlm.nih.gov/6827496/>.
- de Valk, J., E.M. Taal, M.S. Nijhoff, M.H. Harms, E.M. Lieshout, P. Patka, and P.P. Rood. 2014. "Self-referred patients at the Emergency Department: patient characteristics, motivations, and willingness to make a copayment." *International Journal of Emergency Medicine* 7: 30. Accessed July 21, 2021. doi:10.1186/s12245-014-0030-7.
- Dolton, P., and V. Pathania. 2016. "Can increased primary care access reduce demand for emergency care? Evidence from England's 7-day GP opening." *Journal of Health Economics* 49: 193-208. Accessed July 25, 2021. doi:10.1016/j.jhealeco.2016.05.002.
- Durand, A.-C., S. Gentile, B. Devictor, S. Palazzolo, P. Vignally, P. Gerbeaux, and R. Sambuc. 2011. "ED patients: how nonurgent are they? Systematic review of the emergency medicine literature." *The American Journal of Emergency Medicine* 29 (3): 333-345.

- Durand, A.-C., S. Palazzolo, N. Tanti-Hardouin, P. Gerbeaux, R. Sambuc, and S. Gentile. 2012. "Nonurgent patients in emergency departments: rational or irresponsible consumers? Perceptions of professionals and patients." *BMC Research Notes* 5: 525. Accessed November 01, 2020. <https://bmcresnotes.biomedcentral.com/articles/10.1186/1756-0500-5-525>.
- Eagle, D.J., E. Rideout, P. Price, C. McCann, and E. Wonnacott. 1993. "Misuse of the emergency department by the elderly population: myth or reality?" *Journal of Emergency Nursing* 19 (3): 212-218. Accessed July 18, 2021. <https://pubmed.ncbi.nlm.nih.gov/8510362/>.
- Ekwall, A. 2013. "Acuity and anxiety from the patient's perspective in the emergency department." *Journal of Emergency Nursing* 39 (6): 534/538. Accessed August 4, 2021. doi:10.1016/j.jen.2010.10.003.
- Field, S., and A. Lantz. 2006. "Emergency department use by CTAS Levels IV and V patients." *Canadian Journal of Emergency Medicine* 8 (5): 317-322. Accessed July 28, 2021. doi:10.1017/s1481803500013968.
- FitzGerald, G., G. Toloo, P. Aitken, G. Keijzers, and P. Scuffham. 2015. "Public use and perceptions of emergency departments: A population survey." *Emergency Medicine Australasia* 27 (4): 336-342. Accessed November 01, 2020. doi:10.1111/1742-6723.12420.
- Foldes, S.S., L.R. Fischer, and K. Kaminsky. 1994. "What is an emergency? The judgments of two physicians." *Annals of Emergency Medicine* 23 (4): 833-840. Accessed July 19, 2021. doi:10.1016/s0196-0644(94)70322-1.
- Fone, David, Sandra Hollinghurst, and Mark Temple. 2003. "Systematic review of the use and value of computer simulation modelling in population health and health care delivery." *Journal of Public Health Medicine* 25 (4): 325-335.
- Fourny, M., A.S. Lucas, L. Belle, G. Debaty, P. Casez, H. Bouvaist, P. François, G. Vanzetto, and J. Labarère. 2011. "Inappropriate dispatcher decision for emergency medical service users with acute myocardial infarction." *American Journal of Emergency Medicine* 29 (1): 37-42. Accessed August 4, 2021. doi:10.1016/j.ajem.2009.07.008.
- Franco, L.A., and R.P. Hämäläinen. 2016. "Engaging with behavioral operational research: On methods, actors and praxis." In *Behavioral Operations Research: Theory, methodology and practice*, edited by M. Kunc, J. Malpass and L. White, 2-25. London: Palgrave Macmillan. Accessed January 16, 2021. https://link.springer.com/chapter/10.1057%2F978-1-137-53551-1_1.
- Gentile, S., P. Vignally, A.C. Durand, S. Gainotti, R. Sambuc, and P. Gerbeaux. 2010. "Nonurgent patients in the emergency department? A French formula to prevent misuse." *BMC Health Services Research* 10: 66. Accessed July 28, 2021. doi:10.1186/1472-6963-10-66.
- George, G., C. Jell, and B.S. Todd. 2006. "Effect of population ageing on emergency department speed and efficiency: a historical perspective from a district general hospital in the UK." *Emergency Medicine Journal* 23 (5): 379-383. Accessed July 17, 2021. doi:10.1136/emj.2005.02979.
- Gibson, Amy, Deborah Randall, Duong T. Tran, Mary Byrne, Anthony Lawler, Alys Havard, Maureen Robinson, and Louisa R. Jorm. 2018. "Emergency Department Attendance after Telephone Triage: A Population-Based Data Linkage Study." *Health Services Research* 53 (2): 1137-1162. Accessed October 29, 2020. doi:10.1111/1475-6773.12692.
- Gifford, M.J., J.B. Franaszek, and G. Gibson. 1980. "Emergency physicians' and patients' assessments: urgency of need for medical care." *Annals of Emergency Medicine* 9 (10): 502-507. Accessed July 18, 2021. doi:10.1016/s0196-0644(80)80187-9.
- Göransson, K.E., M. De Waern, and P. Lindmarker. 2013. "Patients' pathway to emergency care: is the emergency department their first choice of care?" *European Journal of Emergency Medicine* 20 (1): 45-50.

- Grafstein, E., D. Wilson, R. Stenstrom, C. Jones, M. Tolson, I. Poureslami, and F.X. Scheuermeyer. 2013. "A regional survey to determine factors influencing patient choices in selecting a particular emergency department for care." *Academic Emergency Medicine* 20 (1): 63-70.
- Gruneir, A., M.J. Silver, and P.A. Rochon. 2011. "Emergency department use by older adults: a literature review on trends, appropriateness, and consequences of unmet health care needs." *Medical Care Research and Review* 68 (2): 131-155. Accessed July 23, 2021. doi:10.1177/1077558710379422.
- Guimarães, D.S. Jr, E.J. Soares, G.F. Júnior, and D.D. Medeiros. 2015. "Attributes and circumstances that induce inappropriate health services demand: a study of the health sector in Brazil." *BMC Health Services Research* 15: 65. Accessed July 25, 2021. doi:10.1186/s12913-015-0728-0.
- Günel, M.M., and M. Pidd. 2010. "Discrete event simulation for performance modelling in health care: a review of the literature." *Journal of Simulation* 4 (1): 42-45. Accessed January 16, 2021. doi:10.1057/jos.2009.25.
- Guttman, N., D.R. Zimmerman, and M.S. Nelson. 2003. "The many faces of access: reasons for medically nonurgent emergency department visits." *Journal of Health Politics, Policy and Law* 28 (6): 1089-1120. Accessed July 18, 2021. doi:10.1215/03616878-28-6-1089.
- Hämäläinen, R.P., J. Luoma, and E. Saarinen. 2013. "On the importance of behavioral operational research: The case of understanding and communicating about dynamic systems." *European Journal of Operational Research* 228 (3): 623-634. Accessed January 15, 2021. doi:10.1016/j.ejor.2013.02.001.
- Hart, C. 2018. *Doing a Literature Review: Releasing the Research Imagination*. 2nd. SAGE Publications Ltd.
- Hart, J.T. 1971. "The inverse care law." *The Lancet* 297 (7696): 405-412. Accessed January 24, 2021. doi:10.1016/S0140-6736(71)92410-X.
- Heinert, S.W., M. Mumford, S.E. Kim, M.M. Hossain, M.L. Amashta, and M.A. Massey. 2000. "User Characteristics of a Low-Acuity Emergency Department Alternative for Low-Income Patients." *Western Journal of Emergency Medicine* 21 (6): 162-171. Accessed August 4, 2021. doi:10.5811/westjem.2020.8.47970.
- Hong, M., A. Thind, G.S. Zaric, and S. Sarma. 2020. "The impact of improved access to after-hours primary care on emergency department and primary care utilization: A systematic review." *Health Policy* 124 (8): 812-818. Accessed August 2, 2021. doi:10.1016/j.healthpol.2020.05.015.
- Hong, R., B.M. Baumann, and E.D. Boudreaux. 2007. "The emergency department for routine healthcare: race/ethnicity, socioeconomic status, and perceptual factors." *Journal of Emergency Medicine* 32 (2): 149-158. Accessed August 4, 2021. doi:10.1016/j.jemermed.2006.05.042.
- Howard, M.S., B.A. Davis, C. Anderson, D. Cherry, P. Koller, and D. Shelton. 2005. "Patients' perspective on choosing the emergency department for nonurgent medical care: a qualitative study exploring one reason for overcrowding." *Journal of Emergency Nursing* 31 (5): 429-435. Accessed July 17, 2021. doi:10.1016/j.jen.2005.06.023.
- Howick, Susan, and Fran Ackermann. 2011. "Mixing OR methods in practice: Past, present and future directions." *European Journal of Operational Research* 503-511.
- Howick, Susan, Colin Eden, Fran Ackermann, and Terry Williams. 2008. "Building confidence in models for multiple audiences: The modelling cascade." *European Journal of Operational Research* 1068-1083.
- Hull, S.A., I.R. Jones, and K. Moser. 1997. "Factors Influencing the Attendance Rate at Accident and Emergency Departments in East London: The Contributions of Practice Organization, Population

- Characteristics and Distance.” *Journal of Health Services Research and Policy* 2 (1): 6-13. Accessed November 01, 2020. doi:10.1177/135581969700200104.
- Hulshof, P.J.H., N. Kortbeek, R.J. Boucherie, E.W. Hans, and P.J.M. Bakker. 2012. “Taxonomic classification of planning decisions in health care: a structured review of the state of the art in OR/MS.” *Health Systems* 1 (2): 129–175. Accessed January 16, 2021. doi:10.1057/hs.2012.18.
- Hunt, K.A., E.J. Weber, J.A. Showstack, D.C. Colby, and M.L. Callahan. 2006. “Characteristics of frequent users of emergency departments.” *Annals of Emergency Medicine* 48 (1): 1-8. Accessed October 31, 2020. doi:10.1016/j.annemergmed.2005.12.030.
- Hunter, C., C. Chew-Graham, S. Langer, A. Stenhoff, J. Drinkwater, E. Guthrie, and P. Salmon. 2013. “A qualitative study of patient choices in using emergency health care for long-term conditions: the importance of candidacy and recursivity.” *Patient Education and Counseling* 93 (2): 335-341. Accessed October 28, 2020. doi:10.1016/j.pec.2013.06.001.
- Institute of Medicine (US) Committee on Quality of Health Care in America. 2001. *Crossing the quality chasm: a new health system for the 21st century*. Washington, DC: National Academies Press (US). Accessed November 07, 2020. doi:10.17226/10027.
- Jacob, S.L., J. Jacoby, M. Heller, and J. Stoltzfus. 2008. “Patient and physician perspectives on ambulance utilization.” *Prehospital Emergency Care* 12 (2): 176-181. Accessed October 21, 2020. doi:10.1080/10903120701710058.
- Johnson, L., R. Cornish, A. Boyd, and J. Macleod. 2019. “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 Services Research* 19 (1): 134. Accessed July 23, 2021. doi:10.1186/s12913-019-3922-7.
- Kalidindi, S., P. Mahajan, R. Thomas, and U. Sethuraman. 2010. “Parental perception of urgency of illness.” *Pediatric Emergency Care* 26 (8): 549-553. Accessed July 25, 2021. doi:10.1097/PEC.0b013e3181ea71b3.
- Keizer Beache, S., and C. Guell. 2016. “Non-urgent accident and emergency department use as a socially shared custom: a qualitative study.” *Emergency Medicine Journal* 33: 47-51. Accessed August 4, 2021. doi:10.1136/emmermed-2014-204039.
- Kempe, A., M. Bunik, J. Ellis, D. Magid, T. Hegarty, L.M. Dickinson, and J.F. Steiner. 2006. “How safe is triage by an after-hours telephone call center?” *Pediatrics* 118 (2): 457-463. Accessed July 18, 2021. doi:10.1542/peds.2005-3073.
- Kibar, C.R., and M.L. Borland. 2006. “Too long in the tooth: a descriptive study of adults presenting to a pediatric emergency department.” *Pediatric Emergency Care* 22 (5): 321-333. Accessed August 4, 2021. doi:10.1097/01.pec.0000215140.36662.29.
- Kirby, S.E., S.M. Dennis, U.W. Jayasinghe, and M.F. Harris. 2010. “Patient related factors in frequent readmissions: the influence of condition, access to services and patient choice.” *BMC Health Services Research* 10: 216. Accessed October 30, 2020. doi:10.1186/1472-6963-10-216.
- Koce, F., G. Randhawa, and B. Ochieng. 2019. “Understanding healthcare self-referral in Nigeria from the service users' perspective: a qualitative study of Niger state.” *BMC Health Services Research* 19 (1): 209. Accessed July 25, 2021. doi:10.1186/s12913-019-4046-9.
- Koziol-McLain, J., D.W. Price, B. Weiss, A.A. Quinn, and B. Honigman. 2000. “Seeking care for nonurgent medical conditions in the emergency department: through the eyes of the patient.” *Journal of Emergency Nursing* 26 (6): 554-563. Accessed July 18, 2021. doi:10.1067/men.2000.11090.

- Kraaijvanger, N., D. Rijpsma, H. van Leeuwen, and M. Edwards. 2015. "Self-referrals in the emergency department: reasons why patients attend the emergency department without consulting a general practitioner first-a questionnaire study." *International Journal of Emergency Medicine* 8 (1): 46. Accessed November 01, 2020. doi:10.1186/s12245-015-0096-x.
- Kraaijvanger, N., H. van Leeuwen, D. Rijpsma, and M. Edwards. 2016. "Motives for self-referral to the emergency department: a systematic review of the literature." *BMJ Health Service Research* 16 (1): 685. Accessed October 31, 2020. doi:10.1186/s12913-016-1935-z.
- Krebs, L.D., S.W. Kirkland, R. Chetram, T. Nikel, B. Voaklander, A. Davidson, B. Holroyd, et al. 2017. "Low-acuity presentations to the emergency department in Canada: exploring the alternative attempts to avoid presentation." *Journal of Emergency Medicine* 34 (4): 249-255. Accessed July 25, 2021. doi:10.1136/emered-2016-205756.
- Krug, S.E. 1999. "Access and use of emergency services: Inappropriate use versus unmet need." *Clinical Pediatric Emergency Medicine* 1 (1): 35-44. Accessed July 18, 2021. doi:10.1016/S1522-8401(99)90007-1.
- Kunc, Martin, Paul Harper, and Konstantinos Katsikopoulos. 2018. "A review of implementation of behavioural aspects in the application of OR in healthcare." *Journal of the Operational Research Society* 1044-1072.
- Labarère, J., J.P. Torres, P. Francois, M. Fourny, P. Argento, X. Gensburger, and P. Menthonnex. 2003. "Patient compliance with medical advice given by telephone." *American Journal of Emergency Medicine* 21 (4): 288-292. Accessed July 23, 2021. doi:10.1016/s0735-6757(03)00087-1.
- LaCalle, E., and E. Rabin. 2010. "Frequent Users of Emergency Departments: The Myths, the Data, and the Policy Implications." *Annals of Emergency Medicine* 56 (1): 42-48. Accessed November 01, 2020. doi:10.1016/j.annemergmed.2010.01.032.
- Lane, D.C., C. Monefeldt, and J.V. Rosenhead. 2000. "Looking in the wrong place for healthcare improvements: A system dynamics study of an accident and emergency department." *Journal of the Operational Research Society* 51 (5): 518-531. Accessed January 16, 2021. doi:10.1057/palgrave.jors.2600892.
- Lee, A., C.B. Hazlett, S. Chow, F.L. Lau, C.W. Kam, P. Wong, and T.W. Wong. 2003. "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 Policy* 66 (2): 159-168. Accessed July 19, 2021. doi:10.1016/s0168-8510(03)00023-x.
- Lega, F., and A. Mengoni. 2008. "Why non-urgent patients choose emergency over primary care services? Empirical evidence and managerial implications." *Health Policy* 88 (2-3): 326-338. Accessed July 19, 2021. doi:10.1016/j.healthpol.2008.04.005.
- Lippi Bruni, M., I. Mammi, and C. Ugolini. 2016. "Does the extension of primary care practice opening hours reduce the use of emergency services?" *Journal of Health Economics* 50: 144-155. Accessed July 25, 2021. doi:10.1016/j.jhealeco.2016.09.011.
- Lobachova, L., D.F.M. Brown, J. Sinclair, Y. Chang, K. Zink Thielker, and J.T. Nagurney. 2014. "Patient and provider perceptions of why patients seek care in emergency departments." *The Journal of Emergency Medicine* 46 (1): 104-112. Accessed October 28, 2020. doi:10.1016/j.jemermed.2013.04.063.
- Lorig, K.R., D.S. Sobel, P.L. Ritter, D. Laurent, and M. Hobbs. 2001. "Effect of a self-management program on patients with chronic disease." *Effective Clinical Practice* 4 (6): 256-262. Accessed October 28, 2020. <https://pubmed.ncbi.nlm.nih.gov/11769298/>.

- Lowe, R., A. Porter, H.A. Snooks, and E.E. Birdie. 2011. "The association between illness representation profiles and use of unscheduled urgent and emergency health care services." *British Journal of Health Psychology* 16 (4): 862-879. Accessed October 28, 2020. doi:10.1111/j.2044-8287.2011.02023.x.
- Lowe, R.A., and A.B. Bindman. 1997. "Judging who needs emergency department care: a prerequisite for policy-making." *American Journal of Emergency Medicine* 15 (2): 133-136. Accessed August 4, 2021. doi:10.1016/s0735-6757(97)90083-8.
- Lowthian, J.A., A.J. Curtis, P.A. Cameron, J.U. Stoelwinder, M.W. Cooke, and J.J. McNeil. 2011. "Systematic review of trends in emergency department attendances: an Australian perspective." *Emergency Medicine Journal* 28: 373-377. Accessed July 18, 2021. doi:10.1136/emj.2010.099226.
- Lowthian, J.A., C. Smith, J.U. Stoelwinder, D. Smit, J.J. McNeil, and P.A. Cameron. 2013. "Why older patients of lower clinical urgency choose to attend the emergency department." *International Medicine Journal* 43 (1): 59-65. Accessed October 29, 2020. doi:10.1111/j.1445-5994.2012.02842.x.
- Lozano, K., U.C. Ogbu, A. Amin, B. Chakravarthy, C.L. Anderson, and S. Lotfipour. 2015. "Patient Motivators for Emergency Department Utilization: A Pilot Cross-Sectional Survey of Uninsured Admitted Patients at a University Teaching Hospital." *Journal of Emergency Medicine* 49 (2): 203-210.e3. Accessed July 25, 2021. doi:10.1016/j.jemermed.2015.03.019.
- Ludwick, A., R. Fu, C. Warden, and R.A. Lowe. 2009. "Distances to emergency department and to primary care provider's office affect emergency department use in children." *Academic Emergency Medicine* 16 (5): 411-417. Accessed July 19, 2021. doi:10.1111/j.1553-2712.2009.00395.x.
- Manzi, S., D. Chalk, M. Pearson, J. Day, K. Stein, I. Lang, and M. Pitt. 2016. "Opening the black box: combining Agent Based Simulation and realism in intervention development." Edited by A. Anagnostou, K. Hoad and M. Kunc. *Proceedings of the 2016 Operational Research Society Simulation Workshop (SW16)*. Ettington Chase Hotel, Warwickshire: The Operational Research Society. 155-164. Accessed August 3, 2021. https://clahrc-wessex.nihr.ac.uk/img/publications/SW16_ProceedingsBook-FINAL_RC_-_HW_20042016102810.pdf.
- Martin, A., C. Martin, P.B. Martin, P.A. Martin, G. Green, and S. Eldridge. 2002. "'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?" *Journal of Health Services Research & Policy* 7 (3): 160-165. Accessed July 18, 2021. doi:10.1258/135581902760082463.
- Masso, M., A.J. Bezzina, P. Siminski, R. Middleton, and K. Eagar. 2007. "Why patients attend emergency departments for conditions potentially appropriate for primary care: Reasons given by patients and clinicians differ." *Emergency Medicine Australasia* 19 (4). Accessed October 30, 2020. doi:10.1111/j.1742-6723.2007.00968.x.
- McGuigan, T., and P. Watson. 2010. "Non-urgent attendance at emergency departments." *Journal of Emergency Nursing* 18 (6): 34-38. Accessed July 23, 2021. doi:10.7748/en.18.6.34.s18.
- McKenna, G., A. Rogers, S. Walker, and C. Pope. 2020. "The influence of personal communities in understanding avoidable emergency department attendance: qualitative study." *BMC Health Services Research* 20 (1): 887. Accessed July 17, 2021. doi:10.1186/s12913-020-05705-5.
- Minderhout, R.M., P. Venema, H.M.M. Vos, J. Kant, M.A. Bruijnzeels, and M.E. Numans. 2019. "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* 9: e029853. Accessed October 31, 2020. doi:10.1136/bmjopen-2019-029853.

- Mohiuddin, S., J. Busby, J. Savović, A. Richards, K. Northstone, W. Hollingworth, J.L. Donovan, and C. Vasilakis. 2017. "Patient flow within UK emergency departments: a systematic review of the use of computer simulation modelling methods." *BMJ Open* 7: e015007. Accessed January 16, 2021. <https://bmjopen.bmj.com/content/7/5/e015007>.
- Moll van Charante, E.P., G. ter Riet, and P. Bindels. 2008. "Self-referrals to the A&E department during out-of-hours: patients' motives and characteristics." *Patient Education and Counseling* 70 (2): 256-265. Accessed October 29, 2020. doi:10.1016/j.pec.2007.10.012.
- Moll van Charante, E.P., P.C.E. van Steenwijk-Opdam, and P.J.E. Bindels. 2007. "Out-of-hours demand for GP care and emergency services: patients' choices and referrals by general practitioners and ambulance services." *BMC Family Practice* 8: 46. Accessed October 29, 2020. doi:10.1186/1471-2296-8-46.
- Morgans, A., and S. Burgess. 2012. "Judging a patient's decision to seek emergency healthcare: clues for managing increasing patient demand." *Australian Health Review* 36 (1): 110-114. Accessed October 28, 2020. doi:10.1071/AH10921.
- Morris, D.L., and A.B. Cross. 1980. "Is the emergency ambulance service abused?" *British Medical Journal* 281 (6233): 121-123. Accessed July 19, 2021. doi:10.1136/bmj.281.6233.121.
- Murphy, A.W. 1998. "'Inappropriate' attenders at accident and emergency departments I: definition, incidence and reasons for attendance." *Family Practice* 15 (1): 23-32. Accessed July 27, 2021. <https://pubmed.ncbi.nlm.nih.gov/9527294/>.
- Nagree, Y., V.J. Camarda, D.M. Fatovich, P.A. Cameron, I. Dey, A.D. Gosbell, S.M. McCarthy, and D. Mountain. 2013. "Quantifying the proportion of general practice and low-acuity patients in the emergency department." *The Medical Journal of Australia* 198 (11): 612-615. Accessed October 31, 2020. doi:<https://doi.org/10.5694/mja12.11754>.
- Naouri, D., G. Ranchon, A. Vuagnat, J. Schmidt, C. El Khoury, and Y. Yordanov. 2020. "Factors associated with inappropriate use of emergency departments: findings from a cross-sectional national study in France." *BMJ Quality & Safety* 29 (6): 449-464. Accessed July 18, 2021. doi:10.1136/bmjqs-2019-009396.
- Neil, Amanda, and Barbara de Graaff. 2016. "Need, want and demand: What is really happening with low-acuity presentations?" *Emergency Medicine Australasia* 28 (3): 363-364. Accessed July 28, 2021. doi:10.1111/1742-6723.12591.
- Nelson, J. 2011. "Why patients visit emergency units rather than use primary care services." *Emergency Nurse* 19 (1): 32-36. Accessed October 30, 2020. doi:10.7748/en2011.04.19.1.32.c8448.
- Ng, J.Y., D.M. Fatovich, V.F. Turner, J.A. Wurmel, S.A. Skevington, and M.R. Phillips. 2012. "Appropriateness of healthdirect referrals to the emergency department compared with self-referrals and GP referrals." *Medical Journal of Australia* 197 (9): 498-502. Accessed July 21, 2021. doi:10.5694/mja12.10689.
- NHS Digital. 2020. "Hospital Accident & Emergency Activity 2019-20." 31 March. Accessed July 17, 2021. <https://digital.nhs.uk/data-and-information/publications/statistical/hospital-accident--emergency-activity/2019-20>.
- NHS England/Nursing Directorate. 2013. "Compassion in Practice – One year on." *NHS England*. 26 November. Accessed August 3, 2021. <https://www.england.nhs.uk/wp-content/uploads/2016/05/cip-one-year-on.pdf>.
- NHS Servies. 2021. Accessed July 19, 2021. <https://www.nhs.uk/nhs-services/urgent-and-emergency-care-services/when-to-go-to-ae/>.

- NHS Wales. 2021. *Health in Wales*. Accessed August 3, 2021. <https://www.wales.nhs.uk/nhswalesaboutus/thecoreprinciplesofnhswales>.
- Nicholson, E., T. McDonnell, A. De Brún, M. Barrett, G. Bury, C. Collins, C. Hensey, and E. McAuliffe. 2007. "Factors that influence family and parental preferences and decision making for unscheduled paediatric healthcare - systematic review." *BMC Health Services Research* 20 (1): 663. Accessed October 28, 2020. doi:10.1186/s12913-020-05527-5.
- Northington, W.E., J.H. Brice, and B. Zou. 2005. "Use of an emergency department by nonurgent patients." *The American Journal of Emergency Medicine* 23 (2): 131-137. Accessed October 28, 2020. doi:10.1016/j.ajem.2004.05.006.
- O'Cathain, A., E. Knowles, J. Munro, and J. Nicholl. 2007. "Exploring the effect of changes to service provision on the use of unscheduled care in England: population surveys." *BMC Health Services Research* 7: 61. Accessed October 28, 2020. doi:10.1186/1472-6963-7-61.
- O'Cathain, A., J. Connell, J. Long, and J. Coster. 2020. "'Clinically unnecessary' use of emergency and urgent care: A realist review of patients' decision making." *Health Expectations* (Wiley) 23 (1): 19-40. Accessed October 28, 2020. doi:10.1111/hex.12995.
- Oktaý, C., Y. Cete, O. Eray, M. Pekdemir, and A. Gunerli. 2003. "Appropriateness of emergency department visits in a Turkish university hospital." *Croatian Medical Journal* 44 (5): 585-591. Accessed July 28, 2021. <https://pubmed.ncbi.nlm.nih.gov/14515418/>.
- Olsson, M., and H. Hansagi. 2001. "Repeated use of the emergency department: qualitative study of the patient's perspective." *Emergency Medical Journal* 18 (6): 430-434. Accessed July 18, 2021. doi:10.1136/emj.18.6.430.
- Oslislo, S., C. Heintze, M. Schmiedhofer, M. Möckel, Schenk, L., and F. Holzinge. 2019. "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* 9 (4): e026786. Accessed October 31, 2020. doi:10.1136/bmjopen-2018-026786.
- Oterino de la Fuente, D., J.F. Baños Pino, V.F. Blanco, and A.R. Alvarez. 2007. "Does better access to primary care reduce utilization of hospital accident and emergency departments? A time-series analysis." *European Journal of Public Health* 17 (2): 186-192. Accessed July 20, 2021. doi:10.1093/eurpub/ckl085.
- Palmer, C.D., K.H. Jones, P.A. Jones, S.V. Polaczar, and G.W.L. Evans. 2005. "Urban legend versus rural reality: patients' experience of attendance at accident and emergency departments in west Wales." *Emergency Medicine Journal* 22 (3): 165-170. Accessed July 21, 2021. doi:10.1136/emj.2003.007674.
- Patel, S., and I. Dubinsky. 2002. "Outcomes of referrals to the ED by family physicians." *American Journal of Emergency Medicine* 20 (3): 144-150. Accessed July 23, 2021. doi:10.1053/ajem.2002.32638.
- Pereira, S., A. Oliveira e Silva, M. Quintas, J. Almeida, C. Marujo, M. Pizarro, V. Angélico, et al. 2001. "Appropriateness of emergency department visits in a Portuguese university hospital." *Annals of Emergency Medicine* 37 (6): 580-586. Accessed July 23, 2021. doi:10.1067/mem.2001.114306.
- Petitot, C., F. Chapuis, S. Touzet, G. Fournier, and M. Bonnefoy. 2008. "Inappropriate consultation of elderly subjects attending an emergency ward of a university hospital: A prospective study." *Revue de Geriatrie* 33 (9): 761-769. Accessed July 28, 2021. <https://www.scopus.com/record/display.uri?eid=2-s2.0-58149239735&origin=inward&txGid=898fa6a78752caa08902294bd92d52f9>.

- Philips, H., R. Remmen, P. De Paepe, W. Buylaert, and P. Van Royen. 2010. "Out of hours care: a profile analysis of patients attending the emergency department and the general practitioner on call." *BMC Family Practitioner* 11: 88.
- Pomerantz, W.J., C.J. Schubert, H.D. Atherton, and U.R. Kotagal. 2002. "Characteristics of nonurgent emergency department use in the first 3 months of life." *Pediatric Emergency Care* 18 (6): 403-408. Accessed July 28, 2021. doi:10.1097/00006565-200212000-00001.
- Prince, M., and C. Worth. 1992. "A study of 'inappropriate' attendances to a paediatric Accident and Emergency Department." *Journal of Public Health Medicine* 14 (2): 177-182. Accessed July 21, 2021. <https://pubmed.ncbi.nlm.nih.gov/1515201/>.
- Public Health Information for Scotland. 2018. *The Scottish Burden of Disease Study, 2016*. Deprivation Report, Edinburgh: NHS Health Scotland, 28. Accessed January 24, 2021. <https://www.scotpho.org.uk/media/1656/sbod2016-deprivation-report-aug18.pdf>.
- Purdey, S., and A. Huntley. 2013. "Predicting and preventing avoidable hospital admissions: a review." *Journal of the Royal College of Physicians of Edinburgh* 43 (4): 340-344. Accessed July 21, 2021. doi:10.4997/jrcpe.2013.415.
- Qiong, O.U. 2017. "A Brief Introduction to Perception." *Studies in Literature and Language* 15 (4): 18-28. Accessed August 3, 2021. doi:10.3968/10055.
- Ragin, D.F., U. Hwang, R.K. Cydulka, D. Holson, L.L. Jr Haley, C.F. Richards, B.M. Becker, L.D. Richardson, and Emergency Medicine Patients' Access To Healthcare (EMPATH) Study Investigators. 2005. "Reasons for using the emergency department: results of the EMPATH Study." *Academic Emergency Medicine* 12 (12): 1158-1166. Accessed July 21, 2021. doi:10.1197/j.aem.2005.06.030.
- Rajpar, S.F., M.A. Smith, and M.W. Cooke. 2000. "Study of choice between accident and emergency departments and general practice centres for out of hours primary care problems." *Journal of Accident & Emergency Medicine* 17: 18-21. Accessed July 19, 2021. doi:10.1136/emj.17.1.18.
- Rantala, A., A. Ekwall, and A. Forsberg. 2016. "The meaning of being triaged to non-emergency ambulance care as experienced by patients." *International Emergency Nursing* 25: 65-70. Accessed July 25, 2021. doi:10.1016/j.ienj.2015.08.001.
- Rassin, M., A. Nasie, Y. Bechor, G. Weiss, and D. Silner. 2006. "The characteristics of self-referrals to ER for non-urgent conditions and comparison of urgency evaluation between patients and nurses." *Accident and Emergency Nursing* 14 (1): 20-26. Accessed July 21, 2021. doi:10.1016/j.aaen.2005.
- Richardson, S., M. Ardagh, and P. Hider. 2006. "New Zealand health professionals do not agree about what defines appropriate attendance at an emergency department." *New Zealand Medical Journal* 119 (1232): U1933. Accessed July 23, 2021. <https://pubmed.ncbi.nlm.nih.gov/16633392/>.
- Rieffe, C., P. Oosterveld, D. Wijkkel, and C. Wiefferink. 1999. "Reasons why patients bypass their GP to visit a hospital emergency department." *Accident and Emergency Nursing* 7 (4): 217-225. Accessed November 01, 2020. doi:10.1016/s0965-2302(99)80054-x.
- Rinderknecht, A.S., M. Ho, P. Matykiewicz, and J.M. Grupp-Phelan. 2010. "Referral to the emergency department by a primary care provider predicts severity of illness." *Pediatrics* 126 (5): 917-924. Accessed July 23, 2021. doi:10.1542/peds.2010-0364.
- Rissbacher, C., C. Rissbacher, S. Röhlich, and D. Meraner. 2011. "Gatekeeping in the health care system: how to predict justified and respective non-justified visits to emergency departments?" *Journal of Public Health* 5. Accessed July 28, 2021. <https://www.springermedizin.de/de/gatekeeping-in-the-health-care-system-how-to-predict-justified-a/8805016>.

- Robertson, D.A., and A. Franco. 2016. "An Agent-Based Model of knowledge transferral: exploring the need for closure and cognition." Edited by A. Anagnostou, K. Hoad and M. Kunc. *Proceedings of the 2016 Operational Research Society Simulation Workshop (SW16)*. Ettington Chase Hotel, Warwickshire: The Operational Research Society. 64-71. Accessed August 3, 2021. https://clahrc-wessex.nihr.ac.uk/img/publications/SW16_ProceedingsBook-FINAL_RC_-_HW_20042016102810.pdf.
- Salami, O., J. Salvador, and R. Vega. 2012. "Reasons for nonurgent pediatric emergency department visits: perceptions of health care providers and caregivers." *Pediatric Emergency Care* 28 (1): 43-46. Accessed October 30, 2020. doi:10.1097/PEC.0b013e31823f2412.
- Salmon, A., S.: Briscoe, S. Rachuba, and M. Pitt. 2018. "A structured literature review of simulation modelling applied to Emergency Departments: Current patterns and emerging trends." *Operations Research for Health Care* 19: 1-13. Accessed January 15, 2021. doi:10.1016/j.orhc.2018.01.001.
- Sancton, K., L. Sloss, J. Berkowitz, N. Strydom, and R. McCracken. 2018. "Low-acuity presentations to the emergency department: Reasons for and access to other health care providers before presentation." *Canadian Family Physician* 64 (8): e354-e360. Accessed July 24, 2021. <https://pubmed.ncbi.nlm.nih.gov/30108090/>.
- Sanders, J. 2000. "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." *Journal of Advanced Nursing* 31 (5): 1097-1105. Accessed July 18, 2021. doi:10.1046/j.1365-2648.2000.01379.x.
- Schacter, Daniel. 2019. *Psychology*. Third European Edition published 2020. London: Red Globe Press.
- Selasawati, H.G., L. Naing, W.A. Wan Aasim, T. Winn, and B.N. Rusli. 2007. "Factors associated with inappropriate utilisation of emergency department services." *Asia Pacific Journal of Public Health* 19 (2): 29-36. Accessed July 28, 2021. doi:10.1177/10105395070190020601.
- Sempere-Selva, T., S. Peiró, P. Sendra-Pina, C. Martínez-Espín, and I. López-Aguilera. 2001. "Inappropriate use of an accident and emergency department: magnitude, associated factors, and reasons--an approach with explicit criteria." *Annals of Emergency Medicine* 37 (6): 568-579. Accessed July 23, 2021. doi:10.1067/mem.2001.113464.
- Senge, Peter M. 2006. *The Fifth Discipline: The art and practice of the learning organization*. 2nd. London, UK: Random House Business.
- Shearer, F.M., P.M. Bailey, B.L. Hicks, B.V. Harvey, L. Monterosso, and G. Rogers, I.R. Ross-Adjie. 2015. "Why do patients choose to attend a private emergency department?" *Emergency Medicine Australasia* 27 (1): 62-65. Accessed July 23, 2021. doi:10.1111/1742-6723.12330.
- Siminski, P., A.J. Bezzina, L.P. Lago, and K. Eagar. 2008. "Primary care presentations at emergency departments: rates and reasons by age and sex." *Australian Health Review* 32 (4): 700-709. Accessed July 19, 2021. doi:10.1071/ah080700.
- Şimşek, P., and A. Gürsoy. 2016. "Turkish health care providers' views on inappropriate use of emergency department: Who, when and why?" *International Emergency Nursing* 27: 31-36. Accessed July 28, 2021. doi:10.1016/j.ienj.2015.11.004.
- Singal, B.M., J.R. Hedges, E.W. Rousseau, A.B. Sanders, E. Berstein, R.M. McNamara, and T.M. Hogan. 1992. "Geriatric patient emergency visits. Part I: Comparison of visits by geriatric and younger patients." *Annals of Emergency Medicine* 21 (7): 802-807. Accessed July 17, 2021. doi:10.1016/s0196-0644(05)81025-x.

- Smith, V., M. Mustafa, E. Grafstein, and Q. Doan. 2015. "Factors Influencing the Decision to Attend a Pediatric Emergency Department for Nonemergent Complaints." *Pediatric Emergency Care* 31 (9): 640-644. Accessed August 4, 2021. doi:10.1097/PEC.0000000000000392.
- Stanley, R., J. Zimmerman, C. Hashikawa, and S.J. Clark. 2007. "Appropriateness of Children's Nonurgent Visits to Selected Michigan Emergency Departments." *Pediatric Emergency Care* 23 (8): 532-536. Accessed July 28, 2021. doi:10.1097/PEC.0b013e318128f84a.
- Stark, O., and D.A. Behrens. 2010. "An evolutionary edge of knowing less (or: On the 'curse' of global information)." *Journal of Evolutionary Economics* 20 (1): 77-94. Accessed January 16, 2021. doi:10.1007/s00191-009-0137-9.
- Steele, S., D. Anstett, and W.K. Milne. 2008. "Rural emergency department use by CTAS IV and V patients." *Canadian Journal of Emergency Medicine* 10 (3): 209-214. Accessed July 28, 2021. doi:10.1017/s1481803500010125.
- Stewart, B., R. Fairhurst, J. Markland, and O. Marzouk. 2006. "Review of calls to NHS Direct related to attendance in the paediatric emergency department." *Emergency Medicine Journal* 23 (12): 911-914.
- Sun, Wu. 2010. *The Art of War*. Tribeca Books.
- Tinson, A., and C. Tallack. 2020. *Deprivation and excess deaths. Reducing inequalities in mortality in England*. Accessed January 24, 2021. <https://www.health.org.uk/news-and-comment/charts-and-infographics/deprivation-and-excess-deaths>.
- Toloo, G., P. Aitken, J. Crilly, and G. FitzGerald. 2016. "Agreement between triage category and patient's perception of priority in emergency departments." *Scandinavian journal of trauma, resuscitation and emergency medicine* 24: 126. Accessed October 31, 2020. doi:10.1186/s13049-016-0316-2.
- Tran, D.T., A. Gibson, D. Randall, A. Havard, M. Byrne, M. Robinson, A. Lawler, and L.R. Jorm. 2017. "Compliance with telephone triage advice among adults aged 45 years and older: an Australian data linkage study." *BMC Health Service Research* 17: 512. Accessed October 29, 2020. doi:10.1186/s12913-017-2458-y.
- Tsai, J.C.H., W.-Y. Chenc, and Y.-W. Liang. 2011. "Nonemergent emergency department visits under the National Health Insurance in Taiwan." *Health Policy* 100 (2-3): 189-195. Accessed July 28, 2021. doi:10.1016/j.healthpol.2010.10.007.
- Unwin, M., L. Kinsman, and S. Rigby. 2016. "Why are we waiting? Patients' perspectives for accessing emergency department services with non-urgent complaints." *International Emergency Nursing* 29: 3-8. Accessed October 31, 2020. doi:10.1016/j.ienj.2016.09.003.
- Uscher-Pines, L., J. Pines, A. Kellermann, E. Gillen, and A. Mehrotra. 2013. "Emergency department visits for nonurgent conditions: systematic literature review." *American Journal of Managed Care* 19 (1): 47-59. Accessed July 24, 2021. <https://pubmed.ncbi.nlm.nih.gov/23379744/>.
- van der Linden, M.C., R. Lindeboom, N. van der Linden, C.L. van den Brand, R.C. Lam, C. Lucas, R. de Haan, and J.C. & Goslings. 2014. "Self-referring patients at the emergency department: appropriateness of ED use and motives for self-referral." 7: 28. Accessed November 01, 2020. doi:10.1186/s12245-014-0028-1.
- van Uden, C.J., R.A. Winkens, G. Wesseling, H.F. Fiolet, O.C. van Schayck, and H.F. Crebolder. 2005. "The impact of a primary care physician cooperative on the caseload of an emergency department: the Maastricht integrated out-of-hours service." *Journal of General Internal Medicine* 20 (7): 612-617. Accessed November 01, 2020. doi:10.1111/j.1525-1497.2005.0091.x.
- Vázquez Quiroga, B., G. Pardo Moreno, G. Fernández Cantalejo, M. Canals Aracil, M.A. Delgado Nicolás, and M. Navas Alonso. 2000. "¿Por qué acuden nuestros pacientes a urgencias del hospital? Why

- do our Patients Attend Hospital Emergency Departments?" *Atención Primaria* 25 (3): 172-175. Accessed July 23, 2021. doi:10.1016/S0212-6567(00)78482-4.
- Walsh, M. 1990. "Geographical factors and A&E attendance." *Nursing Standard* 5 (8): 28-31. Accessed July 23, 2021. doi:10.7748/ns.5.8.28.s41.
- Webster, J., and R.T. Watson. 2002. "Analyzing the past to prepare for the future: Writing a literature review." *MIS Quarterly* 26 (2): xiii-xxiii. Accessed February 20, 2021. <https://www.jstor.org/stable/4132319>.
- Weiss, A.L., L.J. D'Angelo, and A.C. Rucker. 2014. "Adolescent use of the emergency department instead of the primary care provider: who, why, and how urgent?" *Journal of Adolescent Health* 54 (4): 416-420. Accessed October 29, 2020. doi:10.1016/j.jadohealth.2013.09.009.
- Welsh Government. 2019. "A Healthier Wales: our Plan for Health and Social Care." *Welsh Government Services and Information*. Accessed August 3, 2021. <https://gov.wales/sites/default/files/publications/2019-10/a-healthier-wales-action-plan.pdf>.
- Willems, S., W. Peersman, P. De Maeyer, W. Buylaert, J De Maeseneer, and W. De Paepe. 2013. "The impact of neighborhood deprivation on patients' unscheduled out-of-hours healthcare seeking behavior: a cross-sectional study." *BMC Family Practice* 14: 136. Accessed October 28, 2020. doi:10.1186/1471-2296-14-136.
- Williams, C.A., and F. Haffizulla. 2021. "Factors Associated With Avoidable Emergency Department Visits in Broward County, Florida." *Cureus* 13 (6): e15593. Accessed July 24, 2021. <https://pubmed.ncbi.nlm.nih.gov/34277214/>.
- Wong, W.-B., G. Edgar, C. Liddy, and C. Vaillancourt. 2009. "Can after-hours family medicine clinics represent an alternative to emergency departments?" *Can Fam Physician* 55 (11): 1106–1107. Accessed October 29, 2020. <https://pubmed.ncbi.nlm.nih.gov/19910600/>.
- Zandieh, S.O., J.C. Gershel, W.M. Briggs, C.A. Mancuso, and J.M. Kuder. 2009. "Revisiting predictors of parental health care-seeking behaviors for nonurgent conditions at one inner-city hospital." *Pediatric Emergency Care* 25 (4): 238-243. Accessed October 28, 2020. doi:10.1097/pec.0b013e31819e350e.
- Zickafoose, J.S., L.R. DeCamp, and L.A. Prosser. 2013. "Association between Enhanced Access Services in Pediatric Primary Care and Utilization of Emergency Departments: A National Parent Survey." *The Journal of Pediatrics* 163: 1389-1395. Accessed October 28, 2020. doi:10.1016/j.jpeds.2013.04.050.

Table 1: Studies on patients' motives and patients' characteristics in emergency settings (excerpt)

Paper	Country	Study Design	Population	Motives for attending EDs
Agarwal et al., 2012	UK	Qualitative study (interviews)	Patients presenting at hospital ED and linked urgent care center	<p>Anxiety or concern about the presenting problem</p> <p>Range of services available to the ED</p> <p>Perceived efficacy of ED services</p> <p>Lack of alternative services</p>
Berry et al., 2008	USA	Qualitative study (interviews)	Parents of children presenting at children's hospital ED for non-urgent care	<p>Long appointment waits for PCPs</p> <p>Dissatisfaction with the PCP</p> <p>Communication problems</p> <p>Health care provider referral</p> <p>Efficiency</p> <p>Convenience</p> <p>ED resources</p> <p>Quality of care</p> <p>ED expertise with children</p>
Durand et al., 2012	FRA	Qualitative study (interviews)	Non-urgent patients presenting at hospital EDs	<p>Fulfilled health care needs, access to technical facilities</p> <p>Barriers to PCPs</p> <p>Convenience, obtaining rapid appointment with various specialists</p>
Göransson, De Waern and Lindmarker, 2013	SWE	Prospective descriptive study (Questionnaire)	Patients presenting at ED by their own means or by ambulance	<p>Male gender</p> <p>Other caregivers' referral (60.1-87.9%)</p>
Grafstein et al., 2013	CAN	Cross-sectional survey	Ambulatory patients with a Canadian Triage and Acuity Scale (CTAS) level 3-5; age 19+	<p>Distance travelled to reach the ED</p> <p>Perceived ED waiting time</p>
Hunter et al., 2013	UK	Qualitative study (interviews)	Patients with long-term conditions using emergency care	<p>Previous experiences with care providers, accessibility of service, practitioners' perceived expertise</p>

Lobachova et al., 2014	USA	Cross-sectional (web-based) survey	Patients presenting to an ED	Belief that their problem was serious (61%) Other caregivers' referral (35%) Advice of a provider, family member, friend (48%)
Lowe et al., 2011	UK	Population-based (postal) survey	Patients using unscheduled health care (ED, family doctor consultations, pharmacist)	Patients who regarded their condition as serious, unambiguous, distressing, and difficult to manage
Lowthian et al., 2013	AUS	Qualitative study (interviews)	Older lower urgency patients presenting at ED	Referral by a third party Difficulty with accessibility to primary care Patient preferences for timely care Fast-track access to specialist care
Moll van Charante, Riet and Bindels, 2008	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 problem
Brice and Zou, 2005	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
Weiss, D'Angelo and Rucker, 2014	USA	Online survey	Adolescents ages 12 to 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%)
Wong et al., 2009	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

Zickafoose, DeCamp, Prosser, 2013	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 pm on 5 nights or more a week)
Chan and Ovens, 2002	CAN	Population-based, observational, cross-sectional study	Frequent ED users	Low socioeconomic neighborhoods Diagnosed with psychosocial conditions
Chmiel et al., 2011	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
Göransson, De Waern and Lindmarker, 2013	SWE	Prospective descriptive study (Questionnaire)	Patients presenting at ED by their own means or by ambulance	Male gender Shorter symptom duration
Moll van Charante, Riet and Bindels, 2008	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
Moll van Charante and Bindels, 2007	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%)
Philips et al., 2010	BEL	Prospective comparison survey	Group 1: Patients presenting at ED Group 2: Patients using the GP (on call)	Male gender Having visited the ED during the past 12 months at least once 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
Weiss, D'Angelo and Rucker, 2014	USA	Online survey	Adolescents ages 12 to 21 years and their parents/guardians presenting at urban ED at an academic children's hospital	Public insurance or no insurance/unknown insurance status
Willems et al., 2013	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

- Our framework explains patients' non-urgent ED instead of primary care attendance.
- We identify patient demographics and signposting sources.
- Patients' perceptions are also discovered as determinants of ED use.
- The explicit endogenous dynamics of referral and service choice are highlighted.
- Our framework enables strategic healthcare planning decisions.

Journal Pre-proof

Biographies

Dr Doris Behrens is a Professor at the Danube University of Krems. She holds a PhD in Technical Sciences from the Vienna University of Technology with a focus on Operations Research and Biomathematics. In 2008, she habilitated in Operations Research, and at the same time she obtained her teaching qualification on this subject. Several universities such as the Alpen-Adria University Klagenfurt, Cardiff University and the Vienna University of Technology mark her academic career. She worked as a visiting professor at the University of Ljubljana, the Medical University of Vienna and the Karl-Franzens University of Graz, among others. In 2017, she joined the Aneurin Bevan University Health Board, and in 2020 took up the position of senior mathematician at the in-house Continuous Improvement Centre. Currently, she is marginally employed as a senior epidemiologist for the Gwent Test Trace Protect Service.

Jennifer Morgan obtained her PhD in Operational Research from the University of Strathclyde, Glasgow, UK in 2013. She is an honorary research associate of Cardiff University School of Mathematics where she previously worked as an embedded OR modeler in Cardiff and Vale University Health Board developing mathematical models to improve data quality and capture and inform dynamic demand and capacity modelling. Her research interests lie in the development of System Dynamics and Discrete Event Simulation models for a range of operational and strategic problems in Healthcare and Public Health; the process of model development for appropriate and useful models; facilitated modelling of healthcare systems and mixed methods modelling.

Dr Eva Krcal is an Assistant Professor at the Danube University in Krems. She conducts research in the areas "Age-sensitive learning" and "Health, mobility and Globalization". She is head of the Center for Evidence-based health economics.

Professor Paul Harper is the Director of the Health Modelling Centre Cymru and the Head of the Operational Research Group at Cardiff University. Professor Harper's research, and that with many collaborators, has led to sustained impact of significant benefit to the NHS and patient care, resulting in increased efficiency and effectiveness of healthcare systems, and improved outcomes. Projects have included reducing waiting times, reducing elective patient cancellations, finding the most effective and equitable locations on for healthcare facilities, advising on the cost-effectiveness of strategies for preventing and screening for disease such as informing policy on cancer, HIV/AIDS and Chlamydia screening. Professor Harper has a PhD and MSc in Mathematics and Operations Research from the University of Southampton, and a BSc in Mathematics and Statistics from the University of Bath.

Dr Daniel Gartner is a Chair of Operational Research at Cardiff University, School of Mathematics. His research has been published in internationally-leading journals such as Transportation Science and European Journal of Operational Research. In 2019, Daniel received the Cardiff University Recognizing Excellence Rising Star Award and his research was awarded in international conferences such as Operational Research applied to Health Services (ORAHS) and INFORMS meetings. Daniel maintains strong links to international research collaborators at Weill Cornell Medical College at Cornell University and to the School of Information Systems Management at Carnegie Mellon University.

DB and JM led on the conceptualization, data curation and formal analysis. EK, DG, DB and JM worked together on the literature review. PH acquired funding for the study. DB and JM validated the models in the workshops with the various stakeholders. All authors contributed to the writing, review and editing.

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