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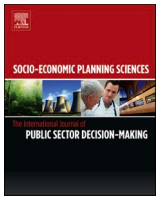

Still looking in the wrong place: Literature-based evidence of why patients really attend an emergency department

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ABSTRACT

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

1. Introduction

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

[5] pioneered using a more comprehensive approach: The authors discussed the demand pattern, ED resource deployment, elective treatments, and bed numbers within a System Dynamics (SD) framework. Due to the inverse relationship between ED wait times and the number of elective cancellations, [5] showed that looking at a single performance measure in the system could be misleading. Research following this track employed SD modelling as the core of a whole-system review of emergency and on-demand health care in Nottingham, England [6]. While DES is helpful in developing policies for managing queues and finding bottlenecks, SD identifies the displacement of demand and the unintended consequences of interventions within the system.

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

There has been an emerging interest in Behavioural Operational

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

The paper is structured as follows. The next section outlines how we ran a sequence of qualitative system dynamics workshops alongside shaping the literature-based model proposed in this paper to develop our core concepts. We also explain our search strategy, analysis, and thematic mapping. Sections 3.1, 3.2, and 3.3 discuss the core concepts for understanding emergency demand and ED activity (patient characteristics, source of referral and patient perception of acceptable ED use, respectively). Identifying the dynamic relationships between these core concepts determines the robust and valid structure of an SD model of the unscheduled care system that provides modellers and healthcare planners with a framework to guide decision-making around primary care and hospital-based emergency services. The paper concludes in section 5 after offering some lessons learned for modellers and healthcare planners in section 4.

2. Methods

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

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

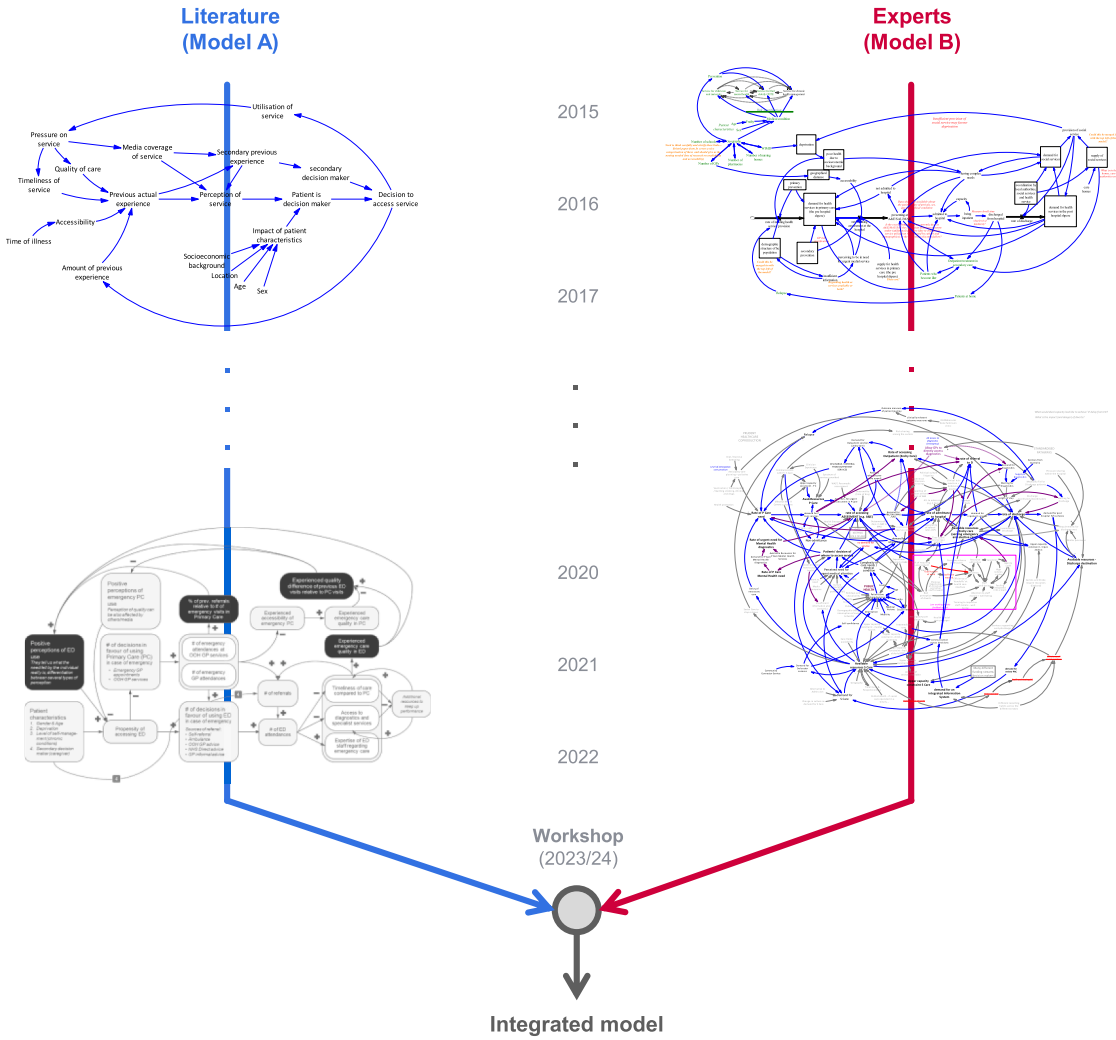

Fig. 1. Methodology of building a model of unscheduled health and social care.

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

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

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

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

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

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

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

Paper	Country	Study Design	Population	Motives for attending EDs
[13]	UK	Qualitative study (interviews)	Patients presenting at hospital ED and linked urgent care centre	Anxiety or concern about the presenting problem Range of services available to the ED Perceived efficacy of ED services Lack of alternative services
[14]	USA	Qualitative study (interviews)	Parents of children presenting at children's hospital ED for non-urgent care	Long appointment waits for PCPs Dissatisfaction with the PCP Communication problems Health care provider referral Efficiency of ED services Convenience of ED attendanceAmount of ED resources Quality of care ED expertise with children
[15]	FRA	Qualitative study (interviews)	Non-urgent patients presenting at hospital EDs	Fulfilled health care needs, access to technical facilities Barriers to PCPs Convenience, obtaining rapid appointments with various specialists
[16]	SWE	Prospective descriptive study (Questionnaire)	Patients presenting at an ED by their own means or by ambulance	Male gender Other caregivers' referral (60.1–87.9%)
[17]	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
[18]	UK	Qualitative study (interviews)	Patients with long-term conditions using emergency care	Previous experiences with care providers, accessibility of service, practitioners' perceived expertise
[19]	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, or friend (48%)
[20]	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
[21]	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

(*continued on next page*)

Table 1 (*continued*)

Paper	Country	Study Design	Population	Motives for attending EDs
[22]	NLD	Cross-sectional comparison (postal) survey	AED (Accident & Emergency Department) self-referrals	Perceived need for diagnostic facilities Conviction that the hospital specialist was best qualified to handle their problem
[147]	USA	Cross-sectional survey	University ED self-referrals for non-urgent care	Unawareness of alternative services (66%) Dependence on ED for all medical care (27%) Perceived efficacy of ED services
[23]	USA	Online survey	Adolescents ages 12–21 years and their parents/ guardians presenting at urban ED at an academic children's hospital	Perception of illness requiring immediate care (34%) PCP referral to the ED (21%)
[24]	CAN	Survey	Patients seeking after-hours care in the Eds	Perceived need for services unavailable at family medicine clinics, such as specialist consultation or diagnostic imaging
[25]	USA	Population-based (web-based) survey	National sample of parents	Unawareness of alternative services (7%–56%) Lack of alternative services (office hours after 5:00 p.m. on 5 nights or more a week)
[26]	CAN	Population-based, observational, cross-sectional study	Frequent ED users	Low socioeconomic neighbourhoods Diagnosed with psychosocial conditions
[27]	CH	Observational, cross-sectional comparison study	Group 1: Patients presenting at hospital ED Group 2: Patients using out-of-hours GP	Younger age (43.8 years) Male gender (53.1%) Injury-related medical problems
[16]	SWE	Prospective descriptive study (Questionnaire)	Patients presenting at an ED by their own means or by ambulance	Male gender Shorter symptom duration
[22]	NLD	Cross-sectional comparison (postal) survey	Group 1: AED (Accident & Emergency Department) patients Group 2: Patients contacting the GP cooperative	Age between 15 and 64 Injury-related medical problems Musculoskeletal, cardiovascular and respiratory problems Distance to the GP centre
[28]	NLD	Population-based, prospective cross-sectional comparison study	Group 1: AED self-referrals Group 2: GP cooperative patients	Younger age Male gender Injury-related medical problems, fracture (19%)
[29]	BEL	Prospective comparison survey	Group 1: Patients presenting at ED Group 2: 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
[23]	USA	Online survey	Adolescents ages 12–21 years and their parents/ guardians presenting at urban ED at an academic children's hospital	Public insurance or no insurance/ unknown insurance status
[30]	BEL	Population-based, cross-sectional comparison study	Group 1: Patients seeking out-of-hours care in EDs Group 2: Patients seeking out-of-hours care in PCCs	Patients living in socially deprived areas

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

condition, not the element of choice.

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

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

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

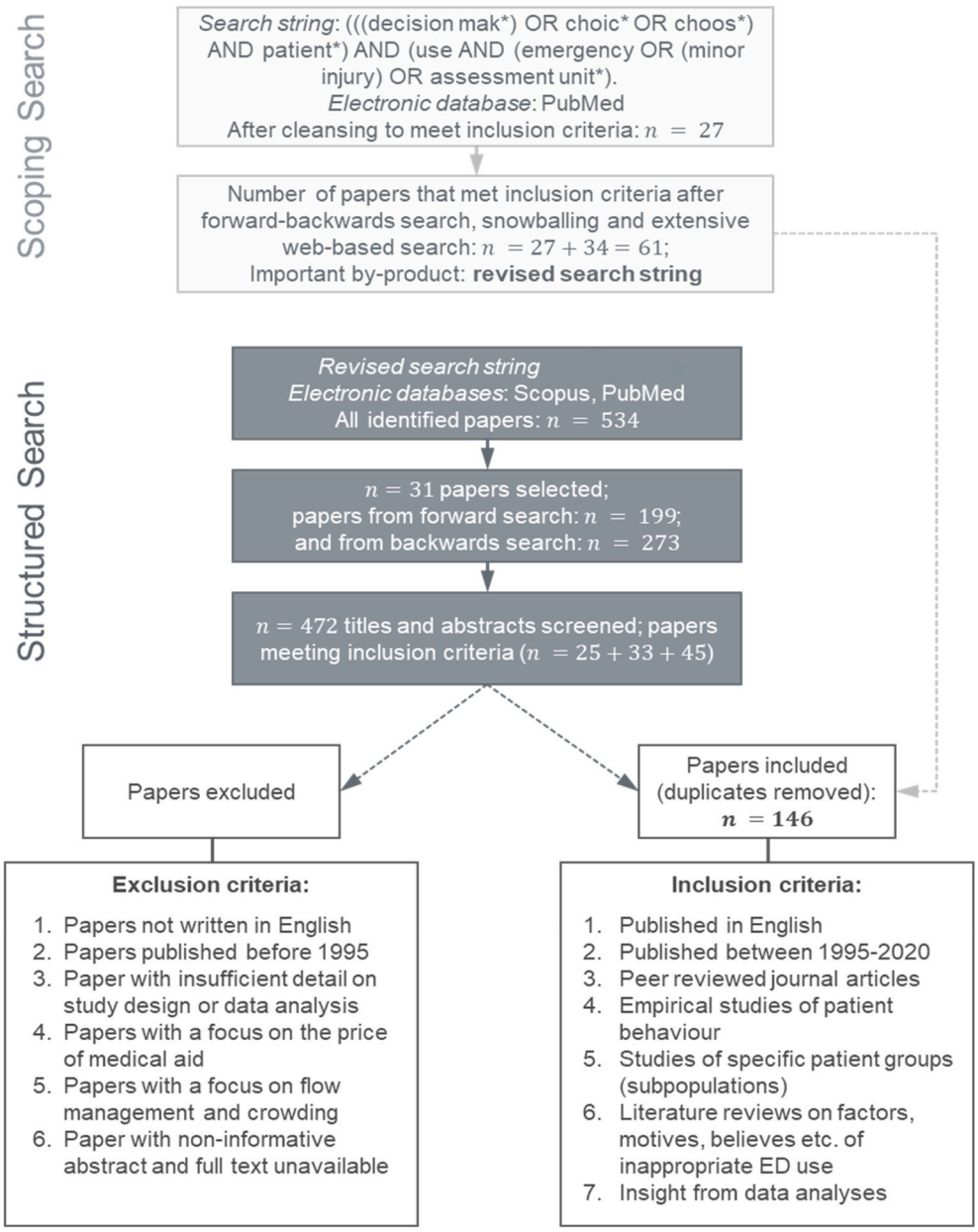

Fig. 2. Structure of the literature research [31].

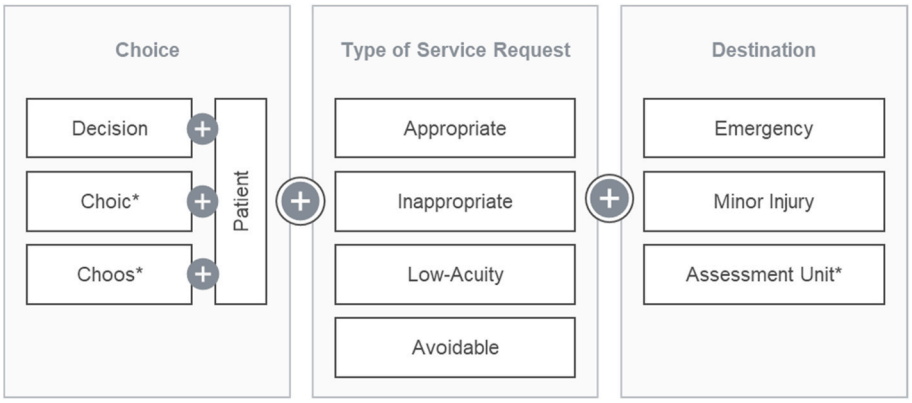

Fig. 3. Search criteria used for the literature search described in this paper.

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

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

3. Analysis: pinning down the core concepts

3.1. Characteristics of ED patients (concept #1)

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

3.1.1. Age and gender

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

Older people who attend hospital-based emergency services are small in numbers compared to other age groups (see Table 2). They present, however, with more complex clinical conditions, consume more resources, have longer lengths of stay in the ED, are more likely to be admitted to hospitals and experience more adverse outcomes than younger patients [39–44]. They also have a higher rate of return visits to the ED [40]. For example, Ref. [21] said that 20% of lower-urgency community-dwelling patients aged ≥70 years had attended ED 3–6 times in the previous 12 months.[1] Partially, this was because more than half of all advanced-age (mean: 82 years) ED patients found it difficult to access care outside regular office hours. About a third of them reported wait times of more than 2–3 days for urgent problems in primary care. The latter explains why three-quarters of the older patients presented at an ED during business hours. Referral by a third party and patient preferences for fast-track access to specialist care were other reasons for more frequent ED attendances of older patients [21]. The formation of perceptions that may have reinforced this behaviour will be addressed in section 3.3. Still, several studies identify older patients as 'appropriate' ED users [46–49].

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

3.1.2. Sociodemographic characteristics and deprivation

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

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

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

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

3.1.4. Caregiver decision

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

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

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

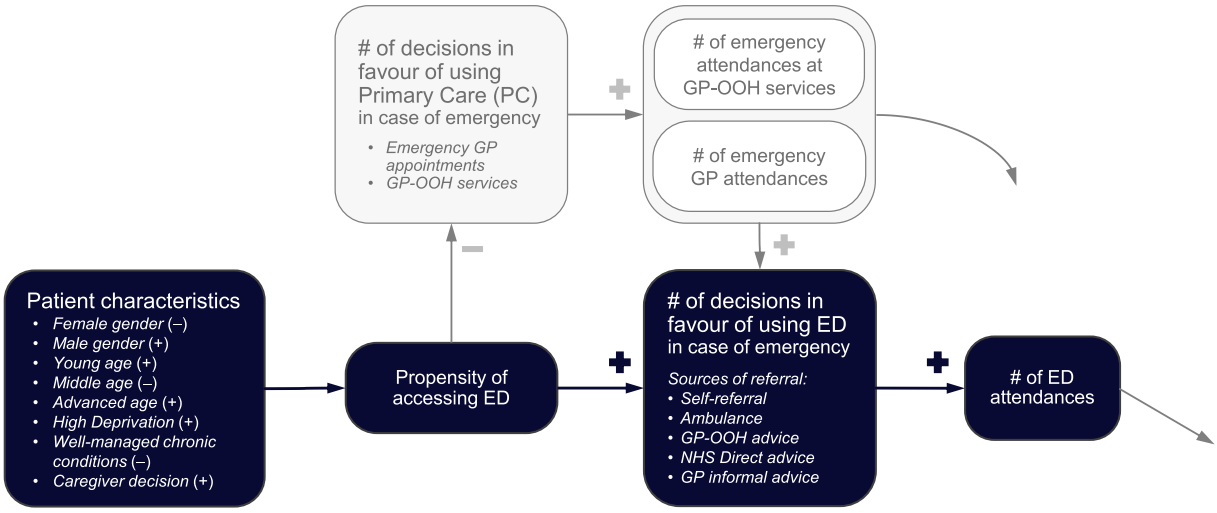

Fig. 4. Impact of patient characteristics on the propensity of accessing an ED and,subsequently, ED attendance. *(The "+" and "-" signs indicate that variables affect one another positively (moving in the same direction) and negatively (moving in opposite directions), respectively).*

Table 2
A&E Attendances by Age Band, 2015-16 to 2019-20.

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

'other' secondary decision-maker is mostly a caregiver, for example, a parent [14]. For young children, ED attendance is informed by the adult taking the child to the emergency department [70,71]. In this context, younger maternal age was associated with a higher frequency of presenting infants to an ED for medically 'inappropriate' conditions [72]. Moreover, Ref. [73] reported that parents perceive an ED as the default to-go-to when a child is unwell.

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

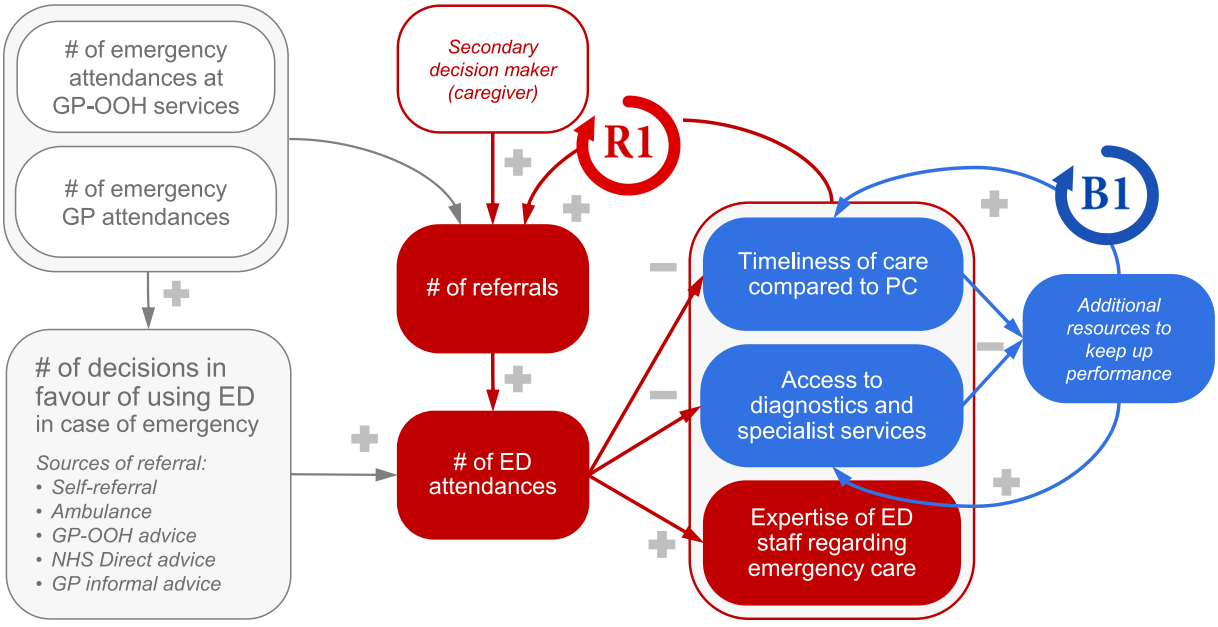

Fig. 5. Quality-referral dynamic, pulling patients from primary care into an ED. In the diagram, B1 refers to a balancing loop; R1 refers to a reinforcing loop. The former prevents timeliness of care and access to diagnostics from deteriorating, while the latter reinforces the referral dynamics and increases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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

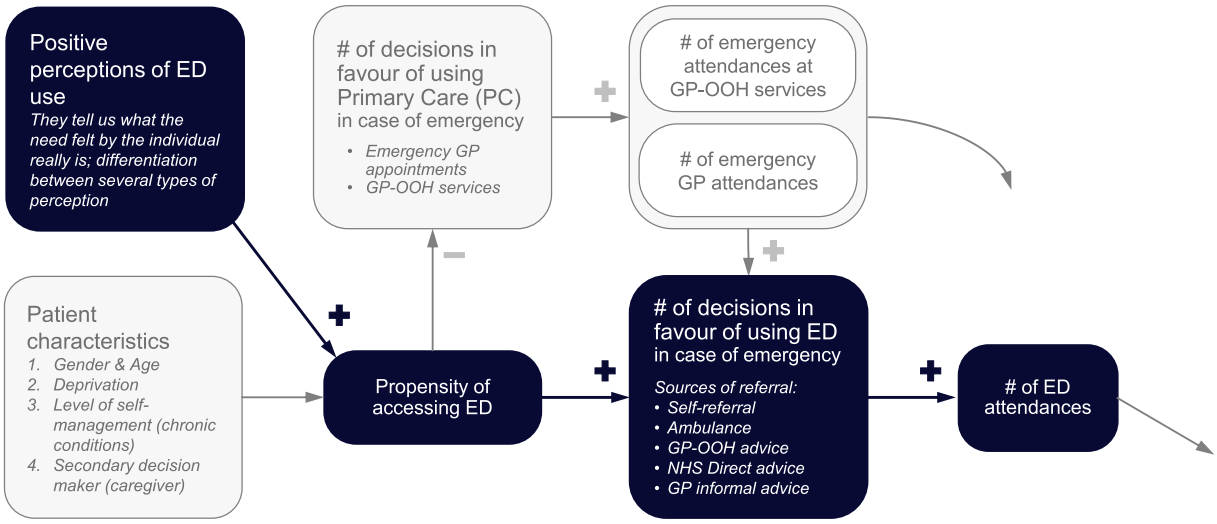

Fig. 6. Relationship between the perception of ED use and its actual use. *(The "+" and "-" signs indicate that variables affect one another positively (moving in the same direction) and negatively (moving in opposite directions), respectively.)*

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

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

For example, a US study found that about 40% of ED patients between 14 and 21 were triaged as medically non-urgent. At the same time, a third remained of the conviction that they were severely ill, requiring immediate attention [23]. Half of the respondents of an Australian study expected a higher priority than the actual triage category they were assigned [113]. Two-thirds of Canadian Triage and Acuity Scale (CTAS) V patients and one-third of CTAS IV patients believed their conditions were more urgent than their triage nurse rating [114]. Another US study reported that ED physicians triaged no more than 67% of ED presentations as medically appropriate [115].[7]

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

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

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

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

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

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

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

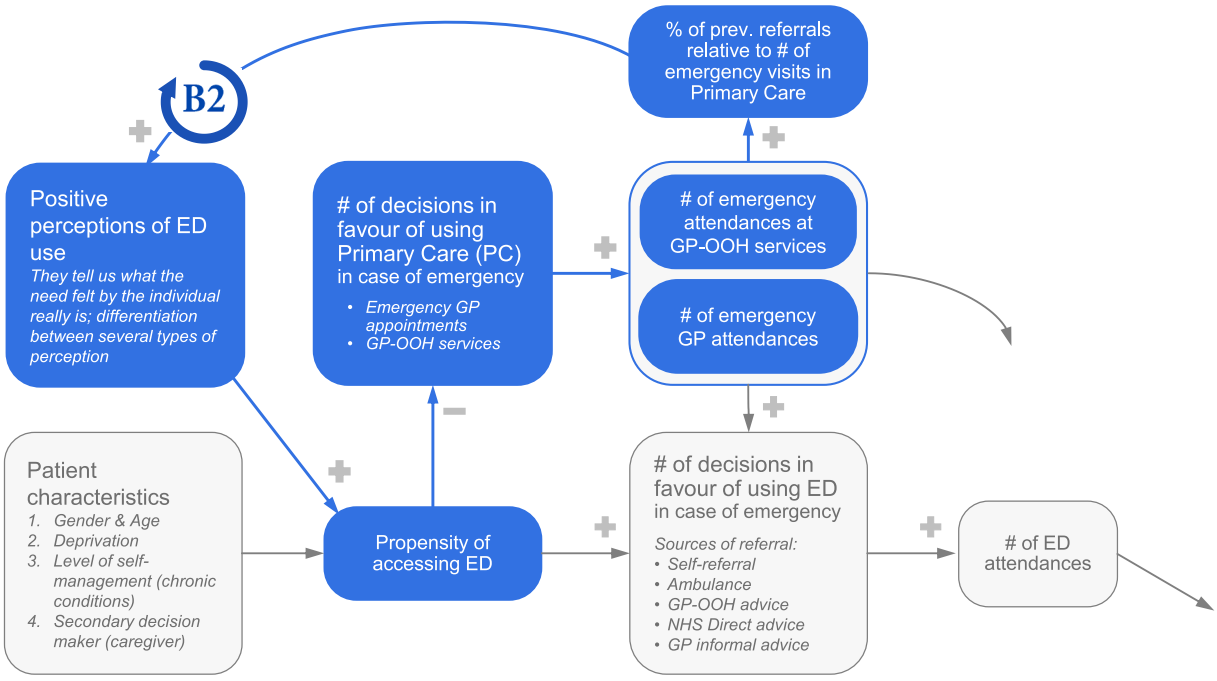

Fig. 7. Reinforcement of the perception that secondary emergency care is superior to primary emergency care. In the diagram, B2 refers to a balancing loop; it mitigates the number of emergency attendances in primary care. *(The "+" and "-" signs indicate that variables affect one another positively (moving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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Other convenience-related factors for ED attendance include expected wait times [14,17,36,106,121,146,148,152,160], proximity [17,35,62,65,106,132,161] and/or convenient location [148]. In this context, it is not only the physical distance[11] between the patient's home and the ED that matters regarding the **'convenience perception'**. Self-referral to an emergency department is also positively correlated with the distance to the GP practice [22,55,161].[12]

Also, opening hours matter [36,132].[13] Moreover, younger patients and those with painful conditions appear to place greater priority on wait times [17]. Up until the first SARS-CoV-2-induced spike in English hospital demand, 84% of all ED attendances spent less than four hours in the emergency department [67]. Also, an ED provides access to medical care 24/7 [114], which brings us back to the quality aspect discussed in section 3.3.3 (cf. Fig. 8) in the following way. The Insititute of Medicine [162] identifies the domains of quality in healthcare as patient-centredness, safety, equity, efficiency, effectiveness, and timeliness of care. When patients are motivated in their service choices by the belief that a 24/7 ED provides more timely access to what they need [46,114], 'accessibility', 'convenience', 'efficacy' and 'urgency' blend into each other as the single guiding motive for seeking ED care in case of a perceived emergency.

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

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

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

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

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

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

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

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

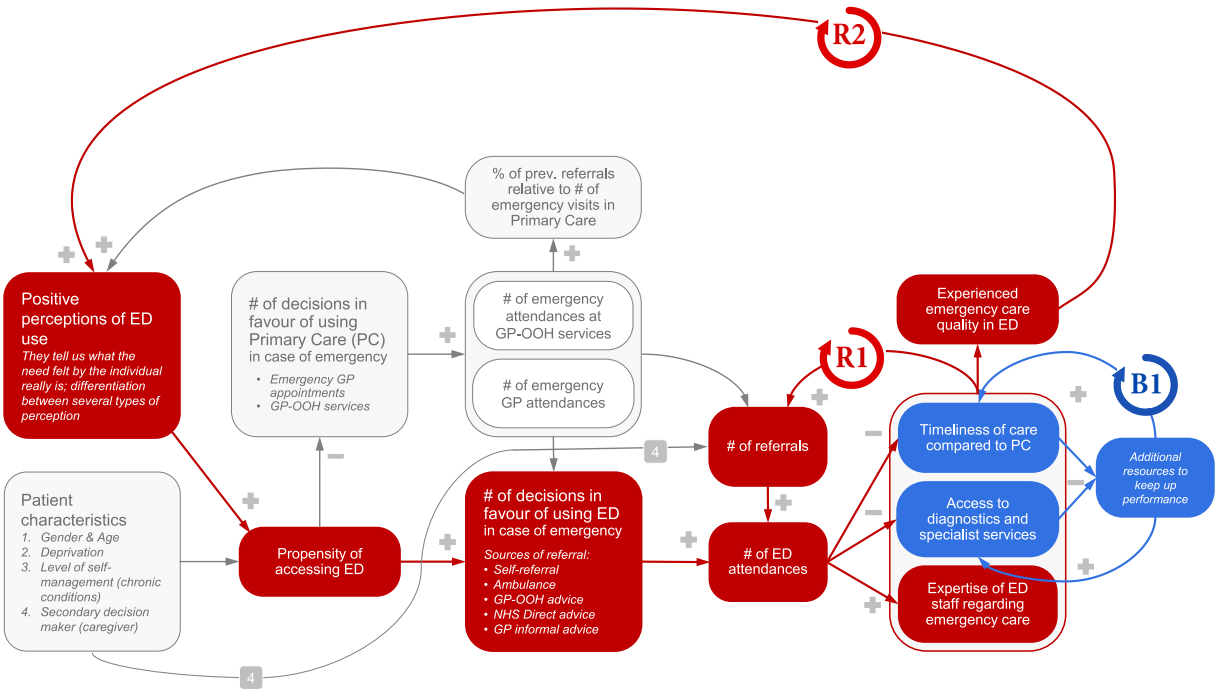

Fig. 8. The reinforcing power of the (perceived) quality of care at an ED. In the diagram, B1 refers to a balancing loop; R1 and R2 refer to reinforcing loops. The former mitigates two of ED's quality indicators from deteriorating, while the latter reinforce the perceptions of ED use (R2) and drive the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

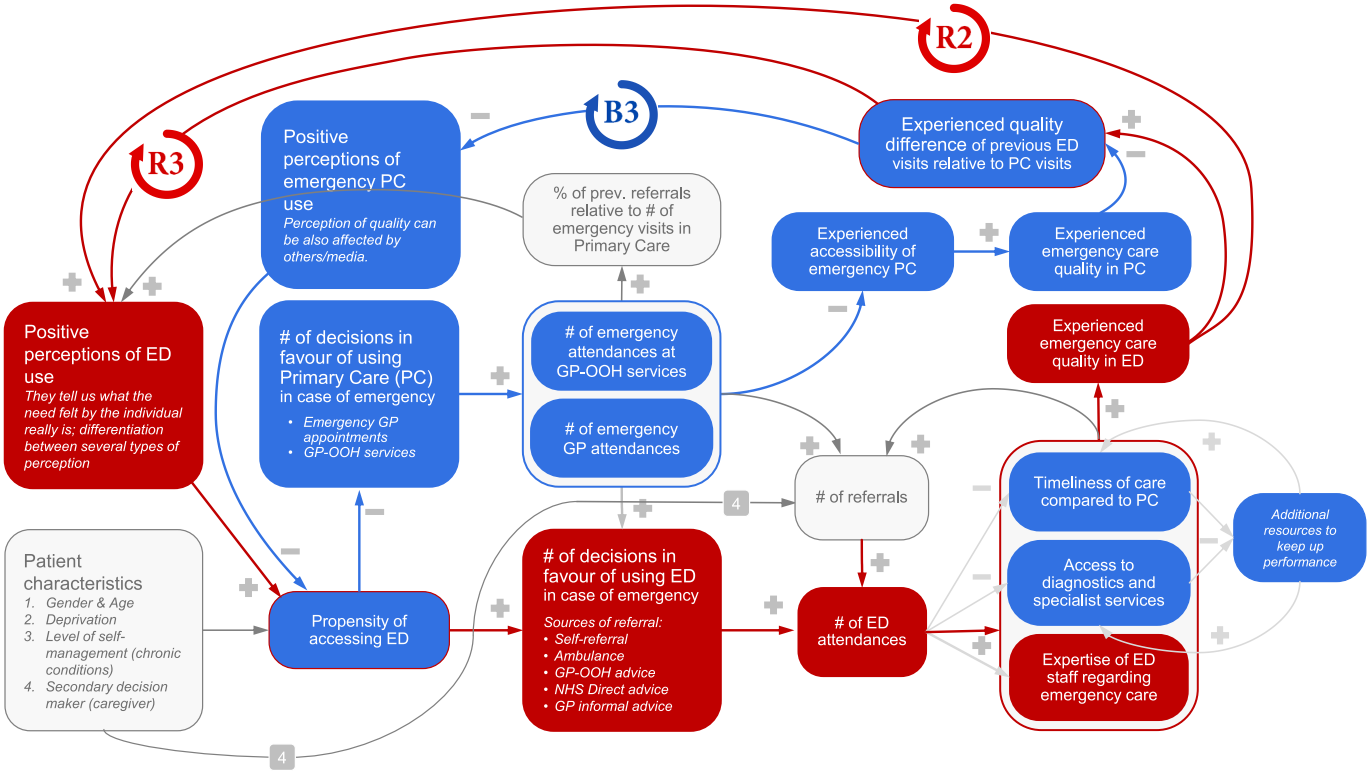

Fig. 9. Dynamics generated by the perceived quality gap between primary care (PC) and ED. In the diagram, B3 refers to a balancing loop; R2 and R3 refer to reinforcing loops. The former mitigates the dynamics and stabilises the number of emergency attendances in primary care, while the latter reinforce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

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

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

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

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

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

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

It seems unclear whether patients genuinely know/understand the role and functions of an ED [170,171]. For example, Ref. [172] identified that patients who attended an ED with an inappropriate presenting complaint believed that EDs '*provide services for every kind of health problem*'. **Misperceiving the role of an ED** is not limited to patients. An incorrect understanding of 'non-urgent ED visits' also exists amongst caregivers, primary care providers, and ED personnel [173]. This is reflected by substantial differences in the opinions on inappropriate ED use between health professionals (ED nurses, doctors, and paramedics) and patients [23,170,174,175]. Moreover, the literature suggests that ambulances are also prone to 'inappropriate' utilisation (using expert opinion and the benefit of hindsight for judgment). Figures show that the proportion of 'appropriate' ambulance users is between 50% and 68% [83,176].

4. Insights for modellers and healthcare planners

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

4.1. *How system design and patient behaviour are interrelated*

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

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

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

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

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

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

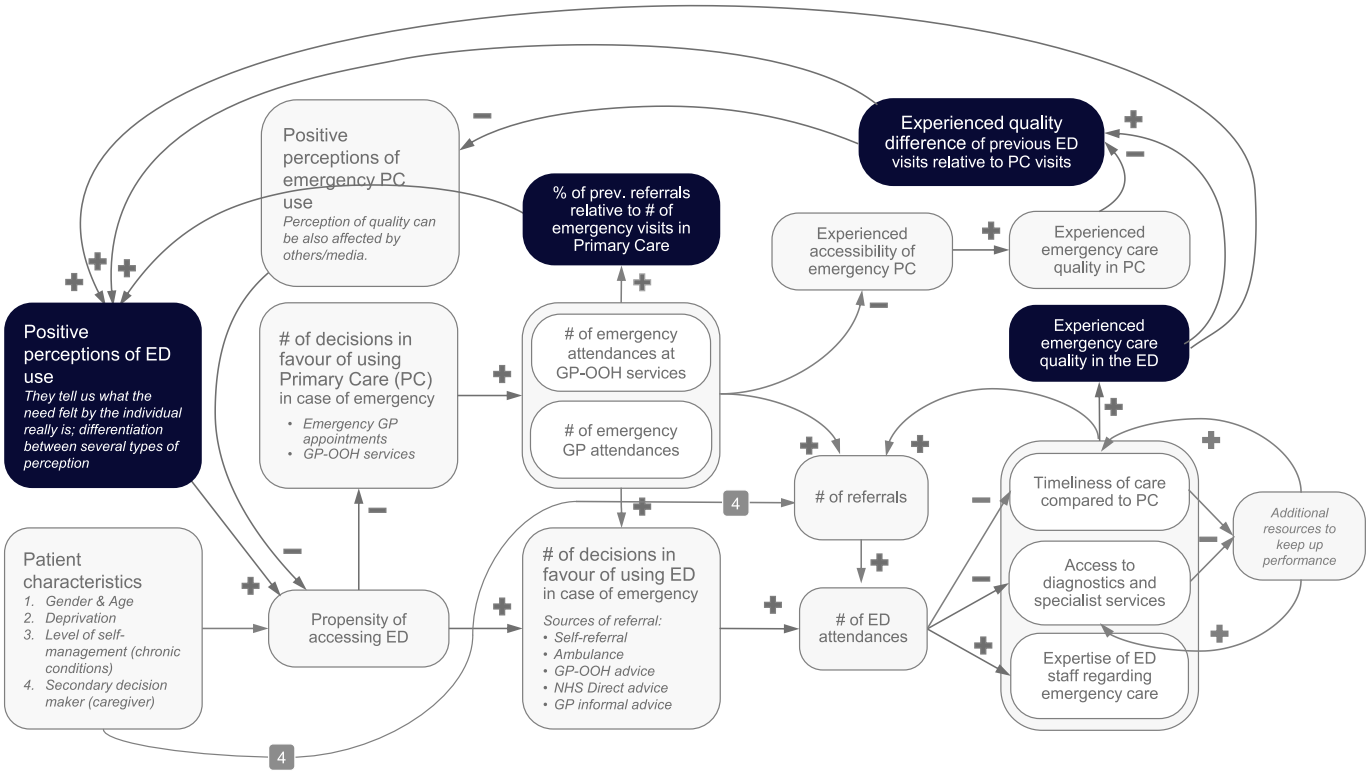

Fig. 10. Key elements of the recursive process of shaping perceptions of ED use. *(The "+" and "-" signs indicate that variables affect one another positively (moving in the same direction) and negatively (moving in opposite directions), respectively.)*

Table 3
Links between concepts supported by the medical literature.

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

choice and behaviour (see Fig. 9).

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

4.3. How to pin down the 'right' scope of the model

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

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

4.4. How to utilise our BOR framework to redesign services

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

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

Our modelling framework maps the relationship between changes in experience, service reputation, and the number of patients and can evaluate another practical intervention. [191] find that nurses could safely reassign non-urgent patients to GP care (apart from cases with a borderline semi-urgent or non-urgent status). This would be an intervention deflecting potential ED patients but leaving the reputation of GP services untouched. However, we look to make primary care more attractive for 'minor' complaints and not only ED less attractive (even though both interventions reduce the perceived quality gap between service providers). Hence, the effect of this intervention could be controversial and alludes to exploration using the BOR modelling framework. Another intervention pertains to bringing the service where the patients are, not the other way around. Employing a GP within a hospital-based emergency department has been identified as a cost-effective intervention (more effective, less expensive) compared to a standard ED service concerning process time and patient satisfaction [192]. However, this will not improve primary care's reputation but ED's standing as a 'we meet all patient needs' type of service. A model-based reputation analysis would enable modellers and planners to jointly evaluate the entire cost of the intervention, incorporating the forgone reputational change of primary care.

4.5. How to make primary care truly attractive

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

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

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

5. Limitations and conclusions

5.1. Limitations

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

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

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

5.2. Conclusions

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

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

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

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

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

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

Author statement

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

Data availability

Data will be made available on request.

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