


# BMJ Open Compliance and patient satisfaction with treatment settings recommended by the medical on-call service 116117 in Germany using computer-assisted structured initial assessment: a cross-sectional observational study accompanying the demand intervention

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## ABSTRACT

**Objectives** In order to reduce the use of emergency departments, computer-assisted initial assessment was implemented at the medical on-call service 116117. Our study assessed compliance and patient satisfaction.

**Design** Cross-sectional observational postal survey.

**Setting** Medical on-call service 116117 by eight Associations of Statutory Health Insurance Physicians in Germany.

**Participants** The intervention was observed between January 2020 and March 2021. Minors and patients with invalid contact data were excluded. A random sample of eligible patients received standardised questionnaires by mail.

**Outcome measures** We analysed associations of sociodemographic data, health status, previous service use, health literacy, and recommended settings with compliance and patient satisfaction by multivariable, multilevel logistic regression.

**Interventions** Based on symptoms and context factors, the computer software suggested service levels. Staff and patient discussed if higher levels were indicated, services were available and self-transport was possible. They then agreed on recommendations for treatment settings.

**Results** Of 9473 contacted eligible patients, 1756 patients (18.5%) participated. Median age was 66 years (IQR=50–79), and 986 (59.0%) were women. At least one recommended setting was used by 1397 patients (85.4%). General practitioner (GP) practices were used by 143 patients (68.4%). Generally, better compliance was associated with lower depression levels (OR 1.59, 95% CI 1.17 to 2.17,  $p=0.003$ ), fewer previous hospital stays (OR 2.02, 95% CI 1.27 to 3.23,  $p=0.003$ ) and recommendations for any setting other than GP practices (OR 0.13, 95% CI 0.06 to 0.29,  $p<0.001$ , to OR 0.37, 95% CI 0.19 to 0.72,  $p=0.003$ ). A total of 606 patients (50.7%) were completely satisfied. Patient satisfaction was associated with higher age (OR 1.30, 95% CI 1.13 to 1.49,  $p<0.001$ ), better self-rated health (OR 1.30, 95% CI 1.10

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ The large sample size and multilevel, multivariable methods facilitated a detailed analysis.
- ⇒ The questionnaire contained validated instruments and was piloted in a pretest.
- ⇒ It was not possible to conduct a randomised controlled trial because legal regulations required initial assessment in the telephone services from January 2020, and it was therefore not possible to establish a control group with care as usual.
- ⇒ Our study has a low participation rate of 18.5%, which might affect representativeness of results.
- ⇒ The questionnaires were sent out between 4 days and 72 days after patients received the intervention; therefore, recall bias and reduced willingness to participate in the survey are possible.

to 1.53,  $p=0.002$ ), not having musculoskeletal disorders (OR 0.68, 95% CI 0.49 to 0.94,  $p=0.021$ ), better health literacy (OR 0.69, 95% CI 0.54 to 0.89,  $p=0.005$ , and OR 0.49, 95% CI 0.36 to 0.67,  $p<0.001$ ) and receiving no recommendation for GP practices (OR 0.61, 95% CI 0.43 to 0.87,  $p=0.006$ ).

**Conclusions** Most patients were compliant and satisfied. Lowest compliance and satisfaction were found in GP practices, but nonetheless, two of three patients with respective recommendations were willing to use this setting.

**Trial registration number** German Clinical Trials Register DRKS00017014.

## INTRODUCTION

In many countries worldwide, the number of patients using emergency departments has been rapidly growing over the past years.<sup>1–3</sup> Therefore, many policymakers aim to reduce

the use of emergency departments by patients with low urgency conditions. For example, in Germany, the number of emergencies in hospitals has risen from 14.9 million cases in 2009 to 19.3 million cases in 2016 and stayed on that level until 2020. About 55% of these patients were not admitted to a hospital.<sup>4</sup> In Germany, unregulated access to emergency departments and emergency department crowding are in the focus of discussion.<sup>4-6</sup>

Emergency department crowding has been described as a symptom of healthcare dysfunction<sup>7</sup> resulting in adverse moral consequences by impairing the capacity of healthcare to improve the patients' health, to ensure patient safety, to respect patient autonomy and to avoid health disparities.<sup>8</sup> For example, treatment of pain and definite therapy for acute myocardial infarction can be delayed<sup>9 10</sup>; the probability of harmful medical errors and mortality rates can increase<sup>11 12</sup>; and treatment in hallways can be necessary, which can undermine patients' privacy and control over their personal information.<sup>13</sup>

Emergency department crowding has many causes including throughput and output factors, which—in principle—could be solved by improving patient flow and discharge procedures within the hospitals, but also input factors requiring responses on the healthcare system level.<sup>1</sup> These input factors include limited availability of outpatient services, patient preferences and the context in which the health problem occurred.<sup>14-16</sup> Moreover, many patients have little knowledge about in which cases emergency services should be used and which emergency service is suited best to their health problem.<sup>17 18</sup>

In Germany, in addition to hospitals' emergency services, outpatient emergency services are organised by the regional Associations of Statutory Health Insurance

Physicians (ASHIPs). Despite defined properties of each available setting (cf [table 1](#)), there is no gatekeeping in the German healthcare system and patients are free to choose which service they use. In the last years, following the political discussion, different strategies have been implemented to improve patient allocation in emergency care. Interventions include increasing the number of co-located emergency practices in hospitals,<sup>19</sup> a more patient-oriented approach to outpatient emergency services<sup>20</sup> and the DEMAND ("implementation of a standardized initial assessment as the basis of DEMAND management in outpatient emergency care") intervention.<sup>21</sup>

The DEMAND intervention is based on computer-assisted structured initial assessments conducted by the staff and gives recommendations for healthcare settings suited best to the patients' health problems.<sup>21 22</sup> Since January 2020, structured initial assessment at the telephone services of ASHIPs is required by law (§75 (1a) SGB V). Subsequently, the intervention has been implemented by nine ASHIPs at the medical on-call service 116117.

This study was part of the accompanying research to the DEMAND intervention and aimed (1) to describe compliance rates and patient satisfaction in each setting, (2) to identify variables associated with non-compliance and (3) to identify variables associated with patient satisfaction.

## METHODS

We conducted a cross-sectional observational study based on a standardised postal survey of patients who had received the DEMAND intervention. A summary of intervention and accompanying research is given in

**Table 1** Available healthcare settings

Setting	Defined mode of access	Defined target condition	Defined services
Rescue service	Telephone number 112	Potentially life-threatening health problems and serious injuries	Emergency medical treatment on site and immediate transport to the hospital
Emergency department	Rescue service or self-transport	Severe health problems requiring urgent treatment or hospital admission	Immediate ambulatory treatment by hospital physicians and hospital admission
Emergency home visit	Telephone number 116117 (mandatory)	Health problems requiring to be treated in a timely manner; self-transport to an emergency practice is not possible	Check-up visit by outpatient physicians with undefined specialty who have the duty to participate in outpatient emergency services
Emergency practice	Self-transport after calling 116117 (not mandatory)	Health problems requiring to be treated in a timely manner	Outpatient treatment outside office hours
Telephone counselling	Telephone number 116117 (mandatory, service not available in all regions)	Health problems for which initial medical advice is needed	Advice by physicians (primarily GPs)
Specialist practice	Self-transport	Health problems requiring specialist care	Outpatient specialist care during office hours
GP practice	Self-transport	All kinds of health problems	Primary care during office hours

GP, general practitioner.

the German Clinical Trials Register. Our study is based on study arm 1 of the DEMAND intervention, which was implemented in the telephone services of eight ASHIPs located in the German federal states of Bavaria, Brandenburg, Bremen, Hesse, North Rhine-Westphalia (represented by two ASHIPs in the regions North Rhine and Westphalia-Lippe), Schleswig-Holstein and Thuringia. Results of arm 2, the implementation of the DEMAND intervention in selected hospitals,<sup>23</sup> and arm 3, historical control groups for arms 1 and 2,<sup>22</sup> are reported elsewhere.

### Intervention

The DEMAND intervention was implemented at the medical on-call service 116117, which is one option of after-hours care in Germany, but not mandatory. The intervention consisted of (1) computer-assisted structured initial assessment conducted by the staff interviewing the patient and (2) recommendations of suitable treatment settings by the staff after appraisal of the specific situation of the patient. The process from the patients' call to the setting recommendations is shown in [figure 1](#). The staff usually had medical background, were trained in all aspects of the intervention and were instructed to conduct the intervention with all patients presenting acute health problems via telephone.

The computer-assisted structured initial assessment was facilitated by the software *Strukturierte medizinische Ersteinschätzung in Deutschland* (SmED, structured medical initial assessment in Germany), which was developed on the basis of the established Swiss Medical Assessment System (SMASS software, <https://www.in4medicine.ch/smash.html>). The appropriateness of recommendations generated by SMASS had been evaluated in 2012.<sup>24</sup>

SmED was used as a tool supporting decision making and documentation. It facilitated a structured clinical assessment considering the 100 most prevalent health problems in the International Classification of Primary Care.<sup>25</sup> In the first step of the assessment, age and sex were recorded, and a possible immediate threat to life was examined. In this context, relevant variables were 'recent severe shortness of breath', 'recent impairment of consciousness', 'recent serious cardiovascular problems', 'recent persistent nerve dysfunction', 'recent short-terminal neurological dysfunction', 'serious injury' and 'heavy bleeding'. The selection of these factors was based on established procedures in preclinical medicine.<sup>26</sup> If necessary, the assessment was stopped and the rescue service was alerted.

In the second step, a systematic query of symptoms, duration, previous illnesses, risk factors and measures already taken was conducted in order to assess the treatment urgency (ie, 'immediately', 'as soon as possible', 'less than 24 hours' or '24 hours and more') and to suggest which service level (ie, 'rescue service', 'emergency department', 'outpatient practice' or 'telephone counselling') should be used.

Based on the results from this assessment, staff and patient discussed if—in the specific situation of the

patient—a higher service level was indicated, the service was available and self-transport was possible, and agreed on recommendations for suitable treatment settings (ie, rescue service, emergency department, 'emergency home visit', 'emergency practice', 'specialist practice', 'general practitioner (GP) practice' and/or telephone counselling). Rescue service, home visits and telephone counselling were commissioned by the staff, the other settings had to be visited by the patient.

### Patient and public involvement

There was no patient and public involvement in the design, conduct and reporting of our research.

### Selection of participants and data collection

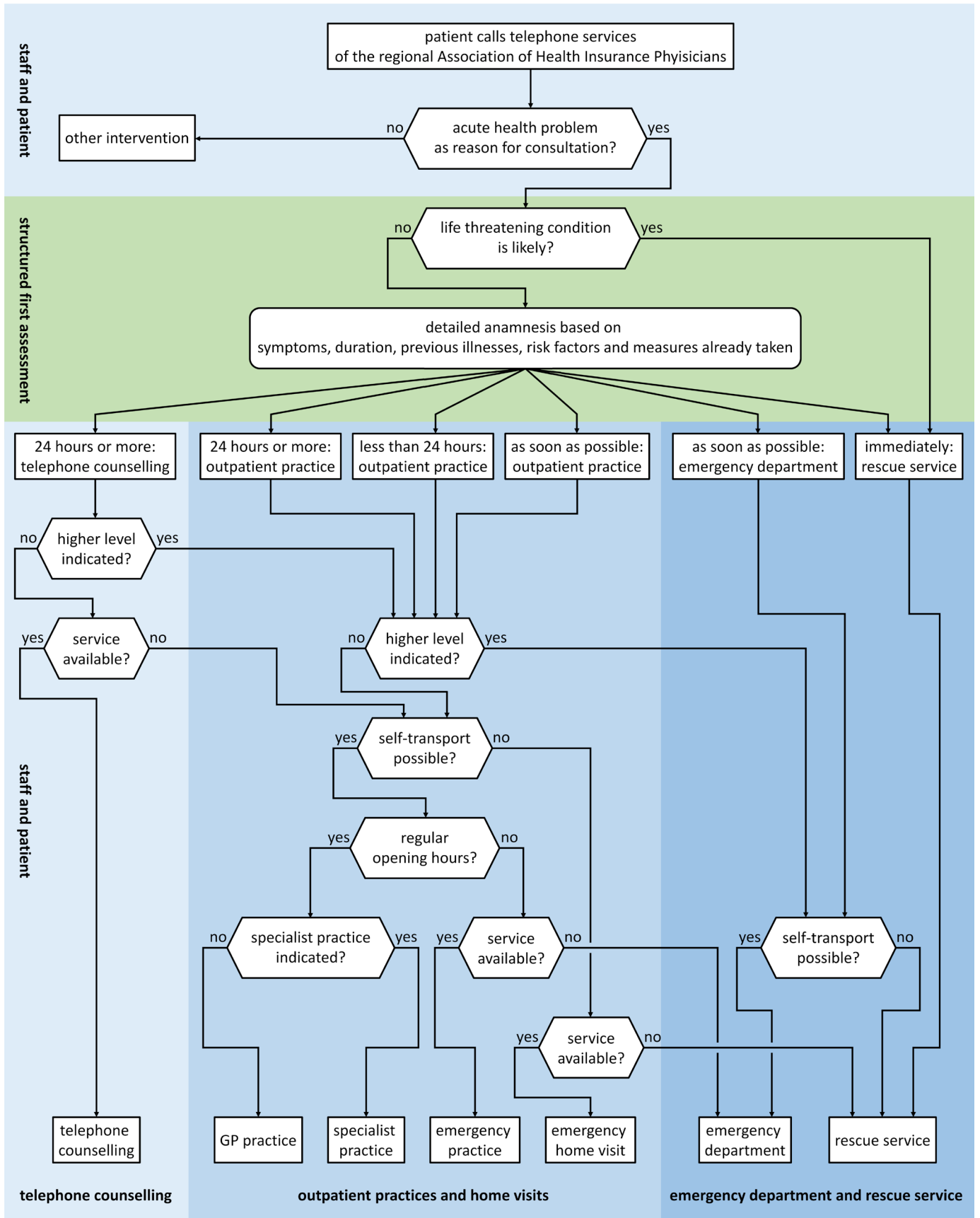
Patients were included if they had received the intervention between January 2020 and March 2021. The specific observation times per region are described in the methods section in online supplemental file 1). After each finished month of the observation time, the respective ASHIP created a list of patients who had received the intervention in the respective time frame. Patients were excluded from this list if they were less than 18 years old or if they had not reported a valid postal address. The contact data of all eligible patients were transferred to the study centre. Stratified by region, we randomly selected 10 000 patients based on electronically created random numbers (cf Methods section in online supplemental 1).

Selected patients received envelopes containing questionnaire and patient information and expressed their consent to study participation by returning the completed questionnaires by mail to the study centre. There was a time lag of 4–72 days between intervention and contacting patients (cf Methods section in online supplemental 1). Retrospectively, we excluded patients if the letter could not be delivered due to an incorrect postal address, if the patients reported that they did not use the telephone service of the respective ASHIP, and if relatives or other household members reported that the patients were not able to fill out the questionnaire (eg, due to functional limitations) or if household members reported that the patients had died.

Before starting the survey, we conducted a pretest in the regions North Rhine and Westphalia-Lippe. Contact data of 2873 patients of legal age were transferred from the ASHIP on 3 December 2019, and 100 patients were randomly selected, contacted by mail and asked to fill out our questionnaire on 10 December 2019. Retrospectively, we had to exclude four patients because of incorrect postal addresses and one patient who died. Of the 95 remaining patients, 16 (16.8%) participated in the pretest. The resulting data were used for revising our research methods and questionnaire.

### Measurements

We assessed recommended and used settings of emergency care by patient self-report, allowing for multiple answers. The patients rated their satisfaction with the



**Figure 1** Decision making in the demand intervention. GP, general practitioner.

computer-assisted initial assessment and the used settings by rating their agreement to eight statements on a 4-point Likert scale (ie, 'clearly no', 'rather no', 'rather yes' and 'clearly yes'). The questionnaires assessing recommended and used settings and patient satisfaction can be found in online supplemental file 2).

Additionally, the patient survey also included sociodemographic data, health status at the time of the emergency call, past health service use, and health literacy. Sociodemographic data included age, gender, living arrangement, educational level of the patients, and country of birth of the study participants and their parents. Living arrangement was coded in the categories 'living together with others' and 'living alone'. The educational level was operationalised by the highest general and vocational qualification and was coded pursuant to the CASMIN ("Comparative Analysis of Social Mobility in Industrial Nations") classification<sup>27</sup> in three hierarchical categories.

Health status included self-rated health, depressiveness, subjective treatment urgency and reasons for consulting the telephone services of the ASHIP. Self-rated health was assessed with a Visual Analogue Scale ranging from 0 (indicating the worst) to 100 (indicating the best imaginable health status at the day of the initial assessment). The Patient Health Questionnaire, 2 item version (PHQ-2)<sup>28</sup> was used to screen for symptoms of depression in the 2 weeks before initial assessment. It consists of two items and results in a summary score ranging between 0 (indicating no symptoms) and 8 (indicating both symptoms occurring almost every day).

The subjective treatment urgency was rated on a Numerical Rating Scale ranging from 0 (indicating no urgent need for treatment) to 10 (indicating very urgent need for treatment and/or life threatening condition). Consultation reasons were assessed by open questions and retrospectively coded by the project staff (JHO and AM) in the International Classification of Primary Care, Second Revision (ICPC-2),<sup>25</sup> which facilitates grouping by organ system and diagnosis type (eg, 'symptoms/complaints' or 'infections').

Past health service use was indicated by patient report of using or not using GP practices, specialist practices, hospitals and emergency services in the 3 months before the initial assessment. Health literacy was measured by the European Health Literacy Questionnaire with 16 Items (HLS-EU-Q16) rated on a 4-point Likert scale and dichotomised for our analyses. The resulting summary score was then divided into three hierarchical categories.<sup>29 30</sup>

### Statistical analyses

The study population, the frequency of non-use of recommended settings and patient satisfaction with the used settings were characterised by descriptive statistics. The eight satisfaction items were dichotomised into 'agreement' (clearly yes and rather yes) and 'non-agreement' (rather no and clearly no), and a summary score was calculated by counting the number of items indicating agreement.

Variables associated with not using any of the recommended settings were identified by multilevel logistic regression models adjusted for random effects at the level of regions and months of observation within regions. Variables associated with patient satisfaction summary score were identified by multilevel ordered logistic regression models adjusted for random effects at the level of regions and months of observation within regions.

Independent variables of both analyses included sociodemographic data, the variables describing health status, past health service use and health literacy and the setting recommendations made after initial assessment. For both endpoints, we calculated unadjusted models and one multivariable model in which the estimates of all variables were adjusted for all other variables. The statistical models are detailed in the Methods section in online supplemental 1). For these analyses, an alpha-level of  $p \leq 0.05$  was defined as statistically significant. All statistical analyses were based on the available data and performed using Stata V.15.1.

## RESULTS

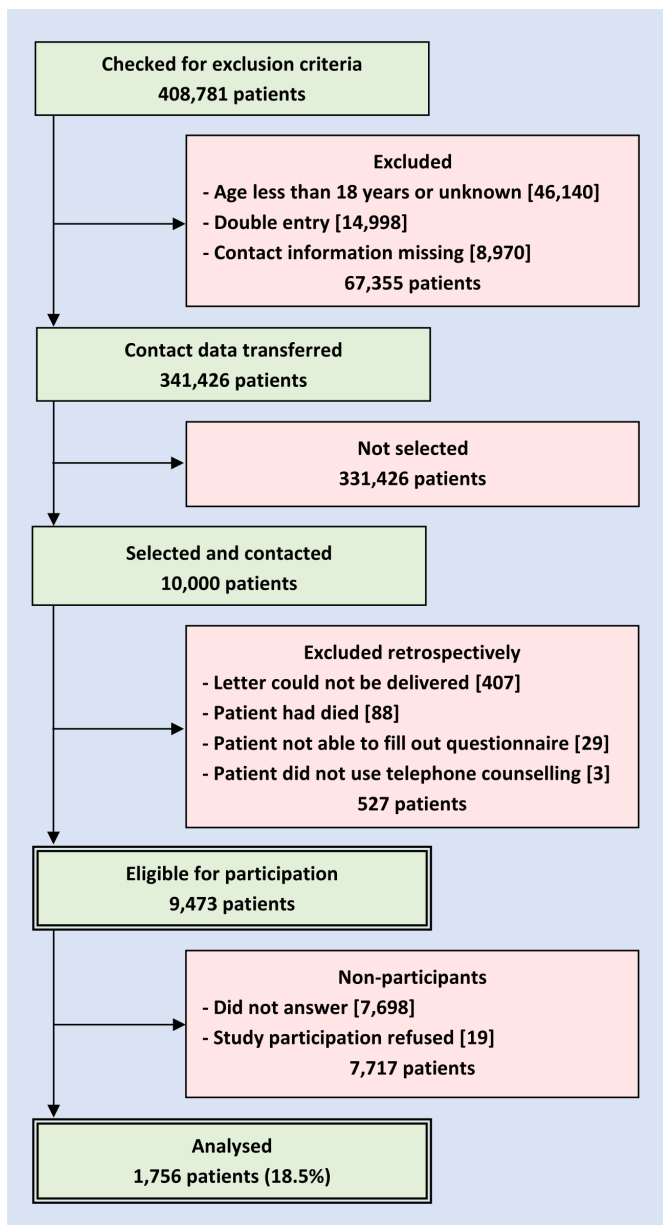
### Characteristics of study subjects

Until March 2021, a total of 529 367 initial assessments have been conducted in nine ASHIPs implementing the DEMAND intervention. The recruitment of study participants in eight of these ASHIPs is shown in figure 2. After screening 408 781 patients for exclusion criteria, we obtained contact data of 341 426 eligible patients. However, of the 10 000 randomly selected and contacted patients, 527 had to be retrospectively excluded due to exclusion criteria or because they died or had functional limitations. Finally, 1756 patients participated in the survey, which corresponds to a response rate of 18.5%. The distribution of the sample regarding included regions and observation periods can be found in online supplemental figure S1 in supplement 1).

Characteristics of study participants are shown in table 2. Median age of the patients was 66 years (IQR 50–79); 986 (59.0%) were women; and 499 patients (30.2%) were living alone. Most were born in Germany (1426 patients, 85.9%). Tertiary education had been achieved by 375 patients (23.0%). The median subjective treatment urgency was 7 (IQR 5–8). The patients rated their health on the day of the intervention as a median of 40 (IQR 24–60). Most (1096 patients, 68.7%) presented symptoms or complaints. Based on self-rating, inadequate health literacy was found in 348 patients (22.4%).

### Compliance with setting recommendations

In total, 1397 patients (85.4%) used at least one of the recommended settings (cf figure 3). As 371 patients (22.0%) had received more than one recommendation, the frequency of use of the recommended specific settings is lower than the total rate following any recommendation. The highest number of patients following the specific recommendation is related to rescue service



**Figure 2** Recruitment of study participants.

(236 patients, 81.4%) and emergency home visits (533 patients, 80.4%); the lowest number is related to emergency practices (138 patients, 70.8%) and GP practices (143 patients, 68.4%). Although there are differences on an aggregated level regarding the use of recommended settings; for example, emergency home visits were recommended for 663 patients (40.6%) but used by 577 patients (35.3%), and rescue service was recommended for 290 patients (17.7%) but used by 338 patients (20.7%)—no general patterns of alternative usage are discernible from the individual data regarding the specific settings (cf figure 3).

Not using a recommended, but at least one other setting was related to a higher level of depressiveness (OR 1.59, 95% CI 1.17 to 2.17 for 3 points on the PHQ-2 scale,  $p=0.003$ ) and hospital admissions in the 3 months preceding the first assessment (OR 2.02, 95% CI 1.27

**Table 2** Study population

Characteristics	Value
Age (years), median (IQR)	66 (50–79) (n=1660)
Gender, n (%)	
Women	986 (59.0)
Men	681 (40.8)
Non-binary	3 (0.2)
Living arrangement, n (%)	
Living alone	1153 (30.2)
Living together with others	499 (69.8)
Education (pursuant to CASMIN), n (%)	
Uncompleted, general elementary or basic vocational	549 (33.7)
Secondary school certificate or ‘A’ level equivalent	707 (43.4)
Higher or lower tertiary	375 (23.0)
Country of birth, n (%)	
Patient and both parents in Germany	1426 (85.9)
Patient in Germany and at least one parent abroad	98 (5.9)
Patient abroad	136 (8.2)
Subjective treatment urgency (Numerical Rating Scale), median (IQR)	7 (5–8) (n=1580)
Self-rated health (EQ-5D Visual Analogue Scale), median (IQR)	40 (24–60) (n=1640)
Depressiveness (pursuant to PHQ-2), median (IQR)	1 (0–2) (n=1493)
Health problem: organ system (pursuant to ICPC-2), n (%)	
General and unspecified disorders	372 (23.3)
Musculoskeletal system	350 (21.9)
Digestive system	293 (18.4)
Cardiovascular system	250 (15.7)
Respiratory system	216 (13.5)
Neurological system	145 (9.1)
Urological system	97(6.1%)
Health problem: diagnosis type (pursuant to ICPC-2), n (%)	
Symptoms and complaints	1096 (68.7)
Infections	88 (5.5)
Injuries	110 (6.9)
Other diagnoses	312 (19.6)
Past health service use in the last 3 months, n (%)	
GP practices	1088 (67.8)
Specialist practices	727 (45.3)
Hospitals	348 (21.7)
Emergency care	290 (18.1)

Continued

**Table 2** Continued

Characteristics	Value
Health literacy (pursuant to HLS-EU-Q16), n (%)	
Inadequate (0–8 points)	348 (22.4)
Problematic (9–12 points)	561 (36.2)
Sufficient (13–16 points)	642 (41.4)
GP, general practitioner; HLS-EU-Q16, European Health Literacy Questionnaire with 16 Items; ICPC-2, International Classification of Primary Care, Second Revision; PHQ-2, Patient Health Questionnaire 2.	

to 3.23,  $p=0.003$ ), but no other sociodemographic data (including gender) or indicators of health status, health-care use or health literacy. However, it was related to the recommended settings. A higher chance for following the recommendation was related to receiving a recommendation for rescue service (OR 0.13, 95% CI 0.06 to 0.29,  $p<0.001$ ), emergency departments (OR 0.24, 95% CI 0.11 to 0.52,  $p<0.001$ ), specialist practices (OR 0.25, 95% CI 0.09 to 0.68,  $p=0.006$ ), telephone counselling (OR 0.29, 95% CI 0.15 to 0.54,  $p<0.001$ ), emergency practices (OR 0.29, 95% CI 0.15/0.55,  $p<0.001$ ) and emergency home visits (OR 0.37, 95% CI 0.19 to 0.72,  $p=0.003$ ) but not to recommendations of GP practices (cf [table 3](#)).

In the unadjusted analyses, the same variables were associated with not using a recommended setting as in the multivariable model (cf online supplemental table S1 in supplement 1). We identified associations of this endpoint with depressiveness (OR 1.51, 95% CI 1.17 to 1.96,  $p=0.002$ ), previous hospital admissions (OR 1.98, 95% CI 1.29 to 3.03,  $p=0.002$ ) and the recommended setting. Similar to the multivariable model, this included a recommendation for rescue service (OR 0.14, 95% CI 0.06 to 0.30,  $p<0.001$ ), emergency departments (OR 0.21, 95% CI 0.10 to 0.46,  $p<0.001$ ), telephone counselling (OR 0.27, 95% CI 0.15 to 0.51,  $p<0.001$ ), specialist practices (OR 0.30, 95% CI 0.11 to 0.80,  $p=0.016$ ), emergency practices (OR 0.30, 95% CI 0.16 to 0.57,  $p<0.001$ ) and emergency home visits (OR 0.41, 95% CI 0.21 to 0.78,  $p=0.006$ ) but not to recommendations of GP practices. Additionally, we found associations with age (OR 1.21 for 20-year difference, 95% CI 1.01 to 1.44,  $p=0.036$ ) and education (OR 0.65 for secondary compared with lower educational level, 95% CI 0.44 to 0.94,  $p=0.023$ ) that had not been identified in the multivariable model.

### Patient satisfaction with used settings

Patient satisfaction with the used settings is shown in [figure 4](#). Generally, the highest rates of agreement were given to the statements indicating that patients could say everything they wanted to say (1445 patients, 90.6%) and that the staff had enough time for the patients (1385 patients, 85.5%). The lowest rates of agreement were found in the statements indicating that patients could be helped with their health problem (1170 patients, 73.2%)

and that patients found the waiting time reasonable (1116 patients, 70.5%). A total of 606 patients (50.7%) were completely satisfied with the intervention, but there were differences in the rating of the eight items in the specific settings. The largest deviations from total satisfaction rates were found in the items indicating that patients felt they were treated in the right setting (153 patients, 68.6% agree in GP practices vs 1270 patients, 81.2% in total) and that patients could be helped with their health problem (139 patients, 61.3% in GP practices, and 63 patients, 63.0% in specialist practices vs 1170 patients, 73.2% in total).

Results from the multivariable analysis of variables associated with patient satisfaction are shown in [table 4](#). Patient satisfaction was associated with higher age (OR 1.30, 95% CI 1.13 to 1.49 per 20 years difference,  $p<0.001$ ), better self-rated health (OR 1.30, 95% CI 1.10 to 1.53 per 30 points difference on the EQ-5D ("EuroQoL 5 dimension questionnaire") visual analogue scale,  $p=0.002$ ), not having musculoskeletal disorders (OR 0.68, 95% CI 0.49 to 0.94,  $p=0.021$ ), better health literacy (OR 0.69, 0.54 to 0.89 for problematic vs sufficient,  $p=0.005$ , and OR 0.49, 95% CI 0.36 to 0.67 for inadequate vs sufficient,  $p<0.001$ ) and receiving no recommendation for GP practices (OR 0.61, 95% CI 0.43 to 0.87,  $p=0.006$ ).

In the unadjusted analyses, we identified similar associations as in the multivariable model (cf online supplemental table S2 in supplement 1). Patient satisfaction was associated with age (OR 1.18, 95% CI 1.05 to 1.31,  $p=0.004$ ), self-rated health (OR 1.30, 95% CI 1.13 to 1.49,  $p<0.001$ ), musculoskeletal disorders (OR 0.68, 95% CI 0.52 to 0.91,  $p=0.008$ ), health literacy (OR 0.67, 95% CI 0.53 to 0.86,  $p=0.002$  and OR 0.52, 95% CI 0.40 to 0.70,  $p<0.001$ ) and receiving no recommendation for GP practices (OR 0.61, 95% CI, 0.43 to 0.85,  $p=0.004$ ). Additionally, we found associations with digestive disorders (OR 0.72, 95% CI 0.53 to 0.96,  $p=0.025$ ) and neurological disorders (OR 0.65, 95% CI 0.46 to 0.92,  $p=0.014$ ).

## DISCUSSION

### Statement of principal findings

The DEMAND intervention is implemented in large scale on the population level in Germany. The accompanying research focused on the patients' perspective regarding the intervention's process and outcome quality. Most patients were compliant with recommendations and satisfied with the intervention. Compliance was higher when patients had lower depression levels and had no recent hospital stays. Patient satisfaction was better when patients were older and had better self-rated health, no musculoskeletal disorders and better health literacy. In addition, both endpoints were dependent to a large extent from the recommended setting.

### Comparison with the literature

In the DEMAND-intervention, the patients' willingness to follow one of the recommendations was generally very

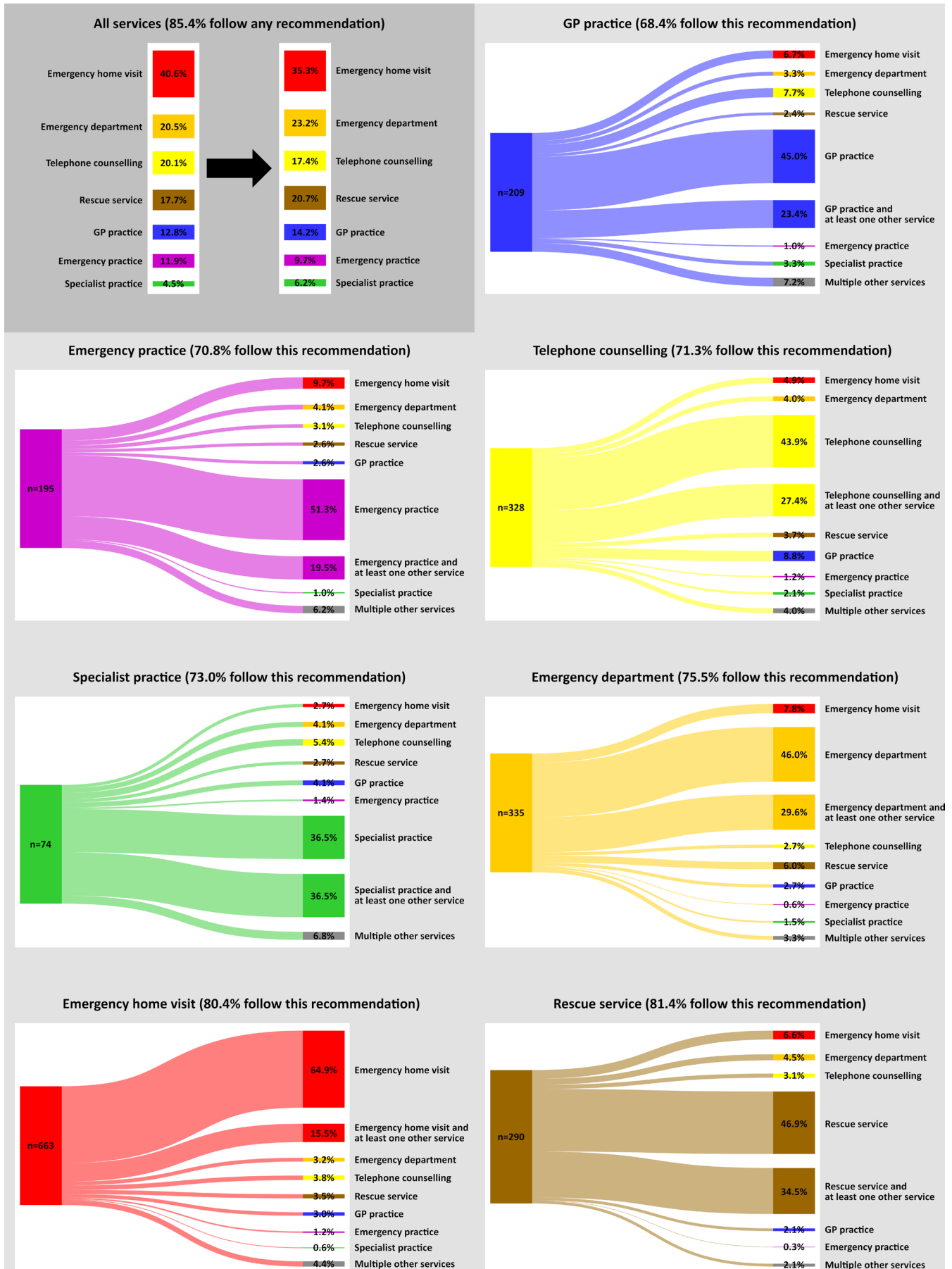


Figure 3 Compliance with recommendations by treatment setting. GP, general practitioner.



**Table 3** Associations with not using any of the recommended settings: results from multivariable, multilevel logistic regression analysis adjusted for random effects on region and month within region level (n=1171)

Characteristics	OR (95% CI)	P value
Age (per 20 years' difference)	1.10 (0.88 to 1.37)	0.424
Gender		
Men or non-binary	Reference	
Women	1.25 (0.88 to 1.79)	0.217
Living arrangement		
Living with others	Reference	
Living alone	1.06 (0.72 to 1.57)	0.776
Education (pursuant to CASMIN)		
Uncompleted, general elementary or basic vocational	Reference	
Secondary school certificate or 'A'-level equivalent	0.78 (0.50 to 1.21)	0.262
Higher or lower tertiary	0.74 (0.44 to 1.24)	0.253
Country of birth		
Patient and both parents in Germany	Reference	
Patient in Germany and at least one parent abroad	1.54 (0.79 to 2.97)	0.202
Patient abroad	1.06 (0.55 to 2.03)	0.861
Subjective treatment urgency (Numerical Rating Scale, per 3 points difference)	0.86 (0.64 to 1.13)	0.279
Self-rated health (EQ-5D Visual Analogue Scale, per 30-point difference)	0.97 (0.75 to 1.25)	0.813
Depressiveness (pursuant to PHQ-2, per 3-point difference)	1.59 (1.17 to 2.17)	0.003
Health problem: organ system (pursuant to ICPC-2)		
General and unspecified disorders	0.78 (0.48 to 1.28)	0.328
Musculoskeletal system	0.94 (0.56 to 1.58)	0.810
Digestive system	1.08 (0.63 to 1.84)	0.782
Cardiovascular system	0.61 (0.30 to 1.24)	0.174
Respiratory system	0.80 (0.44 to 1.44)	0.450
Neurological system	1.02 (0.55 to 1.90)	0.947
Urological system	0.78 (0.34 to 1.79)	0.553
Health problem: diagnosis type (pursuant to ICPC-2)		
Symptoms and complaints	1.45 (0.78 to 2.67)	0.238
Infections	1.25 (0.50 to 3.16)	0.636
Injuries	1.63 (0.77 to 3.47)	0.202
Other diagnoses	1.28 (0.65 to 2.55)	0.476
Past health service use		
GP practices	1.06 (0.70 to 1.60)	0.770
Specialist practices	1.00 (0.69 to 1.45)	0.983
Hospitals	2.02 (1.27 to 3.23)	0.003
Emergency care	0.89 (0.52 to 1.51)	0.657
Health literacy (pursuant to HLS-EU-Q16)		
Sufficient (13–16 points)	Reference	
Problematic (9–12 points)	0.88 (0.59 to 1.31)	0.527
Inadequate (0–8 points)	0.63 (0.38 to 1.06)	0.082
Setting recommendation		
Rescue service	0.13 (0.06 to 0.29)	<0.001
Emergency home visit	0.37 (0.19 to 0.72)	0.003
Emergency department	0.24 (0.11 to 0.52)	<0.001

Continued



Table 3 Continued

Characteristics	OR (95% CI)	P value
Emergency practice	0.29 (0.15 to 0.55)	<0.001
Specialist practice	0.25 (0.09 to 0.68)	0.006
GP practice	0.73 (0.38 to 1.40)	0.338
Telephone counselling	0.29 (0.15 to 0.54)	<0.001

GP, general practitioner; HLS-EU-Q16, European Health Literacy Questionnaire with 16 Items; ICPC-2, International Classification of Primary Care, Second Revision; PHQ-2, Patient Health Questionnaire 2.

high (85.4%). Both in descriptive data and inferential statistics, the highest willingness to follow the recommendation was identified when patients were visited at home by rescue service (81.4%) and the lowest when a visit of the regular GP was recommended (68.4%). Many other studies assessed compliance to telephone triage decisions. In a systematic review,<sup>31</sup> most studies reported overall compliance rates with telephone triage decisions between 70% and 88%. Considering the specific decisions, primary care had lower compliance rates (median: 66%) than emergency or urgent care (median: 75%). In a meta-analysis from the same year,<sup>32</sup> the pooled analysis showed an overall patient compliance with telephone triage decisions of 62%, and a higher likelihood of following decisions for using emergency services (63%) than non-urgent care at a physician office or a clinic (44%). More recent papers reported similar results.<sup>33 34</sup>

In DEMAND, associations between socio-demographic data, health status, past health service use, health literacy and compliance with setting recommendations had been analysed. The only patient-related associations with non-compliance were depression level and past inpatient service use. Several other studies also investigated patient factors related to non-compliance to telephone triage decisions. They reported a large variety of associations, for example, younger age, lower socioeconomic status, high level of psychological distress, limited English proficiency, living in remote or socially disadvantaged areas, and taking many medications regularly.<sup>35-39</sup> Also, distances between patient homes and treatment settings might influence which setting is used,<sup>39</sup> which might be one reason for high rates of emergency home visits in DEMAND.

The DEMAND intervention resulted in high rates of patient satisfaction with the lowest satisfaction in the indicator 'waiting time'. Using GP practices in the context of the DEMAND intervention was connected with lower patient satisfaction than in the other settings, particularly because some patients felt that they were not treated in the right settings and that they could not be helped with their health problem. An overview of systematic reviews concluded in 2017 that patient satisfaction with telephone triage was generally high and usually on the same level or above other forms of care.<sup>40</sup> A more recent systematic review came to similar results.<sup>41</sup> Many studies highlighted waiting time as predictive of reduced patient

satisfaction.<sup>42-47</sup> Two systematic reviews reported that satisfaction rates were lower when expectations of patients regarding the decision were not met.<sup>41 48 49</sup> Some studies saw patient satisfaction with the triage to be predictive of the compliance with the decision.<sup>31</sup>

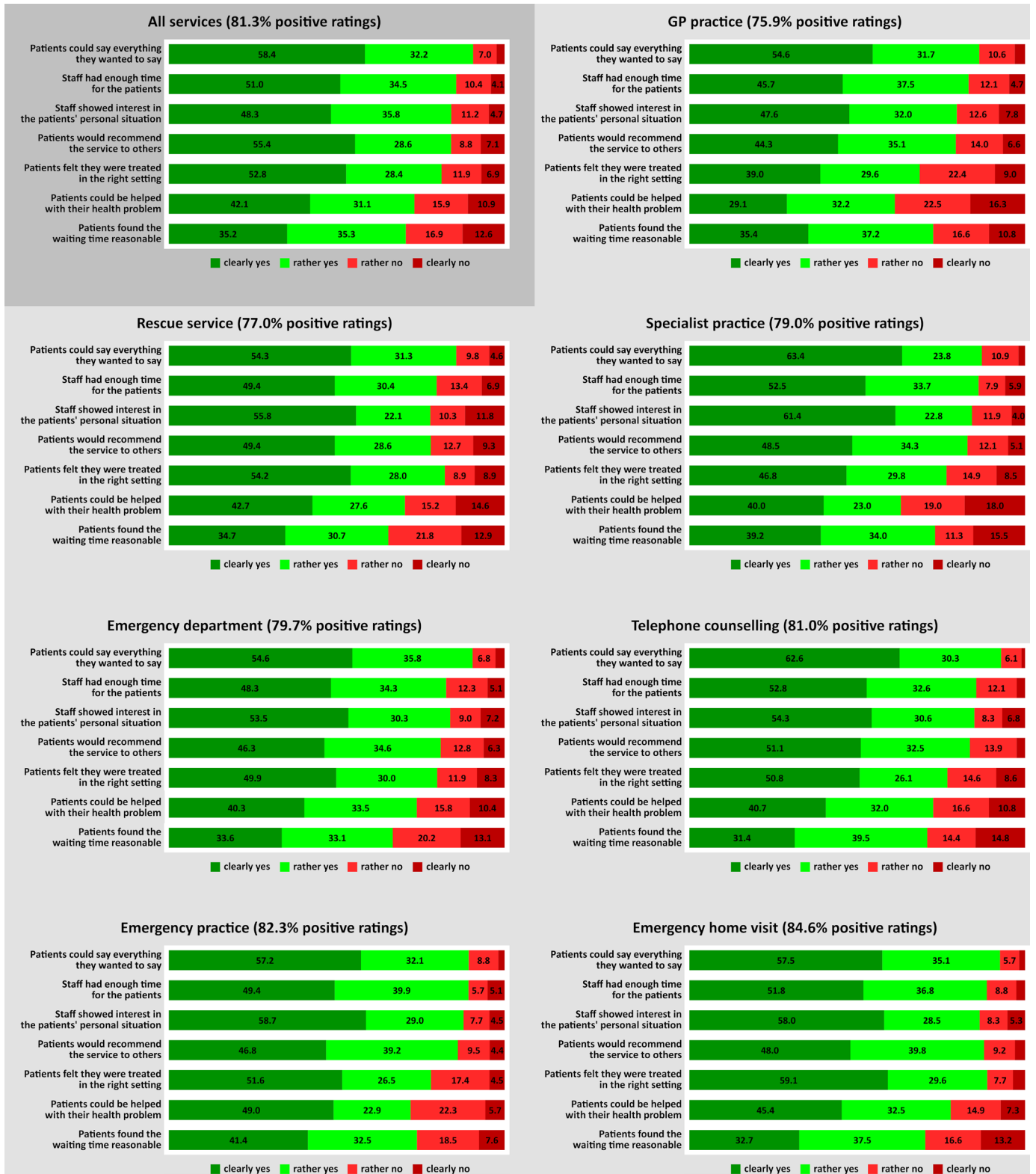
In our study, patient satisfaction was associated with age, the specific health problem and health literacy. The accompanying research to the DEMAND intervention in selected hospitals reported similar factors to be associated with satisfaction of patients.<sup>23</sup> Several other studies also found lower satisfaction in patients with higher age,<sup>50 51</sup> more severe health problems such as multimorbidity, poorly controlled diabetes or migraine-related disability,<sup>51-54</sup> and lower health literacy.<sup>55-57</sup>

### Implications

The DEMAND intervention comprised the combination of computer-assisted structured initial assessment and appraisal of the patients' personal situation by trained staff. These two elements were combined following the evaluation of the SMASS software, which pointed out that computer-assisted telephone triage was safe but required competent specialists with dedicated training in communication.<sup>24</sup>

Generally, compliance with recommendations and patient satisfaction were high. The specific setting 'GP practices' was associated with the lowest compliance and patient satisfaction. This had been expected based on data from other studies.<sup>31-34</sup> One probable reason for this low rate is that the patients already used emergency care, which the medical on-call service 116117 is part of, and that they did not expect to be redirected to primary care. Moreover, the specific compliance rate to GP practices of 68.4% in our study is similar<sup>31</sup> or higher<sup>32</sup> than in other approaches. Therefore, our study could be a promising approach for implementation in other countries as well.

As in the accompanying research to the DEMAND intervention in hospitals, compliance and patient satisfaction were associated with specific health problems, and satisfaction was associated with health literacy. Therefore, tailored information for these patient groups about the intervention could be helpful for further increasing acceptance rates of our approach.



**Figure 4** Patient satisfaction with used services by treatment setting. GP, general practitioner.

### Strengths and limitations

Due to the legal regulations requiring initial assessment in the telephone services of ASHIPs from 1 January 2020 on, it was not possible to establish a control group and conduct a randomised controlled trial evaluating the effectiveness of the intervention. For this reason, we

do not know if compliance with setting recommendations and satisfaction of patients receiving computer-assisted structured initial assessment are better or worse compared with patients who did not receive this intervention. Despite registration of the accompanying research to the DEMAND intervention, the protocol of our study

**Table 4** Associations with patient satisfaction summary score: results from multivariable, multilevel ordered logistic regression analysis adjusted for random effects on region and month within region level (n=1195)

Characteristics	OR (95% CI)	P value
Age (per 20 years difference)	1.30 (1.13 to 1.49)	<0.001
Gender		
Men or non-binary	Reference	
Women	1.04 (0.83 to 1.31)	0.730
Living arrangement		
Living with others	Reference	
Living alone	0.93 (0.73 to 1.19)	0.566
Education (pursuant to CASMIN)		
Uncompleted, general elementary or basic vocational	Reference	
Secondary school certificate or 'A'-level equivalent	0.92 (0.69 to 1.22)	0.565
Higher or lower tertiary	0.91 (0.65 to 1.29)	0.608
Country of birth		
Patient and both parents in Germany	Reference	
Patient in Germany and at least one parent abroad	0.85 (0.54 to 1.34)	0.490
Patient abroad	1.19 (0.80 to 1.77)	0.399
Subjective treatment urgency (Numerical Rating Scale, per 3-point difference)	0.96 (0.80 to 1.16)	0.704
Self-rated health (EQ-5D Visual Analogue Scale, per 30-point difference)	1.30 (1.10 to 1.53)	0.002
Depressiveness (pursuant to PHQ-2, per 3-point difference)	0.98 (0.80 to 1.20)	0.820
Health problem: organ system (pursuant to ICPC-2)		
General and unspecified disorders	0.95 (0.70 to 1.29)	0.738
Musculoskeletal system	0.68 (0.49 to 0.94)	0.021
Digestive system	0.76 (0.54 to 1.07)	0.119
Cardiovascular system	1.19 (0.77 to 1.82)	0.436
Respiratory system	0.82 (0.57 to 1.17)	0.275
Neurological system	0.71 (0.49 to 1.03)	0.068
Urological system	1.27 (0.74 to 2.17)	0.391
Health problem: diagnosis type (pursuant to ICPC-2)		
Symptoms and complaints	0.99 (0.67 to 1.46)	0.963
Infections	1.42 (0.77 to 2.63)	0.262
Injuries	1.20 (0.71 to 2.03)	0.497
Other diagnoses	0.96 (0.63 to 1.45)	0.833

Continued

**Table 4** Continued

Characteristics	OR (95% CI)	P value
Past health service use		
GP practices	1.08 (0.84 to 1.39)	0.534
Specialist practices	0.96 (0.76 to 1.22)	0.761
Hospitals	0.85 (0.62 to 1.18)	0.333
Emergency care	0.96 (0.67 to 1.36)	0.809
Health literacy (pursuant to HLS-EU-Q16)		
Sufficient (13–16 points)	Reference	
Problematic (9–12 points)	0.69 (0.54 to 0.89)	0.005
Inadequate (0–8 points)	0.49 (0.36 to 0.67)	<0.001
Setting recommendation		
Rescue service	1.32 (0.93 to 1.88)	0.117
Emergency home visit	0.96 (0.70 to 1.31)	0.792
Emergency department	0.91 (0.64 to 1.30)	0.613
Emergency practice	1.17 (1.72 to 1.00)	0.065
Specialist practice	1.01 (0.59 to 1.73)	0.965
GP practice	0.61 (0.43 to 0.87)	0.006
Telephone counselling	0.98 (0.73 to 1.31)	0.887
GP, general practitioner; HLS-EU-Q16, European Health Literacy Questionnaire with 16 Items; ICPC-2, International Classification of Primary Care, Second Revision.		

was not published in advance. Publishing study protocols is recommended in order to reduce publication and reporting bias.<sup>58</sup>

Patients' contact data were collected for healthcare and not for study purposes, and it was not possible to assess many exclusion criteria in a systematic way. A consequence is a low participation rate of 18.5%, which is comparable to similar studies.<sup>59 60</sup> On the one hand, this reflects that probably some patients died without our knowledge or might not have been able to respond due to bad health condition or functional limitations. Also, individuals could not be contacted for our study if they lived in a hotel or holiday apartment or were at a friend's place while using the telephone services. Moreover, some patients' not visited at home might have given wrong contact data. On the other hand, the low participation rate could be connected to unwillingness to participate in the study, and selection bias is therefore possible. However, while specific groups (eg, men, lower age groups and lower educational level) are often under-represented in studies with low participation rates, associations in the data sets are usually not affected by response bias.<sup>61–63</sup> Moreover, in our study, we had no data to compare non-responders with study participants.

The large sample size and multilevel, multivariable methods facilitated a detailed analysis. However, we did not conduct a sample size calculation, and therefore variables associated with compliance and patient satisfaction might still have been missed due to limited statistical power. The questionnaire contains validated instruments

like PHQ-2<sup>27</sup> and HLS-EU-Q16<sup>29</sup> and was piloted in a pretest, but there are also self-developed instruments for which no psychometric validation had been conducted and reliability and validity are unknown, for example, the items measuring patient satisfaction. It needs to be noted that the questionnaire was sent out between 4 days and 72 days after receiving the intervention. For this reason, in some cases, recall bias might have affected the patients' answers. As in most surveys, we also cannot rule out completely that errors or social desirability might have biased the data.

## CONCLUSIONS

Most patients were compliant and satisfied with setting recommendations. The lowest compliance rate and patient satisfaction were found when GP practices were recommended and used. However, despite using emergency care, two out of three patients recommended to visit a GP were willing to be redirected to primary care.

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## REFERENCES

- Morley C, Unwin M, Peterson GM, *et al.* Emergency department crowding: a systematic review of causes, consequences and solutions. *PLoS One* 2018;13:e0203316.
- Lowthian JA, Curtis AJ, Jolley DJ, *et al.* Demand at the emergency department front door: 10-year trends in presentations. *Medical Journal of Australia* 2012;196:128–32. 10.5694/mja11.10955 Available: <https://onlinelibrary.wiley.com/toc/13265377/196/2>
- Pines JM, Hilton JA, Weber EJ, *et al.* International perspectives on emergency department crowding [International perspectives on emergency department crowding]. *Acad Emerg Med* 2011;18:1358–70. 10.1111/j.1553-2712.2011.01235.x Available: <http://doi.wiley.com/10.1111/acem.2011.18.issue-12>
- Mangiapanè S, Czihal T, Stillfried D von. The utilization of ambulatory emergency care and unplanned hospitalizations in Germany, 2010–2019. *Dtsch Arztebl Int* 2022;119:arztebl.m2022.0160:425–6.. 10.3238/arztebl.m2022.0160 Available: <https://www.zi.de/fileadmin/images/content/Publikationen/Zi-Paper-16-2021-Notfallversorgung.pdf>
- Sachverständigenrat zur Begutachtung der Entwicklung im Gesundheitswesen. In: *Needs-based management of healthcare. Bedarfsgerechte Steuerung der Gesundheitsversorgung*. German. Bonn/Berlin, 2018. Available: [http://www.svr-gesundheit.de/fileadmin/Gutachten/Gutachten\\_2018/Gutachten\\_2018.pdf](http://www.svr-gesundheit.de/fileadmin/Gutachten/Gutachten_2018/Gutachten_2018.pdf) [accessed 12 Aug 2022].
- Sachverständigenrat zur Begutachtung der Entwicklung im Gesundheitswesen. Bedarfsgerechte Versorgung – perspektiven für ländliche regionen und ausgewählte leistungsbereiche needs-based care-perspectives for rural regions and selected service areas. German. Bonn/Berlin; 2014. Available: [http://www.svr-gesundheit.de/fileadmin/Gutachten/Gutachten\\_2014/Langfassung2014.pdf](http://www.svr-gesundheit.de/fileadmin/Gutachten/Gutachten_2014/Langfassung2014.pdf) [Accessed 12 Aug 2022].
- Kelen GD, Wolfe R, D'Onofrio G, *et al.* Emergency department crowding: the Canary in the health care system. *NEJM Catal* 2021. Available: <https://catalyst.nejm.org/doi/full/10.1056/CAT.21.0217>
- Moskop JC, Geiderman JM, Marshall KD, *et al.* Another look at the persistent moral problem of emergency department crowding. *Ann Emerg Med* 2019;74:S0196-0644(18)31479-3:357–64..
- Pines JM, Shofer FS, Isserman JA, *et al.* The effect of emergency department crowding on analgesia in patients with back pain in two hospitals. *Acad Emerg Med* 2010;17:276–83.
- Kulstad EB, Kelley KM. Overcrowding is associated with delays in percutaneous coronary intervention for acute myocardial infarction. *Int J Emerg Med* 2009;2:149–54.
- Epstein SK, Huckins DS, Liu SW, *et al.* Emergency department crowding and risk of preventable medical errors. *Intern Emerg Med* 2012;7:173–80.
- Bernstein SL, Aronsky D, Duseja R, *et al.* Society for academic emergency medicine, emergency department crowding Task force. The effect of emergency department crowding on clinically oriented outcomes. *Acad Emerg Med* 2009;16:1–10.
- Lin YK, Lin CJ. Factors predicting patients' perception of privacy and satisfaction for emergency care. *Emerg Med J* 2011;28:604–8.
- Scherer M, Lühmann D, Kazek A, *et al.* Patients attending emergency departments—a cross-sectional study of subjectively perceived treatment urgency and motivation for attending. *Dtsch Arztebl Int* 2017;114:645–52.
- Somasundaram R, Geissler A, Leidel BA, *et al.* Beweggründe für die inanspruchnahme von notaufnahmen – ergebnisse einer patientenbefragung [Reasons for Emergency Department Visits: Results of a Patient Survey]. *Gesundheitswesen* 2018;80:621–7.
- Durand AC, Palazzolo S, Tanti-Hardouin N, *et al.* Nonurgent patients in emergency departments: rational or irresponsible consumers? perceptions of professionals and patients. *BMC Res Notes* 2012;5:525.
- von dem Knesebeck O, Koens S, Schäfer I, *et al.* Public knowledge about emergency care—results of a population survey from Germany. *Front Public Health* 2022;9:787921.
- Metelmann B, Brinkrolf P, Kliche M, *et al.* Es gelingt Der bevölkerung nur unzureichend, die richtige ressource für medizinische akutfälle zu wählen. *Med Klin Intensivmed Notfmed* 2022;117:144–51.

- 19 Kopetsch T, Steffen L. *Ambulante notfallbehandlung in Der gesetzlichen krankensversicherung – eine empirische analyse outpatient emergency treatment in statutory health insurance-an empirical analysis*. German: ZfWP, 2020: 203–31.
- 20 Krefis AC, Fischerei J, Hoffmann P, et al. Temporal analysis of determinants for respiratory emergency department visits in a large German Hospital. *BMJ Open Respir Res* 2018;5:e000338.
- 21 Graf von Stillfried D, Czihal T, Meer A. Sachstandsbericht: strukturierte medizinische erstinschätzung in deutschland (smed). *Notfall Rettungsmed* 2019;22:578–88.
- 22 Herrmann T, Willms G. Erfahrungen bei Der implementierung eines großprojektes Im innovationsfonds. In: Engehausen R, Scholz S, eds. *Innovationsfonds – Transfer in die Regelversorgung. [Innovation fund – transfer into standard care]*. Heidelberg, 2021: 115–32.
- 23 Schäfer I, Menzel A, Herrmann T, et al. Patient satisfaction with computer-assisted structured initial assessment facilitating patient streaming to emergency departments and primary care practices: results from a cross-sectional observational study accompanying the demand intervention in Germany. *BMC Prim Care* 2022;23:213:213..
- 24 Meer A, Gwerder T, Duembgen L, et al. Is computer-assisted telephone triage safe? A prospective surveillance study in walk-in patients with non-life-threatening medical conditions. *Emerg Med J* 2012;29:124–8.
- 25 WONCA International Classification Committee. *ICPC-2-R: International Classification of Primary Care*. Oxford, 2005.
- 26 Schaufelberger M, Meer A, Furger PP, et al. Expertenkonsens-consensus d'e'perts-alarmsymptome Der medizin-symptomes d'alarm' en medecine. *Neuhausen Am Rheinflall* 2013.
- 27 Brauns H, Steinmann S. Educational reform in France, west-germany and the United Kingdom: updating the CASMIN educational classification. *ZUMA-Nachrichten* 1999;44:7–44.
- 28 Löwe B, Kroenke K, Gräfe K. Detecting and monitoring depression with a two-item questionnaire (PHQ-2). *J Psychosom Res* 2005;58:163–71.
- 29 Sørensen K, Pelikan JM, Röthlin F, et al. Health literacy in Europe: comparative results of the European health literacy survey (HLS-EU). *Eur J Public Health* 2015;25:1053–8.
- 30 Jordan S, Hoebel J. Health literacy of adults in Germany: findings from the German health update (GEDA) study. *Bundesgesundheitsbl Gesundheitsforsch Gesundheitsschutz* 2015;58:942–50.
- 31 Blank L, Coster J, O'Cathain A, et al. The appropriateness of, and compliance with, telephone triage decisions: a systematic review and narrative synthesis. *J Adv Nurs* 2012;68:2610–21.
- 32 Purc-Stephenson RJ, Thrasher C. Patient compliance with telephone triage recommendations: a meta-analytic review. *Patient Educ Couns* 2012;87:135–42.
- 33 Gibson A, Randall D, Tran DT, et al. Emergency department attendance after telephone triage: a population-based data linkage study. *Health Serv Res* 2018;53:1137–62.
- 34 Nakubulwa MA, Greenfield G, Pizzo E, et al. To what extent do callers follow the advice given by a non-emergency medical helpline (NHS 111): a retrospective cohort study. *PLoS One* 2022;17:e0267052.
- 35 De Coster C, Quan H, Eford R, et al. Follow-through after calling a nurse telephone advice line: a population-based study. *Fam Pract* 2010;27:271–8.
- 36 Huibers L, Koetsenruijter J, Grol R, et al. Follow-Up after telephone consultations at out-of-hours primary care. *J Am Board Fam Med* 2013;26:373–9.
- 37 Njeru JW, Damodaran S, North F, et al. Telephone triage utilization among patients with limited English proficiency. *BMC Health Serv Res* 2017;17:706:706..
- 38 Tran DT, Gibson A, Randall D, et al. Compliance with telephone triage advice among adults aged 45 years and older: an Australian data linkage study. *BMC Health Serv Res* 2017;17:512.
- 39 Homburg I, Morreel S, Verhoeven V, et al. Non-Compliance with a nurse's advice to visit the primary care provider: an exploratory secondary analysis of the TRIAGE-trial. *BMC Health Serv Res* 2022;22:463.
- 40 Lake R, Georgiou A, Li J, et al. The quality, safety and governance of telephone triage and advice services – an overview of evidence from systematic reviews. *BMC Health Serv Res* 2017;17:614.
- 41 Sexton V, Dale J, Atherton H. An evaluation of service user experience, clinical outcomes and service use associated with urgent care services that utilise telephone-based digital triage: a systematic review protocol. *Syst Rev* 2021;10:25.
- 42 Rehman SA, Ali PA. A review of factors affecting patient satisfaction with nurse led triage in emergency departments. *Int Emerg Nurs* 2016;29:38–44.
- 43 Krishel S, Baraff LJ. Effect of emergency department information on patient satisfaction. *Ann Emerg Med* 1993;22:568–72.
- 44 McCarthy ML, Ding R, Zeger SL, et al. A randomized controlled trial of the effect of service delivery information on patient satisfaction in an emergency department fast track. *Acad Emerg Med* 2011;18:674–85.
- 45 Dinh MM, Enright N, Walker A, et al. Determinants of patient satisfaction in an Australian emergency department fast-track setting. *Emerg Med J* 2013;30:824–7.
- 46 Yildirim C, Kocoglu H, Goksu S, et al. Patient satisfaction in a university hospital emergency department in turkey. *Acta Medica (Hradec Kralove)* 2005;48:59–62.
- 47 Boudreaux ED, O'Hea EL. Patient satisfaction in the emergency department: a review of the literature and implications for practice. *J Emerg Med* 2004;26:13–26.
- 48 Carrasqueiro S, Oliveira M, Encarnação P. Evaluation of telephone triage and advice services: a systematic review on methods, metrics and results. *Stud Health Technol Inform* 2011;169:407–11.
- 49 Leibowitz R, Day S, Dunt D. A systematic review of the effect of different models of after-hours primary medical care services on clinical outcome, medical workload, and patient and GP satisfaction. *Fam Pract* 2003;20:311–7.
- 50 Tucker JL. The moderators of patient satisfaction. *J Manag Med* 2002;16:48–66.
- 51 Thiedke CC. What do we really know about patient satisfaction? *Fam Pract Manag* 2007;14:33–6.
- 52 Parchman ML, Noël PH, Lee S. Primary care attributes, health care system hassles, and chronic illness. *Med Care* 2005;43:1123–9.
- 53 Walling AD, Woolley DC, Molgaard C, et al. Patient satisfaction with migraine management by family physicians. *J Am Board Fam Pract* 2005;18:563–6.
- 54 Redekop WK, Koopmanschap MA, Stolk RP, et al. Health-Related quality of life and treatment satisfaction in Dutch patients with type 2 diabetes. *Diabetes Care* 2002;25:458–63.
- 55 MacLeod S, Musich S, Gulyas S, et al. The impact of inadequate health literacy on patient satisfaction, healthcare utilization, and expenditures among older adults. *Geriatr Nurs* 2017;38:S0197-4572(16)30298-1:334-41..
- 56 Yim CK, Shumate L, Barnett SH, et al. Health literacy assessment and patient satisfaction in surgical practice. *Annals of Medicine and Surgery* 2018;35:25–8.
- 57 Shea JA, Guerra CE, Ravenell KL, et al. Health literacy weakly but consistently predicts primary care patient dissatisfaction. *Int J Qual Health Care* 2007;19:45–9.
- 58 Williams RJ, Tse T, Harlan WR, et al. Registration of observational studies: is it time? *CMAJ* 2010;182:1638–42.
- 59 Piedmont S, Reinhold AK, Bock JO, et al. Apart from the medical complaints, why do patients use emergency medical services? results of a patient survey. *Gesundheitswesen* 2022;84:638–46.
- 60 Brüchert T, Hasselder P, Quentin P, et al. Walking for transport among older adults: a cross-sectional study on the role of the built environment in less densely populated areas in northern Germany. *Int J Environ Res Public Health* 2020;17:9479.
- 61 Abrahamsen R, Svendsen MV, Henneberger PK, et al. Non-Response in a cross-sectional study of respiratory health in Norway. *BMJ Open* 2016;6:e009912.
- 62 Cheung KL, Ten Klooster PM, Smit C, et al. The impact of non-response bias due to sampling in public health studies: a comparison of voluntary versus mandatory recruitment in a Dutch national survey on adolescent health. *BMC Public Health* 2017;17:276.
- 63 Simonetti JA, Clinton WL, Taylor L, et al. The impact of survey nonresponse on estimates of healthcare employee burnout. *Healthc (Amst)* 2020;8:100451.