EFFECTIVENESS AND IMPROVEMENT OPPORTUNITIES OF THE 'URGENT' GERIATRIC EMERGENCY CARE MODEL

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“Keep exploring. Keep dreaming. Keep asking why. Don’t settle for what you already know. Never stop believing in the power of your ideas, your imagination, your hard work to change the world.”

Barack Obama

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Pieter

Leuven, 25 oktober 2021.

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CHAPTER 1

General introduction

BACKGROUND

Emergency departments in a global perspective

A large proportion of the world population counts on emergency departments (EDs) to answer their urgent and acute care needs. Although reasons for ED presentation can vary substantially, these can be categorized into three different groups.[1] The first group are persons requiring emergency care. These are seriously ill or injured patients and patients referred because of a suspected medical emergency. These patients are considered the main patient group of emergency medicine that is focused on providing timely assessment, investigation and management of patients with emergency conditions.[2] The second group are persons in need of unscheduled urgent care. This includes, on the one hand, patients who cannot receive appropriate care in the ambulatory care system (e.g. capacity problems) and, on the other hand, persons who would like to receive immediate care for various reasons (e.g. professional obligations, informal caregiver duties). The third group are persons using the ED as safety net, because all other elements of the healthcare system are, or are perceived to be, deficient.[2] However, while the care needs of ED patients are very similar on an international level, important differences can be observed when comparing the responses to these care needs across different countries.

The main reason for national differences in ED-based care can be explained by the non-simultaneous rise and spread of emergency medicine over the world.[3] To improve the comparability of EDs and harmonize the quality and safety in emergency medicine, the International Federation of Emergency Medicine (IFEM) developed a framework for this purpose. This document defined an ED as: "*The area of a medical facility devoted to provision of an organized system of emergency medical care that is staffed by Emergency Medicine Specialist Physicians and/or Emergency Physicians and has the basic resources to resuscitate, diagnose and treat patients with medical emergencies. The ED is a unique location at which patients can access emergency care, ideally 24 hours a day, 365 days a year. The ED can manage different types of medical emergencies (illness, injury and mental health) in all age groups*."[2,3]

In countries where emergency medicine is well established (e.g. United Kingdom, United States of America, Canada, Australia), it is obvious that this is a dynamic and rapidly evolving discipline, seeking solutions for challenges.[2,4]

Undoubtedly, due to increasing use of ED care and changes in patient profiles (i.e. more severely ill, more comorbidities), the biggest challenge for emergency medicine has become ED crowding.[5,6] This is the circumstance where the amount of patients occupying the ED is beyond the capacity for which the ED is designed and resourced.[1] Tackling ED crowding is a high-ranked priority as it is associated with many unfavourable effects, such as higher patient mortality, increased waiting times (e.g. time to diagnosis and treatment), higher numbers of adverse events (e.g. medication errors, medical errors), lower patient satisfaction and higher costs.[5-7] Moreover, among ED staff, it has also shown to increase stress, which can promote burn out rates.[5-8] Interventions to minimize and prevent ED crowding are mainly based on optimizing the fit of the three interdependent main components in ED logistics, which are "input", "throughput" and "output" (Figure 1). [1,5,6]

Other important initiatives aiming to optimize ED care and outcomes have mainly focused on special populations (e.g. paediatric EDs, level I trauma centres) and specific conditions (e.g. stroke centres and chest pain centres).[4] Mechanisms used to facilitate these care adaptations are very diverse and may depend on local and/or regional choices. For example, EDs or hospitals can be certified or accredited by professional organisations, external organisations or even regional administrators (e.g. chest pain centres can be certified by the American College of Cardiology[9]; stroke centres can be accredited by The Joint Commission[10]; trauma centres are often designated as part of a regionalized system[11]). In addition, regarding some specialisations, individual caregivers can receive required certification after completing a fellowship or training (e.g. certification of paediatric emergency medicine[12]). These initiatives and the way these were operationalised are considered important examples for clinicians and policy makers who need to tackle new challenges for ED-based care.

EDs in Belgium

In Belgium, the definition of an ED is determined by legislation, namely by two Royal Decrees of 27 April 1998 setting the standards of a function "first aid for emergency cases" and a function "specialised emergency care". This implies that the legislator has provided a framework for a tiered emergency care system. However, in practice this has never been operationalised.[13,14] Almost all Belgian hospitals have installed EDs meeting the specialised emergency care standards. But, from an international perspective, these specialised EDs rather fulfil the role of a basic emergency service.[14] For example, specialised

FIGURE 1. The Input – Throughput – Output Model of ED crowding

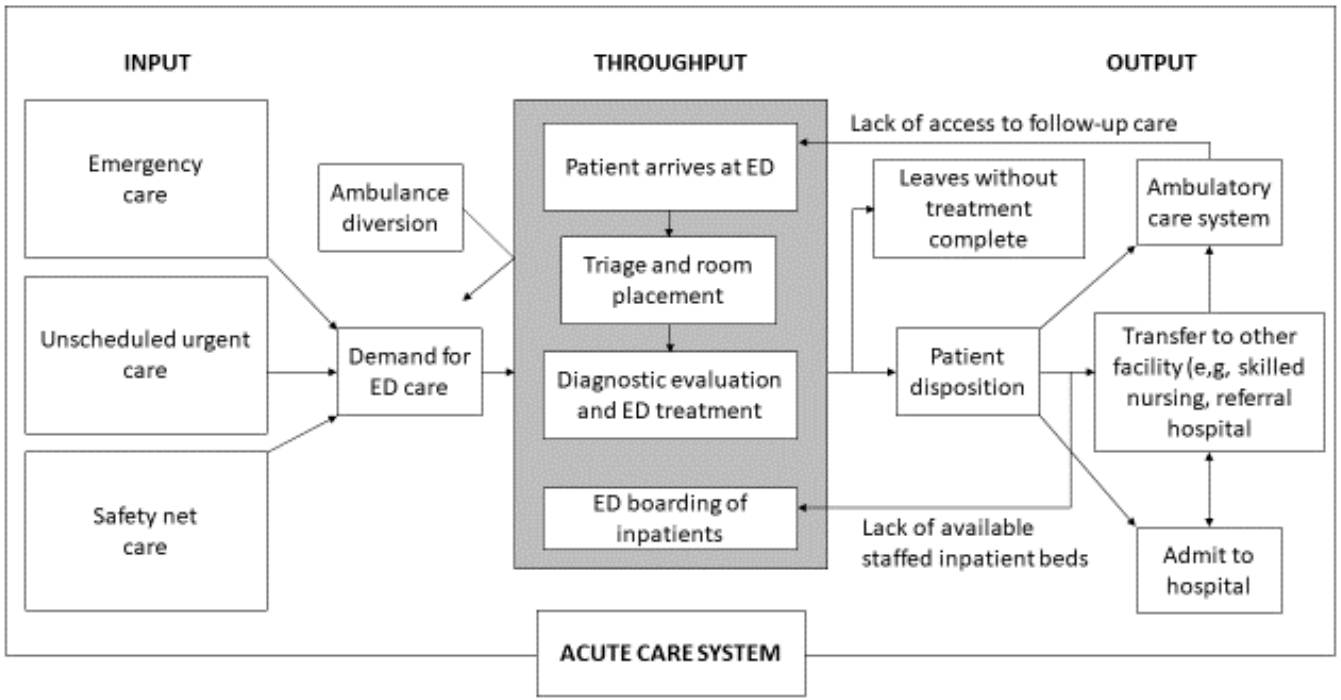


Figure reproduced from Asplin et al.[1] with permission of Elsevier.

EDs in Belgium are characterised by the requirement of having at least one fully equipped shock room and four observation beds (of which at least one is for monitoring a patient in a critical state of illness). Furthermore, these EDs should also be permanently staffed by specialised emergency physicians and specialised emergency nurses who must at all times be able to call on specialists from certain disciplines, such as radiology, internal medicine, surgery, orthopaedics, etc.

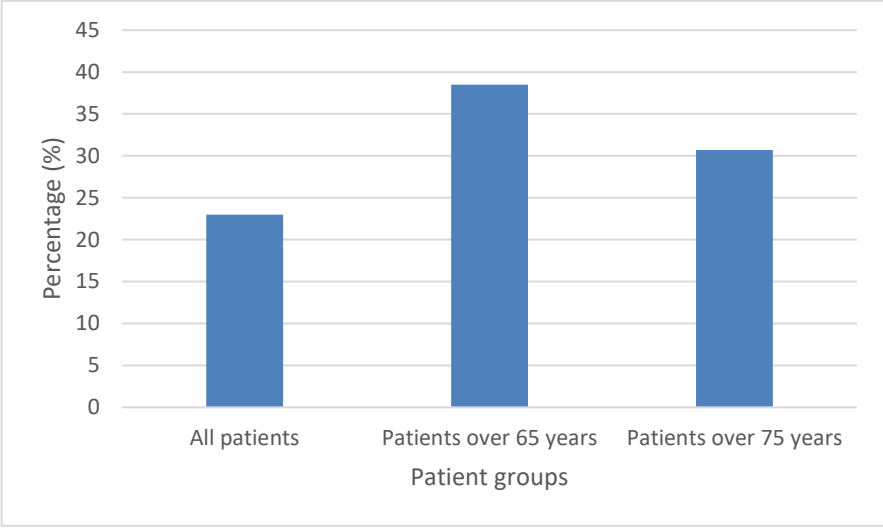
The basic legislation that sets the standards for Belgian EDs describes a generic model. This means that the same approach is envisaged for all patients, regardless of their age and reason for presenting. Although this principle of equality seems noble, as soon as this model of care was installed, the awareness grew that different delineated groups need a separate approach to achieve optimal care and outcomes. As a result, we see, for example, that in Belgium additional standards were set for the emergency care of children (Royal Decree of 2 April 2014 setting the standards for the paediatric care programme) and that hospitals (including their EDs) are obtaining accreditation by leading organisations to demonstrate excellence in their efforts for specific patients (e.g. polytrauma, stroke). In addition, through federally funded pilot projects, several Belgian EDs are also specialised in the care of persons with psychiatric emergencies.[15] This was necessary due to increasing (re-)admission rates among this sub-population as a result of de-institutionalisation in psychiatric care. These examples make clear that the ED landscape in Belgium is rapidly evolving and responsive to challenges in order to guarantee optimal care and outcomes.

EDs are challenged by older adults

ED patients do not only become more numerous and complex, they are also ageing.[2,5,16] This phenomenon is observed worldwide and is especially present in countries with an ageing population. Overall, older patients (i.e. persons aged 65 years or over) account for 12-24% of ED admissions.[17]

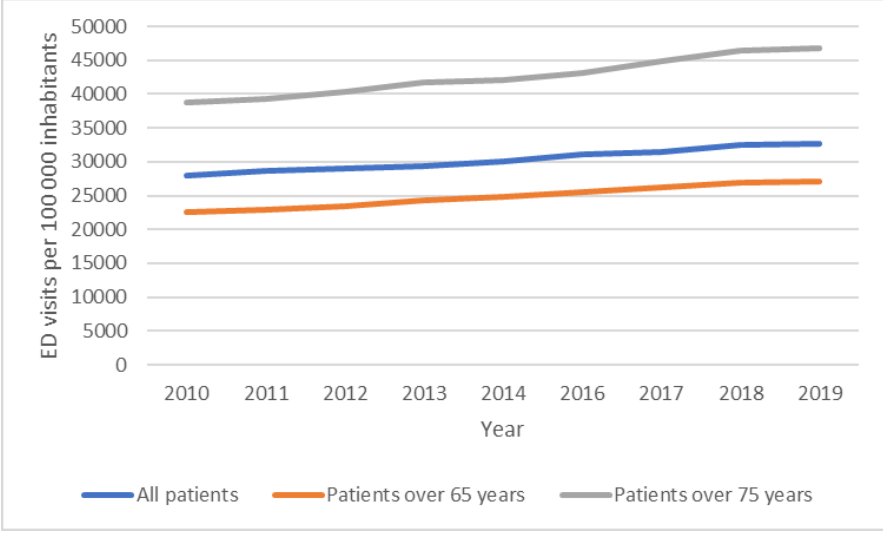
Although demographic forecasts state that the peak of ageing in the Belgian population will be reached around the year 2040 and thus does not have substantial impact yet[18], historical data of admissions to Belgian EDs already illustrate this phenomenon. The total number of admissions to Belgian EDs increased by 23% between 2010 and 2019 (from 3,038,909 to 3,737,898 ED

FIGURE 2. Relative growth of ED visits in Belgium per patient group between 2010 and 2019*



*Absolute numbers and data source are available in table 1.

FIGURE 3. Incidence of ED visits per 100 000 inhabitants per year in Belgium*



*Absolute numbers and data sources are available in table 2.

TABLE 1. Incidence of ED visits in Belgium per year*

	2010	2011	2012	2013	2014	2016	2017	2018	2019
All Patients	3038909	3143675	3196130	3260548	3360375	3506832	3563607	3688850	3737898
Patients over 65 years	563637	581195	604563	634002	655427	697560	728918	760840	780417
Patients over 75 years	364414	375853	390941	408287	418707	435404	451343	467414	476390

* Data from the MZG database, dated 05 07 2021; Data and Policy Information Service, Federal Public Service Health, Food Chain Safety and Environment, Belgium. (Data of the year 2015 are not available due to a transition from the ICD-9-CM classification system to the ICD-10-BE classification system.)

TABLE 2. Incidence of ED visits per 100 000 inhabitants per year in Belgium*

	2010	2011	2012	2013	2014	2016	2017	2018	2019
All patients	28034	28706	28961	29375	30136	31122	31475	32426	32698
Patients over 65 years	22618	22942	23498	24284	24747	25497	26206	26906	27140
Patients over 75 years	38737	39376	40340	41643	42135	43058	44810	46352	46783

* Data from the MZG database, dated 05 07 2021; Data and Policy Information Service, Federal Public Service Health, Food Chain Safety and Environment, Belgium in combination with data from Federaal Planbureau; FOD Economie – Statbel, Bevolking van België en leeftijd – Mannen en vrouwen, 1992-2020 : waarnemingen, Statbel; 2021-2071 : vooruitzichten, FPB en Statbel. (Data of the year 2015 are not available due to a transition from the ICD-9-CM classification system to the ICD-10-BE classification system.

admissions), while over the same period of time the relative growth in the number of ED patients over 65 and over 75 years old was 38.5% and 30.7%, respectively (see Figure 2 and Table 1). When adjusting the incidences of ED admissions for population growth, data show that these are highest and fastest growing in patients 75 years or older (see Figure 3 and Table 2). More specifically, the incidence of ED admissions among this group per 100,000 inhabitants per year increased from 38737 in 2010 to 46783 in 2019, which is an increase of 20.8%. This differs substantially from the incidence of ED admissions per 100 000 inhabitants per year of the total ED population which was 28034 in 2010 and 32698 in 2019 (i.e. an increase of 16.6%). In addition, it is also noteworthy that the ED subgroup of over-65 grew by 20% during this period. These data suggest that the ageing of population might substantially increase the number of admissions to Belgian EDs. This additional "input" may be problematic in a system that is already struggling with crowding.[1]

The challenge of older patients in an ED is not only in their increasing numbers, but especially in their profile and care needs. EDs are conceived on a fast-paced complaint-oriented model, in which patients with one clear complaint are envisaged. On the other hand, older adults often present with multiple or non-specific complaints.[17,19,20] As these are often induced by altered homeostasis due to interactions between normal aging, comorbidities and polypharmacy, older adults frequently have multiple diagnoses.[17,19,20] These include not only acute, new conditions (e.g. atrial fibrillation), but also deteriorations of chronic conditions (e.g. increased kidney failure) and acute events in chronic conditions, such as therapy-induced problems or functional disorders (e.g. unintentional self-intoxication, inappropriate prescribing, decreased mobility due to oedema).[21] In addition, older adults frequently suffer from pre-existing functional impairments and slowly progressing or acute cognitive decline, as well. It is obvious that the diagnostic process among older ED patients can be complicated and does not align with the fast-paced, single complaint-oriented model on which EDs are based.[17,19,20] Therefore, older adults tend to stay longer in EDs and require more diagnostic tests, staff time and resources.[22-24] Thus, from a logistic point of view, having several complex older patients admitted to an ED at the same time, might unbalance the "throughput" of this ED.[1]

The mismatch between the traditional, complaint-oriented model of EDs and the profile of older adults results in poor outcomes for this subgroup of the ED population. In comparison to younger counterparts, older adults are among other at increased risk for undertriage, incorrect diagnosis, inappropriate

treatment, mortality, functional decline, unnecessary admission and unplanned readmission.[17,22,24-27] However, this is not only the result of an inappropriate care model. Emergency physicians and nurses are often inadequately trained in geriatric care, resulting in poor recognition and management of geriatric syndromes.[28] For example, delirium remains undetected in 43%-76% of cases and crucial data for the work-up of a patient presenting after a fall (e.g. such as fall history and circumstances) are seldom part of history taking.[17,27] This leads to incomplete disposition plans (e.g. undetected health and social needs) with missed opportunities to optimize community care. What is also very different in older ED patients compared to younger adults is the need to consider informal caregivers.[29] They can provide important information and are often the driving force in facilitating discharge to the place of origin (e.g. providing transport or walking aids for home use). Consequently, failure to consider informal caregivers can lead to unintended but preventable difficulties, such as delayed discharge or "output" problems.[1]

The preceding sections make clear that EDs struggle to deliver appropriate care to older adults, which is in conflict with the IFEM definition of an ED, stating that these should be able to manage emergencies in all age groups.[2] However, apart from being detrimental to older patients, this also seems a threat for the input, throughput and output of EDs, which is linked to ED crowding and unfavourable effects.[1,5,6] To tackle these problems and risks, the time has come to start considering older adults as a special subgroup of the ED population.[19,30,31] This implies that their approach in the ED should be redesigned, as it has been done for other special groups (e.g. children, trauma patients).[4] Bypassing the ED or transferring older patients as quickly as possible to an inpatient bed, where there is more time for extended assessment, seems not appropriate in this respect, because it may trigger other problems. Firstly, it would not be ethical to hospitalise patients unnecessarily, because this would entail important risks (e.g. infections, functional decline, delirium) and is expensive for society.[32,33] Secondly, low-threshold inpatient bed allocation among this growing group could lead to capacity problems in inpatient beds, which is detrimental for ED output and crowding, as well. In other words, the ED must maintain its role as gatekeeper for access to inpatient beds and refine it to the profile of older patients.[34,35] This is especially pertinent in areas with declining inpatient bed capacity and limited out-of-hours availability of general practitioners.[34]

Geriatric emergency care

At the start of this doctoral research, two important documents were available for clinicians and policy makers who wanted to optimise care trajectories for older patients during ED stay. These were the 'Silver Book' and the 'Multidisciplinary Geriatric Emergency Department Guidelines', which were of British and American origin, respectively.[30,31] Besides structural (e.g. equipment and accommodation), procedural (e.g. screening processes) and staffing recommendations, these documents also focus on optimizing transitions of care. For example, by setting up structural collaborations with general practitioners and community care organisations. In essence, these documents provide support for adapting the complaint-oriented approach in EDs into a patient-oriented approach according the principles of comprehensive geriatric assessment or CGA. CGA is considered the cornerstone of modern geriatric care. It has been defined as *"a multidimensional, interdisciplinary diagnostic process focusing on determining a vulnerable older person's medical, functional, cognitive and social capabilities in order to develop a coordinated and integrated plan for treatment and long term follow up"*.[36] While this approach has particularly shown beneficial in patients admitted to acute geriatric wards, its impact on older ED patients is considered promising, as well.[37] For example, several studies have reported that embedding CGA in the ED improved outcomes, such as lower hospitalisation rates, decreased ED readmission numbers and better post-discharge functionality.[38-41] However, the effects of ED-based CGA remain inconsistent.[38] Therefore, to strengthen the evidence base of geriatric emergency care, further research is necessary to define what care models, procedures, equipment and accommodation standards are necessary to guarantee optimal geriatric emergency care.

CGA-based ED care in University Hospitals Leuven

University Hospitals Leuven is one of the seven university hospitals in Belgium, counting 1995 beds. Its ED is organized as a unit with an admission section (i.e. triage, first aid, diagnosis and treatment (27 cubicles)) and an observation unit with monitoring and intensive care beds (n=30 in total). The total admission rate of this ED increased from 54192 in 2010 to 65246 in 2019, an increase of 20.4%. During this period, the proportion of patients aged over 65 and over 75 increased from 26.2% to 28.4% and from 15.6% to 16.6%, respectively. These data show that the ED population of University Hospitals Leuven is both increasing and ageing, similar to international trends.

As an observational study on the ED of University Hospitals Leuven in 2012 reported high unplanned readmission rates among older patients discharged home (i.e. 29.2% at 3 months after ED discharge), the idea grew of setting up a CGA-based care model on this ED.[42] The Medical Research Council's guidance for developing and evaluating complex interventions guided this endeavour, which was named URGENT (i.e. Unplanned Readmission prevention by Geriatric Emergency Network for Transitional care).[43,44] The URGENT care model incorporated international recommendations and experiences of previous research on geriatric care models with adaptations to the specific context.[30,31,38,42,45-48] These adaptations were based on four elements, which were described extensively in the doctoral dissertation of Els Devriendt.[49] First, a literature review was used to overview key elements of effective CGA-based interventions in the ED.[38] Second, a survey was performed to map geriatric care initiatives in Belgian EDs.[45] Third, in-depth interviews, focus groups and usual care observations helped gaining insights in the experiences and expectations of older patients, informal caregivers and ED staff regarding ED-based geriatric care. Fourth, data of two observational studies in the ED of University Hospitals Leuven were scrutinized to drive decision making on diverse aspects, such as sample size and the strategy to identify patients who might benefit from the intervention.[42,50,51] The end point of Els Devriendt's doctoral thesis overlaps with the starting point of the present doctoral thesis which is the effectiveness of the URGENT care model.[49]

RATIONALE FOR THE DISSERTATION

Challenges in clinical care and gaps in the body of evidence inspired the rationale of this doctoral dissertation.

- The traditional fast-paced, complaint-oriented ED approach cannot adequately manage emergencies in the growing older population.

- ED crowding is a concern for clinicians and policymakers, as it is associated to multiple unfavourable outcomes. One might expect that vulnerable subgroups, such as older patients, are more susceptible to this. On top of that, it is also possible that the growing group of older patients will intensify this crowding problem.

- Although the clinical need for a geriatric approach in the ED is apparent and increasing, it remains unclear what care models, procedures, equipment and accommodation standards are necessary to optimize the geriatric emergency care.

- URGENT is a newly developed care model for older patients in the ED at University Hospitals Leuven. To explore the scaling possibilities of this care model, it is important to document its effectiveness and identify improvement opportunities.

OBJECTIVES

This doctoral project focuses on how to adapt ED care to the needs of older patients and has two overall goals: 1) to document the effectiveness of the URGENT care model and 2) to gain insights in its improvement opportunities. Five research aims (RA) emerge from the overall goals (see figure 4).

Overall goal 1: Effectiveness of the URGENT care model

RA1: To document the effectiveness of the URGENT care model in community-dwelling, older adults compared to usual care on the unplanned ED readmission rate, as primary outcome, with secondary outcomes being ED length of stay, hospitalization rate, in-hospital length of stay, higher level of care, functional decline and post-hospitalization mortality.

Overall goal 2: Improvement opportunities of the URGENT care model

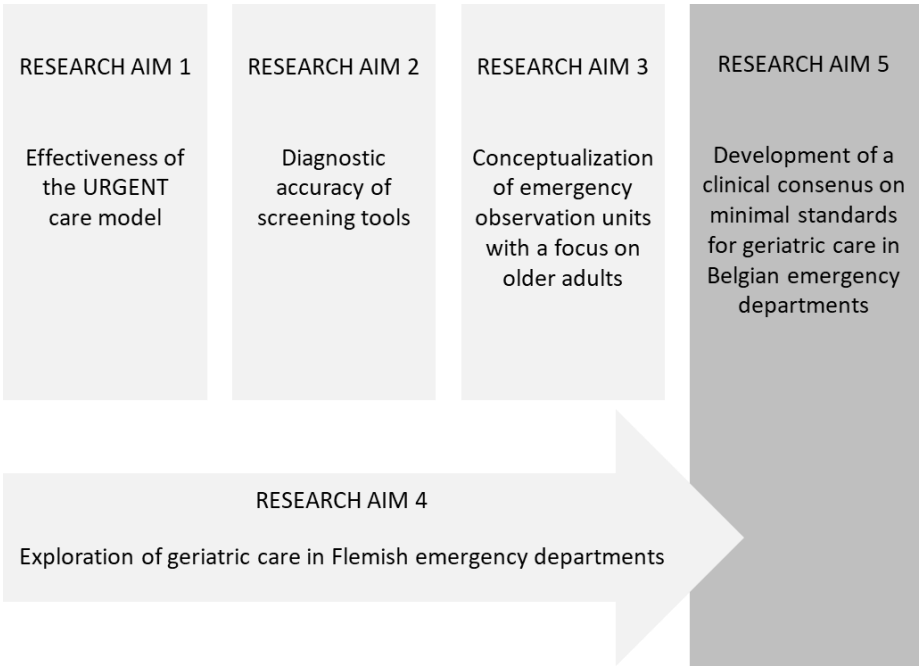
RA2: To report the diagnostic accuracy of the Identification of Seniors At Risk, the Flemish version of Triage Risk Screening Tool, and the interRAI Emergency Department Screener for predicting prolonged ED length of stay, hospitalisation (following index ED stay) and unplanned ED readmission at 30 and 90 days among older community-dwelling adults admitted to the ED.

RA3: To describe how emergency observation units with a focus on older adults are conceptualised in literature.

RA4: To explore how Flemish EDs operationalize geriatric care and identify improvement opportunities related to this topic.

RA5: To establish a clinical consensus on minimal operational standards for geriatric ED care in Belgium.

FIGURE 4. Research aims of the doctoral dissertation



OUTLINE OF THE THESIS

This doctoral dissertation comprises research articles, published in international, peer-reviewed journals and pre-published manuscripts. The next paragraphs present an overview of the different chapters in this dissertation.

The current chapter comprises the background, rationale, objectives and outline of this doctoral dissertation.

Chapter 2 describes the effectiveness of the URGENT care model, that was evaluated with a single-centre, quasi-experimental study (sequential design with two cohorts). This chapter has been published in BMC Geriatrics.

Chapter 3 entails a prospective observational study describing the diagnostic accuracies of geriatric screening tools (i.e. the Identification of Seniors At Risk, the Flemish version of Triage Risk Screening Tool, and the interRAI Emergency Department Screener). This chapter has been published in the Journal of the American Geriatrics Society.

Chapter 4 reports the findings of a scoping review aiming to map the structure and processes of emergency observation units with a geriatric focus and to explore to what extent the CGA-approach was implemented in these units. This chapter has been published in BMC Geriatrics.

Chapter 5 and chapter 6 are pre-published manuscripts reporting results of a survey to describe how Flemish EDs deliver care to older adults and identify improvement opportunities based on the Geriatric ED Accreditation Program of the American College of Emergency Physicians.[52] While chapter 5 focuses on staffing characteristics, chapter 6 concentrates on geriatric-appropriate protocols, equipment and physical environment criteria.

Chapter 7 present a pre-published manuscript of a consensus statement on minimum operational standards for geriatric emergency care in Belgium. This consensus was developed using modified Delphi methodology.

Chapter 8 contains a summary and general reflection on the main findings of this dissertation. In addition, this chapter also provides recommendations for clinical practice, suggestions for further research and a general conclusion.

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CHAPTER 2

Unplanned readmission prevention by a geriatric emergency network for transitional care (URGENT): a prospective before-after study

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Heeren P*, Devriendt E*, Fieuws S, Wellens NIH, Deschodt M, Flamaing J, Sabbe M, Milisen K. Unplanned Readmission prevention by a Geriatric Emergency Network for Transitional care – URGENT: a prospective before-after study. BMC Geriatrics. 2019;19:1-10. (* = equal contribution)

ABSTRACT

Background: URGENT is a comprehensive geriatric assessment (CGA) based nurse-led care model in the emergency department (ED) with geriatric follow-up after ED discharge aiming to prevent unplanned ED readmissions.
Methods: A quasi-experimental study (sequential design with two cohorts) was conducted in the ED of University Hospitals Leuven (Belgium). Dutch-speaking, community-dwelling ED patients aged 70 years or older were eligible for enrolment. Patients in the control cohort received usual care. Patient in the intervention cohort received the URGENT care model.
A geriatric emergency nurse conducted CGA and interdisciplinary care planning among older patients identified as at risk for adverse events (e.g. unplanned ED readmission, functional decline) with the interRAI ED Screener© and clinical judgement of ED staff. Case manager follow-up was offered to at risk patients without hospitalization after index ED visit. For inpatients, geriatric follow-up was guaranteed on an acute geriatric ward or by the inpatient geriatric consultation team on a non-geriatric ward if considered necessary.
Primary outcome was unplanned 90-day ED readmission. Secondary outcomes were ED length of stay (LOS), hospitalization rate, in-hospital LOS, 90-day higher level of care, 90-day functional decline and 90-day post-hospitalization mortality.
Results: Almost half of intervention patients (404/886=45.6%) were categorized at risk. These received on average seven advices. Adherence rate to advices on the ED, during hospitalization and in community care was 86.1%, 74.6% and 34.1%, respectively. One out of four at risk patients without hospitalization after index ED visit accepted case manager follow-up. Unplanned ED readmission occurred in 170 of 768 (22.1%) control patients and in 205 of 857 (23.9%) intervention patients (p=.11). The intervention group had shorter ED LOS (12.7 hours versus 19.1 hours in the control group; p<.001), but higher rate of hospitalization (70.0% versus 67.0% in the control group; p=.003)
Conclusions: The URGENT care model shortened ED LOS and increased the hospitalization rate, but did not prevent unplanned ED readmissions. A geriatric emergency nurse could improve in-hospital patient management, but failed to introduce substantial out-hospital case-management.

Trial registration: The protocol of this study was registered retrospectively with ISRCTN (ISRCTN91449949; registered 20 June 2017).

Keywords: Emergency department, Geriatric care model, Comprehensive geriatric assessment, Unplanned ED readmission, Nurse-led.

BACKGROUND

The growing group of older adults has become an important subset of emergency department (ED) patients with already 12-24% of ED admissions being persons aged 65 years or over.[1] This evolution results in increasing patient volumes in a system that is already burdened with crowding[2] and yields a qualitative challenge, as well, because older adults are characterized by vulnerability features, such as decreased physiological reserves, presence of geriatric syndromes (e.g. delirium), multimorbidity with polypharmacy and potential atypical disease presentation. In addition, other factors such as pre-existing functional impairment, cognitive decline and social issues hamper disposition planning. It is obvious that managing these patients in a fast-paced environment is challenging.[2,3] This is reflected in poorer outcomes regarding functional decline, hospitalization and return rates and death in older adults, compared with younger patients. [4] For example, up to one out of four older adults return to the ED within three months.[4,5]

To improve the outcomes of older ED patients, international guidelines recommend adapting the classic disease-oriented ED approach towards a comprehensive patient-oriented approach.[6,7] Implementing comprehensive geriatric assessment (CGA) in the ED is promoted in that respect. CGA has been defined "a multidimensional interdisciplinary diagnostic process focused on determining a frail older person's medical, psychosocial and functional capabilities in order to develop a coordinated and integrated plan for treatment and long-term follow-up".[8] Although this approach has been proven effective in acute geriatric wards,[9] its effectiveness in ED-based care models remains inconclusive due to inconsistent study results and several methodological issues, such as non-transparent reporting of intervention processes (e.g. fidelity to CGA-based advices).[10]

To stimulate continuity of care, transitional care models are promoted.[6,7] These combine ED-based CGA with structured follow-up after ED discharge. 'Unplanned Readmission prevention by Geriatric Emergency Network for Transitional care' (URGENT) is an example of such a transitional care model that was developed and implemented in the ED and region of University Hospitals Leuven in Belgium[11]. This manuscript reports the evaluation of the URGENT care model.

METHODOLOGY

For detailed information concerning the study setting, care model development and methods, the authors refer to the study protocol that was registered retrospectively with ISRCTN (ISCRCTN91449949).[11] As mentioned in the protocol paper, the aim of this study is to evaluate the effectiveness of the URGENT care model compared to usual care on the unplanned ED readmission rate, as primary outcome, and secondary outcomes (i.e. ED length of stay (LOS), hospitalization rate, in-hospital LOS, higher level of care, functional decline and post-hospitalization mortality) of community-dwelling, older adults.

Design

A single-center, quasi-experimental before-after study was conducted. This yielded a sequential design with two cohorts, comparing usual ED care in the control cohort (CC) to the URGENT care model in the intervention cohort (IC). Patients were recruited from December 1, 2014 to May 31, 2015 (CC) and from October 15, 2015 to May 31, 2016 (IC). Between these two cohorts, a 4-month period was used to pilot and implement the URGENT care model. Patient data collection was completed on August 31, 2016.

Participants

This study targeted Dutch-speaking, community-dwelling ED patients aged 70 years or older. Exclusion criteria were living in a residential care setting, being transferred to the ED from an inpatient ward or another hospital, having a medical condition that makes an interview impossible, being unable to give informed (proxy) consent or being admitted to the ED on Saturday.

Intervention

The URGENT care model was led by a dedicated geriatric emergency nurse that added four consecutive steps to usual ED care. First, older patients at risk for adverse events (i.e. unplanned ED readmission, long ED LOS, hospitalization, long in-hospital LOS, higher level of care, functional decline and post-hospitalization mortality) were identified with two methods; the interRAI ED screener©[12] (iEDS) and clinical judgement. Patients stratified with a high risk (iEDS score 5-6) were offered the subsequent steps of the intervention. Patients stratified with a low risk (iEDS score 1-4) were offered

the subsequent steps if someone of the ED staff estimated that the patient might benefit from it (i.e. clinical judgement). Second, the geriatric emergency nurse conducted CGA among patients identified at risk for adverse events. Third, a CGA-based interdisciplinary care plan was tailored to the patient's needs, capacity and preferences. Fourth, geriatric follow-up was provided if necessary. For inpatients, geriatric follow-up was guaranteed on an acute geriatric ward or by the inpatient geriatric consultation team on a non-geriatric ward if considered necessary.[13] For patients identified as at risk and without hospitalization after index ED visit; case manager follow-up by a community nurse or social worker was planned. Case management comprised free-of-charge assistance and support with the implementation of CGA-based advices after ED discharge. In addition, the geriatric emergency nurse was authorized to refer patients autonomously to the geriatric day clinic of University Hospitals Leuven for specialized in-depth assessment (e.g. falls, cognitive problems) and medical evaluation.

Outcome Measures

The primary outcome was 90-day unplanned ED readmission. Secondary outcomes were hospitalization rate, ED LOS, in-hospital LOS, higher level of care (i.e. a professionally organized living arrangement that differs from the patient's usual living place in the community), functional decline (i.e. an increase of 2 or more points on the total 6-item Katz activities of daily living (ADL) score[14]) and post-hospitalization mortality. All post-ED outcomes were measured 30 and 90 days after hospital discharge. Higher level of care was also measured at hospital discharge. Functional decline and higher level of care at 30 and 90 days after hospital discharge were only measured among patients without hospitalization after index ED visit.

Covariates

Following patient characteristics were registered at baseline with semi-structured interview and electronic patient file review: gender, age, living situation, triage priority level (Emergency Severity Index[15] (ESI)), first treating discipline on the ED, ED specific geriatric screening (iEDS[12]), ADL (6-item KATZ-scale[14]), fall history[12], pain perception[12], weight loss[12], caregiver burden[12], dependence in instrumental activities of daily living (IADL), polypharmacy, cognition (Mini-Cog[16], Confusion Assessment Method[17] (CAM)), screening for depression[18], comorbidity score (Cumulative Illness Rating Scale[19] (CIRS)) and previous ED visit and hospital stay during the 90 days before index ED visit.

Procedure

Study nurses recruited patients and collected baseline data of all CC patients and of IC patients at low risk for adverse events. In the IC, a geriatric emergency nurse scored the iEDS, discussed clinical judgement with ED staff (e.g. nurse, physician or social worker) and collected baseline data of patients at risk for adverse events. In both cohorts, study nurses performed outcome registration by review of the electronic patient file and by telephone calls. The latter were only performed among patients without hospitalization after index ED visit.

Statistical Analyses

Required sample size based on a two-sided test (with α =0.05 and at least 80% power) was 751 patients per cohort, making a total of 1502 patients. This calculation was based on the assumption of a 12-weeks unplanned ED readmission rate of 27% among hospitalized patients and 23% among non-hospitalized patients, a hospitalization rate of 70% and a 25% relative reduction of readmission rates. All analyses have been performed using SAS software, version 9.4 of the SAS System for Windows. P-values smaller than 0.05 were considered significant. Cause-specific hazard-ratios, relative risk ratios, odds ratios and ratios of geometric means comparing IC with CC were reported when appropriate. In all comparative analyses of outcome measures, propensity scores (applying inverse probability of treatment weighting) were used to handle the potential differences in patient mix between the cohorts.[20,21] Bonferroni-Holm correction was applied if relevant. For more details, we refer to our protocol paper.[11]

RESULTS

Study samples and patient characteristics

During the recruitment periods, 2900 individuals were screened for eligibility. Of these individuals, 1220 were excluded, resulting in a sample of 794 CC patients and a sample of 886 IC patients (figure 1).There were no deaths during the index ED visit. During hospitalization following index ED stay, 26 CC patients and 29 IC patients died. Inpatient deaths were excluded from outcome analyses, except for following: hospitalization rate, ED LOS and in-hospital LOS.

Table 1 describes the characteristics of the CC and IC patients. CC patients had more comorbidities (p<0.001), got more often a high risk geriatric screening score (p<0.001) and reported more frequent caregiver burden (p=0.02), unintended weight loss in the preadmission period (p<0.001) and increased depression risk (p=0.001). IC patients had more often difficulties in medication management (p=0.01), reported more frequent help for finances (p=0.02) and visited the ED more often in the 90-day preadmission period (p=0.03).

Patients labelled at risk in the intervention cohort

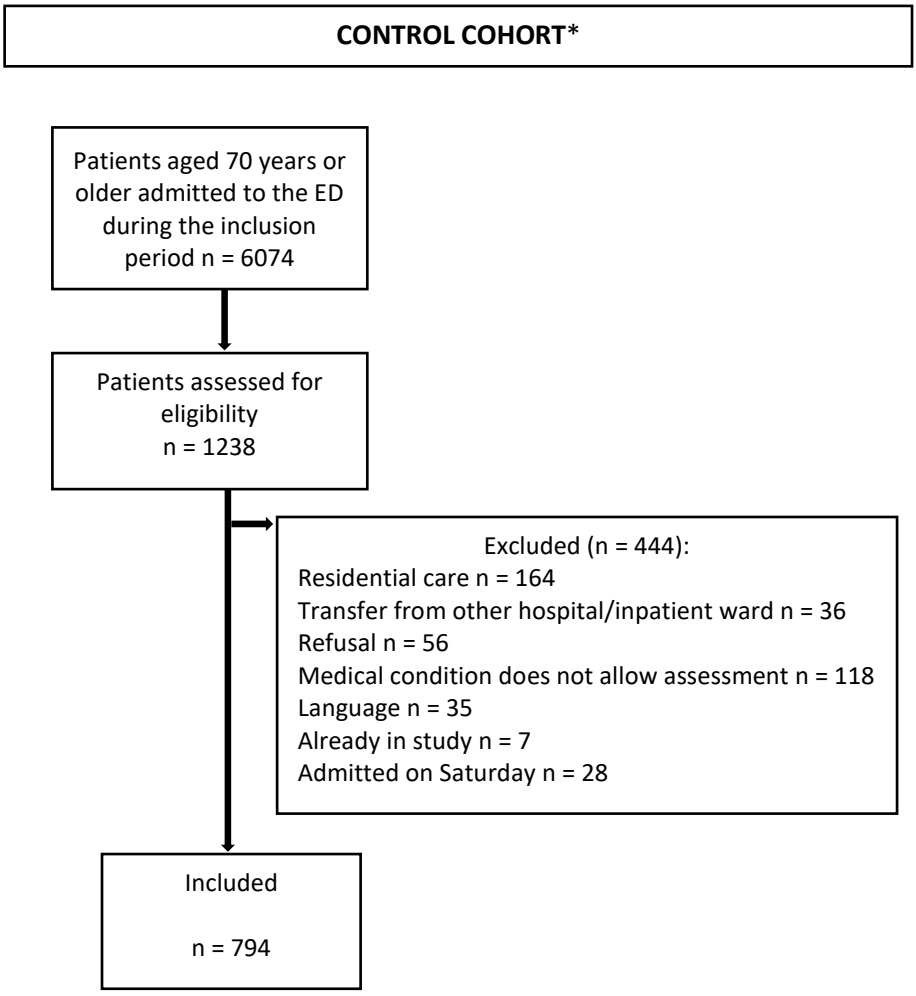
The iEDS and clinical judgement labelled 404 IC patients at risk (i.e. 45.6%) (figure 2). Two–fifth of these patients (39.1%) were hospitalized on a non-geriatric ward of which more than half (n=89/158; 56.3%) had follow-up by the inpatient geriatric consultation team. One out of four (n=109/404: 27.0%) at risk patients were not hospitalized after the index ED visit. Follow-up by the case manager or the geriatric day hospital was organized for 30 (27.5%) and 13 (11.9%) patients, respectively.

All at risk patients (n=404) had a report of the CGA-based interdisciplinary care plan in the electronic patient record. The geriatric emergency nurse formulated a total of 2772 advices and referrals for at risk patients. On average an at risk patient received seven advices and referrals. Overall, 72.1% of these advices and referrals were adopted completely. The number and adherence of advices and referrals varied from setting to setting: 810 advices and referrals with a complete follow-up of 86.1% concentrated on the index ED stay, 1560 advices and referrals with a complete follow-up of 74.6% focused on the hospitalization following index ED stay and 402 advices and referrals with complete follow-up of 34.1% targeted the post-discharge period. Adherence of post-discharge advices and referrals could not be checked in 23.4% (n=94/402). Table 2 describes the five most reported advices and referrals per setting.

Unplanned ED readmission (Table 3)

Incidences of unplanned ED readmission in the CC versus IC were 12.1% versus 13.1% at 30 days post-discharge (p=0.28) and 22.1% versus 23.9% at 90 days post-discharge (p=0.11), respectively. Median time to unplanned ED readmission within 90 days post-discharge was 25.1 days in the CC (minimum-maximum: 0.3-88.3 days) and 27.6 days in the IC (minimum-maximum: 0.2-88.0 days) (p=0.66).

FIGURE 1. Overview of the study samples



*Patients included in month 1-6;

**Patients included in month 11-18; ED = emergency department

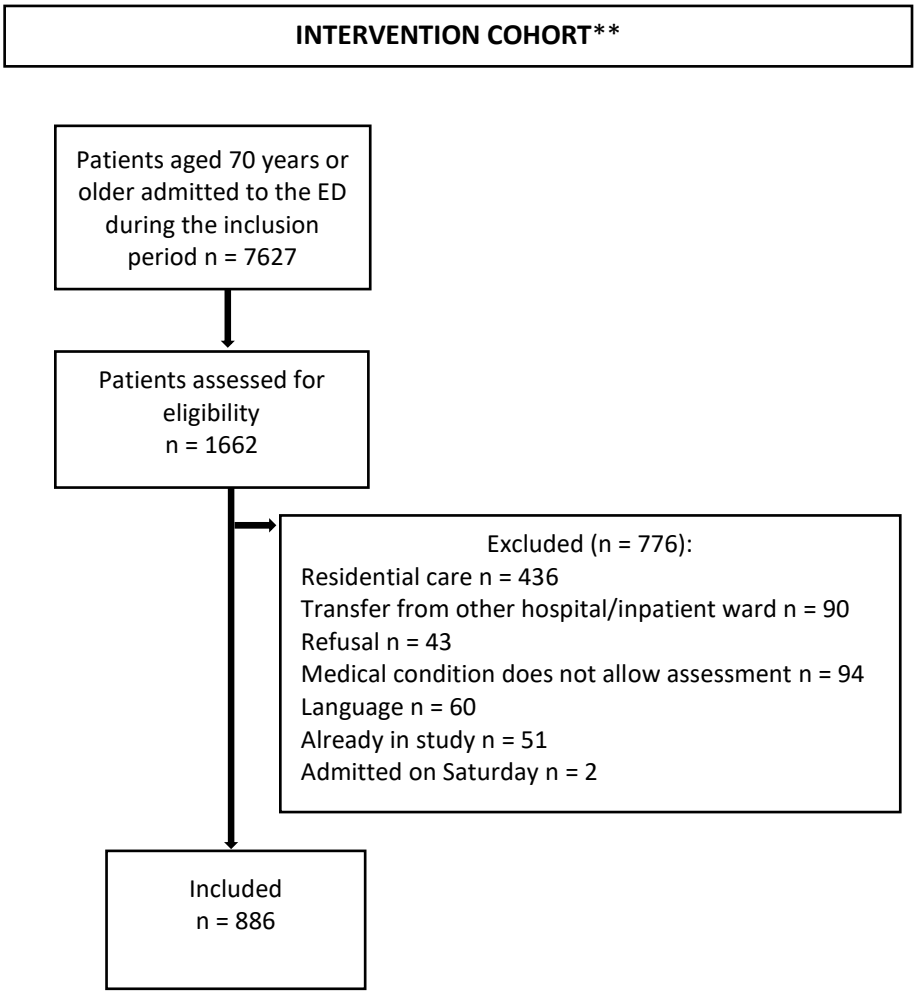

INTERVENTION COHORT**
Patients aged 70 years or older admitted to the ED during the inclusion period n = 7627
Patients assessed for eligibility n = 1662
Excluded (n = 776):
Residential care n = 436
Transfer from other hospital/inpatient ward n = 90
Refusal n = 43
Medical condition does not allow assessment n = 94
Language n = 60
Already in study n = 51
Admitted on Saturday n = 2
Included n = 886

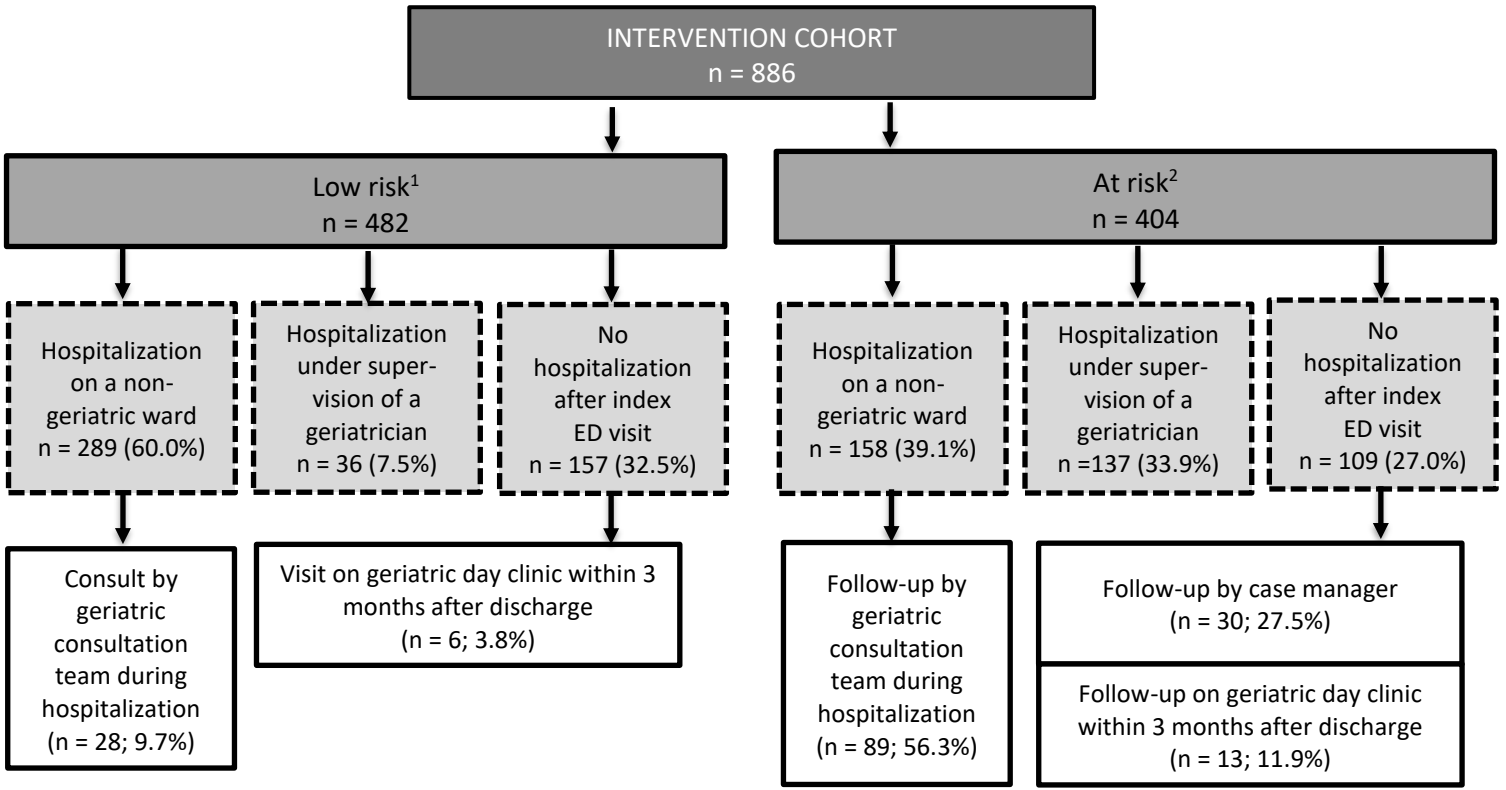
TABLE 1. Patient characteristics

Variable	All patients (n= 1680)	Control cohort (n=794)	Intervention cohort (n=886)	P-value
Age, Q2 (Q1-Q3)	80 (76.0-85.0)	80 (75.0-85.0)	81 (76.0-85.0)	0.46
Female, n (%)	905 (53.9)	436 (54.9)	469 (52.9)	0.42
Living alone, n (%)	610 (36.4)	303 (38.2)	307 (34.8)	0.15
Nursing care at home, n (%)	552 (33.0)	250 (31.6)	302 (34.3)	0.25
Home care, n (%)	246 (14.7)	120 (15.1)	126 (14.3)	0.64
Physiotherapy, n (%)	199 (11.9)	103 (13.0)	96 (10.9)	0.19
Meals on wheels, n (%)	195 (11.7)	92 (11.6)	103 (11.7)	0.95
Cleaning help, n (%)	745 (44.6)	355 (44.8)	390 (44.4)	0.87
Help for management of finances, n (%)	565 (33.8)	246 (31.0)	319 (36.3)	0.02*
Personal alarm system, n (%)	183 (11.0)	79 (10.0)	104 (11.8)	0.22
Caregiver burden, n (%)	206 (12.5)	114 (14.4)	92 (10.7)	0.02*
Premorbid ADL, Q2 (Q1-Q3)	7 (6.0-10.0)	7 (6.0-10.0)	7 (6.0-10.0)	0.06
Fall in last 90 days, n (%)	679 (40.7)	341 (43.2)	338 (38.5)	0.06
Pain, daily and severe, n (%)	247 (14.8)	110 (13.9)	137 (15.6)	0.33

Weight loss, n (%)	309 (18.6)	180 (22.8)	129 (14.8)	<.001*
Difficulty in medication management, n (%)	353 (21.2)	146 (18.4)	207 (23.6)	0.01*
Cognitive impairment, n (%)	706 (46.7)	355 (46.8)	351 (46.6)	0.93
Delirium, n (%)	66 (3.9)	28 (3.5)	38 (4.3)	0.42
Risk for depression, n (%)	273 (16.4)	175 (22.2)	98 (11.2)	.001*
Polypharmacy, n (%)	1201 (72.4)	565 (71.2)	636 (73.6)	0.26
Triage priority level (ESI), n (%)				0.26
°level 1 – 2	547 (37.2)	250 (35.7)	297 (38.6)	
°level 3 – 5	923 (62.8)	450 (64.3)	473 (61.4)	
Comorbidity, Q2 (Q1-Q3)	19 (15.0-24.0)	21 (16.0-26.0)	18 (14.0-23.0)	<.001*
Previous ED visit in last 90 days, n (%)	381 (23.0)	162 (20.6)	219 (25.1)	0.03*
Previous hospital stay in last 90 days, n (%)	394 (23.6)	180 (22.8)	214 (24.3)	0.49
First treating discipline on ED is surgical, n (%)	351 (20.9)	175 (22.0)	176 (19.9)	0.27
Geriatric screening (iEDS), n (%)				<.001*
°Score 1-4	1163 (69.3)	506 (63.9)	657 (74.2)	
°Score 5-6	515 (30.7)	286 (36.1)	229 (25.8)	

P-value: comparison of variable between control and intervention cohort, using Mann-Whitney U or Chi² tests.
*statistical significant with alpha = 0,05; ED = emergency department; ESI = Emergency Severity Index; ADL = Activities of Daily Living; Q2 = median; Q1-Q3 = interquartile range; iEDS = interRAI Emergency Department Screener.

FIGURE 2. Overview of the intervention cohort



[1]Low risk: InterRAI Emergency Department Screener score 1 – 4 AND clinical judgement not supportive of comprehensive geriatric assessment; [2]At risk: InterRAI Emergency Department Screener score 5 – 6 OR clinical judgement supportive of comprehensive geriatric assessment; ED = emergency department

Hospitalization and ED LOS (Table 3)
Patients in the IC were more frequently hospitalized compared to CC patients (70.0% versus 67.0%, respectively; p=0.003; significant after Bonferroni-Holm correction). The median ED LOS was 19.1 and 12.7 hours in the CC and IC, respectively (p<.001; significant after Bonferroni-Holm correction). Median length of inhospital stay was 8.7 days in the CC and 8.6 days in the IC (p=0.15).

Higher level of care, functional decline and post-hospitalization mortality (Table 3)
Incidence of higher level of care was comparable for both cohorts at all follow-up measurements: approximately 14% at hospital discharge and approximately 7% at both 30 and 90 days. No differences were demonstrated for functional decline between the IC and CC; 25.9% versus 21.7% at 30 days post-discharge (p=0.04; not significant after Bonferroni-Holm correction) and 26.6% versus 21.5% at 90 days post-discharge (p=0.02; not statistically significant result after Bonferroni-Holm correction). Ninety days after hospital discharge, 49 (6.4%) and 48 (5.6%) patients had died in the CC and IC, respectively (p=0.73)

DISCUSSION

The aim of this study was to evaluate the effectiveness of the URGENT care model that combined CGA-based, interdisciplinary care planning on the ED with geriatric follow-up after ED discharge. Although the current study did not confirm effects of a transitional ED care model on post-discharge outcomes -including the primary outcome; 90-day unplanned ED readmission rate-, IC patients had shorter ED LOS and a higher hospitalization rate.

Previous studies scrutinizing geriatric emergency interventions reported inconsistent effects on unplanned ED readmission rate. Although some were successful,[22-24] other reported no significant reduction in ED readmissions.[25-27] However, comparing existing studies was difficult, since methodological issues (e.g. overall poor study quality and heterogeneity in the targeted populations, intervention strategies and outcomes) limit the evidence base.[10] We hypothesize that the absence of effect on unplanned ED readmission rate

TABLE 2. Top five most reported advices and referrals per setting in at risk intervention patients (n=404)

Most reported advices and referrals during ED admission (n = 810 advices in 404 patients)	
1.	Advice feasibility of returning home (n = 252)
2.	Advice discharge destination (in-hospital or -out-of-hospital) if retuning home was not possible (n = 234)
3.	Advice pain management (n = 110)
4.	Advice referral to social worker on the ED (n = 73)
5.	Advice additional medical follow-up for treating physician on ED (e.g. blood test, technical intervention) (n = 69)
Most reported advices and referrals in case the patient is hospitalized (n = 1560 advices in 404 patients)	
1.	Advice functional evaluation during hospitalization (n = 342)
2. 3.	Advice referral to occupational therapist during hospitalization (n = 188)
4.	Advice referral to social worker during hospitalization (n = 195)
5.	Advice cognitive evaluation during hospitalization (n = 178)
6.	Advice referral to physiotherapist during hospitalization (n = 152)
Most reported post-discharge advices and referrals (n = 402 advices in 404 patients)	
1.	Advice for additional professional help at home (n = 161)
2.	Advice further cognitive evaluation by healthcare workers at home (n = 29)
3.	Advice ambulatory follow-up by other medical discipline after ED discharge (n = 25)
4.	Advice for (preventive) application for residential care stay (n = 25)
5.	Prescription of aid by physician (e.g. walking aid) (n = 24)

ED = emergency department

(and all other post-discharge outcomes) in the current study is mainly due to low patient acceptance of case management follow-up and low patient adherence to advices in community care. But, off course, many other factors (e.g. social status, cognitive impairment, severity of illness, access to alternative services, missed diagnosis,…) potentially contributed to unplanned readmissions.[28] Although these factors should be attributable to four common themes (i.e. patient, illness, system/organization and clinician),[28] previous studies' inconsistencies in readmission predictors and limited accuracy of readmission prediction models indicate that the odds of preventing unplanned readmissions in a reliable and efficient way might be small.[29,30] Nonetheless, preventing unplanned readmissions should stay a clinical and research objective, because of its importance on macro-, meso- and microlevels. In addition, particularly, early readmissions (i.e. up to 30 days after ED discharge) deserve special attention, as these can be an important determinant of adverse outcomes (e.g. functional decline and mortality).[29]

An important finding of the current study is the reduced ED LOS. Median ED LOS was 6.4 hours (-33.5%) shorter among IC patients, which is clinically relevant for the following two reasons. First, the ED is a hazardous environment for geriatric patients. Shorter ED LOS will prevent ED-stay related

adverse events (e.g. pressure ulcer, delirium, falls). Second, it might also improve patient flows through the ED and reduce crowding, which is a high-ranked priority within emergency medicine.[31] Until now, CGA-based interventions in the ED have rarely evaluated its effect on ED LOS.[26,32,33] This study shows that despite the CGA by the geriatric emergency nurse followed by interdisciplinary care planning during the ED visit, the total ED LOS was not prolonged as one might assume. On the contrary, it even was reduced substantially.

The increased hospitalization rate among IC patients is another finding that needs further explanation. Especially because this contrasts with previous studies reporting lower hospitalization rates or hospitalization avoidance as main result.[23,26,27,34] The increased hospitalization rate was interpreted as appropriate and necessary, since the assessment for URGENT patients was considered more comprehensive compared to usual care. Indeed, the decision to hospitalize was an interdisciplinary process in which the attending ED physician (and not the geriatric emergency nurse) had the final responsibility. Although comprehensive qualitative research methods were not part of the current study, the study notes that the involved care teams believe that

TABLE 3. Outcome variables of the URGENT project

Outcome	All patients	Intervention cohort	Control cohort
Unplanned ED readmission (at 30 days), N/D (%)	205/1625 (12.6%)	112/857 (13.1%)	93/768 (12.1%)
Unplanned ED readmission (at 90 days), N/D (%)	375/1625 (23.1%)	205/857 (23.9%)	170/768 (22.1%)
Time to unplanned ED readmission within 90 days, days, Me (Min-Max)	26.9 (0.2-88.3)	27.6 (0.2-88.0)	25.1 (0.3-88.3)
Hospitalization rate, N/D (%)	1152/1680 (68.6%)	620/886 (70.0%)	532/794 (67.0%)
Length of ED stay, hours, Me (Min - Max)	16.1 (1.3-110.3)	12.7 (1.4-61.2)	19.1 (1.3-110.3)
Length of inhospital stay, days, Me (Min-Max)	8.7 (0.3-77.5)	8.6 (0.6-76.1)	8.7 (0.3-77.5)
Higher level of care (at hospital discharge), N/D (%)	229/1625 (14.1%)	124/857 (14.5%)	105/768 (13.7%)
Higher level of care[£] (at 30 days), N/D (%)	37/500 (7.4%)	20/252 (7.9%)	17/248 (6.9%)
Higher level of care[£] (at 90 days), N/D (%)	36/489 (7.4%)	19/248 (7.7%)	17/241 (7.1%)
Functional decline[£] (at 30 days), N/D (%)	113/476 (23.7%)	61/236 (25.9%)	52/240 (21.7%)
Functional decline[£] (at 90 days), N/D (%)	115/479 (24.0%)	63/237 (26.6%)	52/242 (21.5%)
Post-hospitalization Mortality (at 90 days), N/D (%)	97/1625 (6.0%)	48/857 (5.6%)	49/768 (6.4%)

ED = emergency department; Me = median; Min = minimum; Max = maximum; N = Numerator; D = Denominator; *Statistical significant with alpha=.05[£]Data only available for patients without hospitalization after index ED visit.

Unweighted analysis		Weighted analysis¥	
Ratio	P-value	Ratio	P-value
1.10 (0.85;1.42)	0.49	1.15 (0.89;1.48)	0.28
1.08 (0.91;1.29)	0.38	1.16 (0.97;1.38)	0.11
0.98 (0.80;1.21)	0.88	0.96 (0.78;1.17)	0.66
1.15 (0.93;1.41)	0.19	1.37 (1.12;1.69)	0.003*
0.84 (0.79;0.89)	<.001*	0.89 (0.84;0.95)	<.001*
0.97 (0.86;1.09)	0.60	0.92 (0.81;1.03)	0.15
1.03 (0.81;1.30)	0.82	1.05 (0.83;1.33)	0.69
1.16 (0.62;2.16)	0.65	1.28 (0.70;2.34)	0.42
1.09 (0.58;2.04)	0.80	1.42 (0.78;2.58)	0.26
1.19 (0.86;1.65)	0.29	1.39 (1.01;1.92)	0.04*
1.30 (0.91;1.86)	0.15	1.51 (1.06; 2.14)	0.02*
0.85 (0.56;1.28)	0.44	1.07 (0.71;1.62)	0.73

¥Weighted analysis: result of comparison after application of inverse probability of treatment weighting.

(and all other post-discharge outcomes) in the current study is mainly due to low patient acceptance of case management follow-up and low patient adherence to advices in community care. But, off course, many other factors (e.g. social status, cognitive impairment, severity of illness, access to alternative services, missed diagnosis,…) potentially contributed to unplanned readmissions.[28] Although these factors should be attributable to four common themes (i.e. patient, illness, system/organization and clinician),[28] previous studies' inconsistencies in readmission predictors and limited accuracy of readmission prediction models indicate that the odds of preventing unplanned readmissions in a reliable and efficient way might be small.[29,30] Nonetheless, preventing unplanned readmissions should stay a clinical and research objective, because of its importance on macro-, meso- and microlevels. In addition, particularly, early readmissions (i.e. up to 30 days after ED discharge) deserve special attention, as these can be an important determinant of adverse outcomes (e.g. functional decline and mortality).[29]

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hospitalization avoidance was achieved in several patients as well. The hypothesis that arose from this impression is that the intervention had most likely an impact on the decision-making process of the ED team when carefully balancing the arguments for hospitalization against its alternatives. Unfortunately there were insufficient data available to explore the context and appropriateness of disposition decisions.

Essential to highlight is the need for detailed care process registration in the evaluation of a complex intervention, such as the URGENT care model. Process registration did not only describe how clinical practice was changed. It also explained why intervention effects were present or not. More specifically, the high adherence rate to advices and referrals formulated by the geriatric emergency nurse to be delivered during ED stay (i.e. 86%) explains why outcomes with a direct link to the ED stay (i.e. ED LOS and hospitalization rate) changed significantly, while the opposite occurred in the post-discharge setting (i.e. no impact on post-discharge outcomes due to low patient acceptance of case manager follow-up and low patient adherence to advices in community care (i.e. 34%)). However, despite the process registration in the current study, some results remain difficult to explain. For example, IC patients without hospitalization after index ED visit experienced more functional decline at 30 and 90 days post-discharge. A possible explanation for this result might be the differences in baseline characteristics between the cohorts despite the use of a propensity model.

This study had other limitations which need to be discussed. First, accuracy of the risk stratification component within the intervention was disputable, since the iEDS was a relatively new instrument at the moment of the study, warranting further validation. Its advantage in comparison to classic screening tools was that it allows to target predefined patient strata. Second, selection bias cannot be excluded, since not all patients were included consecutively due to the unpredictable patient flow which is typical for the ED department. In addition, it was difficult to obtain written informed consent among patients with severe cognitive problems. For example, delirium incidence was 3.5% and 4.3% among CC patients and IC patients, respectively, while other ED-based studies reported delirium incidence of approximately 10%.[35,36] Third, the ED of University Hospitals Leuven moved during the timeframe between both inclusion periods to a new infrastructure. Although the care principles and organization model remained unchanged, this might have influenced the results. Fourth, not every unplanned ED readmission was preventable, while it is obvious that a geriatric care model such as URGENT targets preventable

events. However, these could not be documented, because there is no consensus on what is preventable.[37-41] Five, it was not possible to conduct subgroup analysis of patients considered at risk for adverse events, since clinical judgement could not be measured in CC patients. Six, future studies can strengthen the evidence base by focusing more on implementation outcomes[42] (e.g. acceptability, fidelity, penetration, costs) and patient/provider reported outcomes (e.g. patient, family and ED staff satisfaction). Seven, as the URGENT care model provided a variety of interventions for two patient groups (i.e. admitted and discharged patients), dilution of intervention effect cannot be excluded. However, subgroup analyses of intervention effect among admitted and discharged patients did not differ from main analyses (data not shown).

The URGENT care model is most transferable to EDs with embedded observation unit or settings that also have the possibility of providing a period of time (i.e. generally up to 24 hours or longer) to complete diagnostic tests and initial therapeutic interventions (e.g. assessment units or short-stay units in countries with limited (e.g. 4 hours) ED LOS).[43,44]

CONCLUSIONS

The nurse-led URGENT care model for community-dwelling older patients that comprised CGA-based interdisciplinary care planning on the ED with geriatric follow-up after ED discharge did not reduce unplanned ED readmission rate at 30 or 90 days post-discharge. The most important clinically relevant finding is a substantial decrease of the ED LOS. In addition, the hospitalization rate increased, as well. Although this study implicates that geriatric emergency care models have the potential to improve ED management of older patients, their wide-scale implementation cannot be fully endorsed due to inconsistency of study results. Further research should explore these variations thoroughly.

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CHAPTER 3

Old and new geriatric screening tools in a Belgian emergency department: a diagnostic accuracy study

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ABSTRACT

Objectives: To compare the diagnostic accuracy of the Identification of Seniors At Risk (ISAR), the Flemish version of Triage Risk Screening Tool (fTRST), and the interRAI Emergency Department Screener© (iEDS) for predicting prolonged emergency department (ED) length of stay (LOS), hospitalization (following index ED stay) and unplanned ED readmission at 30 and 90 days among older (≥ 70 years) community-dwelling adults admitted to the ED.
Design: Single-center, prospective observation study.
Setting: ED with embedded observation unit in University Hospitals Leuven (Belgium).
Participants: A total of 794 patients (median age = 80 years; 55% female) were included.
Measurements: Study nurses collected data using semi-structured interviews and patient record review during ED admission. Outcome data were collected with patient record review.
Results: Hospitalization (following index ED stay) and unplanned ED readmission at 30 and 90 days occurred in 67% (527/787) of patients and in 12.2% (93/761) and 22.1% (168/761) of patients, respectively. For all outcomes at cut-off 2, the three screening tools had moderate to high sensitivity (range = 0.71-0.90) combined with (very) low specificity (range = 0.14-0.32) and low accuracy (range = 0.21-0.67). At all cut-offs, likelihood ratios and interval likelihood ratios had no or small impact (range = 0.46-3.95; zero was not included) on the posttest probability of the outcomes. For all outcomes, area under the receiver operating characteristics curve varied in the range of 0.49 to 0.62.
Conclusion: Diagnostic characteristics of all screening tools were comparable. None of the tools accurately predicted the outcomes as a stand-alone index. Future studies should explore the clinical effectiveness and implementation aspects of ED-specific minimum geriatric assessment and intervention strategies.

Keywords: Acute care, Emergency department, Geriatric screening.

BACKGROUND

Adverse outcomes, such as unplanned readmission, functional decline or death, occur in one out of three older adults (aged ≥ 65 years) discharged after emergency department (ED) care.[1] To improve these outcomes, EDs all over the world are adapting care processes to the needs of the growing older population.[2-4] Yet, not all older adults are at increased risk for adverse events and ED caregivers are already dealing with time-constraints and ED crowding.[1,5] Accurate identification and prioritization of high-risk subsets is therefore needed to ensure efficient ED care.[6]

In the last two decades, numerous manuscripts reported the diagnostic accuracy of screening tools for older adults in the ED.[1,6-8] The classic architecture of these tools comprises a fixed short-list of selected risk factors (e.g. living alone, functional impairment, polypharmacy) for an adverse outcome with every risk factor having a predefined weight. Usually, the cumulative score of the different risk factors and a fixed cut-off dichotomizing the risk are used to identify high-risk subsets. The most widely studied tools with this architecture are 'Identification of Seniors At Risk' (ISAR)[9] and 'Triage Risk Screening Tool' (TRST)[10], which were validated for several adverse outcomes, such as (unplanned) ED readmission, functional decline and hospital readmission.[1,7] However, although these quick and easily administered 'multi-purpose' tools appear very relevant for clinical practice, their diagnostic accuracy is limited.[1,7,8]

The interRAI ED Screener© (iEDS)[11] is a relatively recent screening tool that needs validation. It is considered a 'new' generation tool due to its particular architecture. Instead of accumulating subscores of present risk factors, the iEDS uses a decision tree diagram to risk-stratify patients in six groups indicating the need for (comprehensive) geriatric assessment. This risk-stratification approach yields the benefit that patients with identical risk scores are more homogeneous (in comparison to patients with identical risk scores in 'old' generation tools). This might allow hospital managers and policy makers the ability for more targeted allocation of limited resources, taking into account the local context (e.g. choices according to frequency distribution of risk scores, available resources, skill mix and/or strategic targeting of patients at most risk versus patients with medium risk for adverse events). Also the iEDS is embedded in a suite of standardised assessments that share a

common language for multiple populations in diverse care settings which aims to guarantee continuity of information across the care continuum, within the hospital trajectory and across care settings (https://www.interrai.org/).

As no studies have been published so far comparing the diagnostic accuracy of 'old' and 'new' screening tools, the aim of this study is to describe the diagnostic accuracy of the ISAR, the Flemish version of TRST (fTRST) and the iEDS for predicting four outcomes (i.e. prolonged ED length of stay (LOS), hospitalization following index ED stay and unplanned ED readmission at 30 and 90 days among older adults admitted to the ED.

METHODOLOGY

We conducted a secondary analysis of a prospectively included cohort (December 2014 – May 2015), that represented 'usual ED care' in a monocentric, quasi-experimental study, 'Unplanned Readmission prevention by Geriatric Emergency Network for Transitional care' (URGENT).[12,13] The Medical Ethics Committee of University Hospitals Leuven approved this project (B322201422910). This study was reported using the Standards for Reporting of Diagnostic Accuracy checklist (STARD).[14]

Setting and participants

The study was conducted in the ED of University Hospitals Leuven in Belgium. This is an academic hospital with 1995 beds. Its ED is organized as a unit with an admission section including triage, first aid, diagnosis and treatment (12 cubicles) and an observation unit including 30 beds for monitoring and critical care.

Dutch-speaking participants aged 70 year or older who lived in the community were invited for study participation. Exclusion criteria were living in a residential care setting, being transferred to the ED from an inpatient ward or another hospital, having a medical condition that makes an interview impossible, being unable to give informed (proxy) consent or being admitted to the ED on Saturday.

Baseline data

Data on age, sex, living situation, assistance for instrumental activities of daily living (i.e. nursing care, home care, physiotherapy, meals on wheels, cleaning help, help for finances, help for medication intake and use of personal alarm system), caregiver burden and recent ED stay and recent hospital stay were collected. 'Recent' was defined as in the last 90 days prior to ED admission.[11]

The following clinical data were collected: premorbid activities of daily living (ADL) (KATZ index)[15], fall in the last 90 days[11], daily and severe pain in the last three days prior to ED admission[11], weight loss (5% or more in the last 30 days or 10% or more in the last 180 days)[11], cognitive impairment (Mini-Cog)[16,17], delirium (Confusion Assessment Method)[18,19], risk stratification for depression[20], polypharmacy (five or more drugs daily)[10,21], triage priority level (Emergency Severity Index (ESI))[22] and comorbidity (Modified Cumulative Ilness Rating Scale (CIRS))[23].

Screening tools

Supplementary figure S1 and S2 provide an overview of all items in the screening tools that were used in the current study.

The ISAR is a six-item tool developed to determine older adults' risk of future adverse outcomes including mortality, functional decline, institutionalization and ED readmission.[7,9] It contains dichotomous (i.e. yes/no) questions regarding functional impairment (premorbid and acute change), recent hospitalization, diminished memory, decreased vision, and recent hospitalization. The ISAR score varies from zero to six. Patients with at least two risk factors present are considered at risk (i.e. ISAR score of two or more) for adverse outcomes.

The TRST is developed to determine older adults' risk of future adverse outcomes including hospitalization, institutionalization and ED readmission.[8,10] In the current study, the Flemish version of TRST (fTRST) was used.[24,25] This is a five-item tool containing dichotomous (i.e yes/no) questions regarding presence of cognitive impairment; difficulty in walking/transferring or having experienced a fall incident in past six months; living alone with no available caregiver; polypharmacy (i.e. five or more medications daily) and hospitalization in the past three months. The fTRST score varies from zero to six. Patients with cognitive impairment and patients with at least two risk factors present are considered at risk (i.e. fTRST score of two or more) for adverse outcomes.

The iEDS is a ten-item decision tree diagram that quantifies an older adult's urgency for geriatric assessment and case-management.[11] Originally, the iEDS was developed to identify community-dwelling older adults' risk of prolonged length of stay, hospitalization, readmission and discharge to a higher level of care. It comprises items regarding activities of daily living (i.e. bathing, personal hygiene, dressing lower body, locomotion); cognitive skills for daily decision-making; mood symptoms (e.g. sad, depressed, feelings of hopelessness); presence of overwhelmed feelings among family members; self-rated health; unstable health conditions and dyspnea. The iEDS score varies from one (i.e. least urgent need for geriatric assessment or referral) to six (i.e. most urgent need for for geriatric assessment or referral). The shortest and longest algorithm pathway comprise two and eight questions, respectively. The iEDS is publicly available as a free-of-charge smartphone or tablet application (app) for Android and iOS with versions in multiple languages. Although the app contains sufficient information for accurate use of the instrument, a manual can be purchased for training and clinical implementation. Implementation into electronic medical records needs to first obtain clearance from interRAI. interRAI licenses its assessment systems without royalties to governments and care providers, but royalties apply to software vendors that use its intellectual property.

Outcomes

Prolonged ED length of stay (LOS), hospitalization (following index ED stay) and unplanned ED readmission at 30 and 90 days were the outcome variables of the current study. Prolonged ED LOS was defined as an ED stay corresponding to the 90th percentile or longer.[26] Unplanned ED readmission was defined as a subsequent or repeat ED visit that followed the index ED visit or hospitalization, and could not have been foreseen at the time of discharge.[12]

Procedures

Study nurses conducted recruitment and data collection on weekdays between 9:00 AM and 5:30 PM. Eligibility was checked by reviewing the electronic patient record and by discussion with ED caregivers. Informed consent was obtained from all participants or proxies. Baseline data were collected using semi-structured interview (e.g. fall in the last 90 days) and patient record review (e.g. polypharmacy). Two study nurses independently scored comorbidity data. Inconsistent comorbidity scores were discussed and arbitrated with an emergency medicine physician. Outcome data were collected with patient record review. None of the data collection procedures was formally blinded.

Analysis

SPSS® 20.0 was used to calculate absolute and relative frequencies, means, standard deviations, medians (Q2), interquartile ranges (Q1-Q3) and the 90th percentile of ED LOS, as appropriate. Excel® Software was used to calculate sensitivity, specificity, negative predictive value (NPV), positive predictive value (PPV), positive likelihood ratio (PLR), negative likelihood ratio (NLR), accuracy and interval likelihood ratio (ILR).[27] Clinimetric scores were categorized as low (≤0.69), moderate (0.70-0.89) and high (≥0.90). The impact of high LRs (i.e. >1) on the posttest probability of the outcome was categorized: no change (i.e. 1), small (2-5), moderate (5-10), large (>10).[28] The impact of low LRs (i.e. >1) on the posttest probability of the outcome was categorized: no change (i.e. 1), small (0.2-0.5), moderate (0.1-0.2), large (<0.1).[28] Receiver operating characteristics (ROC) curves were constructed with SPSS®.

RESULTS

Study Sample and patient characteristics (figure 1 and table 1)

Figure one gives an overview of the patient selection process. The number of patients assessed for eligibility was 1238. Of this group, 794 were included in the study. Median age of participants was 80 years old and 55% of them were female. A fall in the last 90 days (43.2%) and cognitive impairment (46.8%) were registered in almost half of patients. Polypharmacy was present in seven out of ten patients (71.2%). Seven participants were omitted from clinimetric analyses because at least one of the screening tool scores was missing. Zero and twenty-six patients died during ED stay and hospitalization, respectively. Patients who died during the index hospitalization were excluded from clinimetric analysis focusing on 30-day and 90-day unplanned readmission.

Prediction of prolonged ED LOS (table 2, table 3, supplementary table S1 and supplementary figure S3)

ED LOS varied between 1.3 and 110.3 hours with a median stay of 19.2 hours. The 90th percentile was calculated at 30.7 hours. At cut-off two (i.e. a screening tool score of two or more and the original cut-off of fTRST and ISAR) all screening tools had moderate sensitivity (ISAR: 0.88; fTRST: 0.82; iEDS: 0.85) combined with very low specificity (ISAR: 0.14; fTRST: 0.28; iEDS: 0.25) and very low accuracy (ISAR: 0.21; fTRST: 0.33; iEDS: 0.31). NPV was high (≥0.90)

for all tools at all cut-offs. At all cut-offs, LRs had no or small impact on the posttest probability of the outcome. LRs with small impact were reported for PLR of ISAR and fTRST at cut-off six. These LRs were 2.73 and 2.60, respectively. Area under the ROC curve (AUC) was low (ISAR: 0.55; fTRST: 0.57; iEDS: 0.56) for all tools.

FIGURE 1. Selection of older community-dwelling adults in a large, Belgian emergency department (Presented data were also published elsewhere.[13])

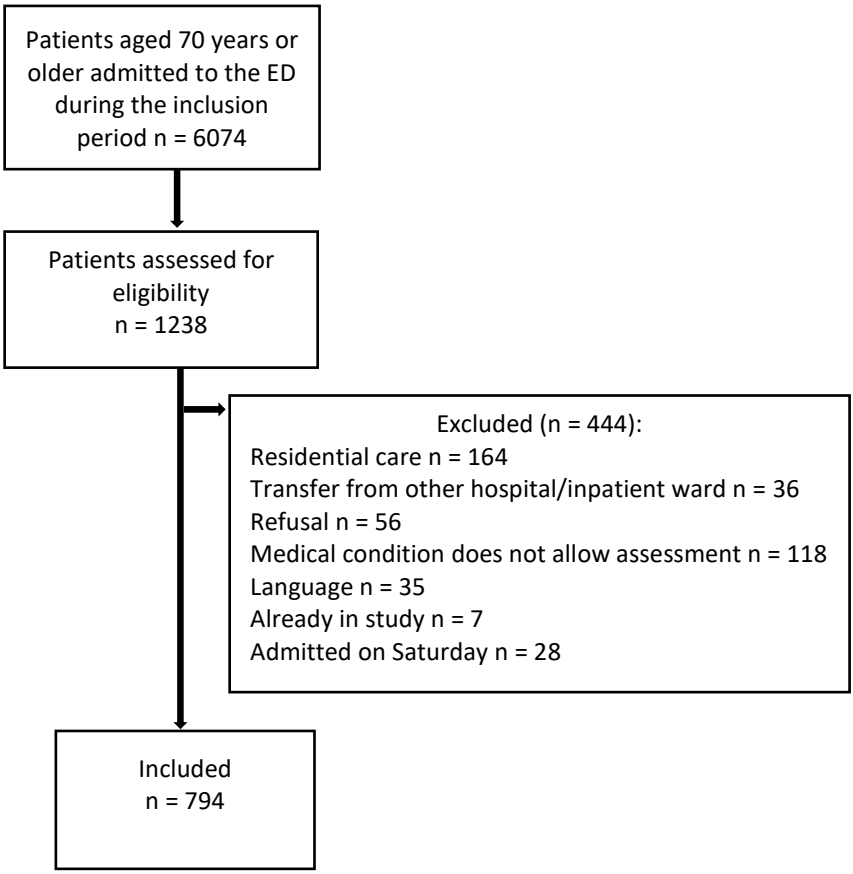


TABLE 1. Characteristics of older community dwelling adults assessed in a large, Belgian emergency department*

Variable	Missing	URGENT usual care cohort (n=794)
Age, Q2 (Q1-Q3)	0	80 (75.0-85.0)
Female, n (%)	0	436 (54.9)
Living alone, n (%)	1	303 (38.2)
Nursing care at home, n (%)	3	250 (31.6)
Home care, n (%)	1	120 (15.1)
Physiotherapy, n (%)	1	103 (13.0)
Meals on wheels, n (%)	1	92 (11.6)
Cleaning help, n (%)	1	355 (44.8)
Help for management of finances, n (%)	1	246 (31.0)
Personal alarm system, n (%)	1	79 (10.0)
Caregiver burden, n (%)	4	114 (14.4)
Premorbid ADL, Q2 (Q1-Q3)	14	7 (6.0-10.0)
Fall in last 90 days, n (%)	4	341 (43.2)
Pain, daily and severe, n (%)	3	110 (13.9)
Weight loss (>5% past 6 months), n (%)	3	180 (22.8)
Difficulty in medication management, n (%)	2	146 (18.4)
Cognitive impairment, n (%)	36(1)	355 (46.8)
Delirium, n (%)	2	28 (3.5)
Risk for depression, n (%)	7	175 (22.2)
Polypharmacy, n (%)	0	565 (71.2)
Triage acuity, n (%)	94	
°level 1 – 2 (high acuity)		250 (35.7)
°level 3 – 5 (lower acuity)		450 (64.3)
Comorbidity, Q2 (Q1-Q3)	0	21 (16.0-26.0)
Previous ED visit < 90 days, n (%)	8	162 (20.6)
Previous hospital stay < 90 days, n (%)	5	180 (22.8)

*Presented data were also published elsewhere[13]; (1)missing (n=17), refusal (n=1) or unable to complete test (n=18); ADL = activities of daily living; URGENT = Unplanned Readmission prevention by Geriatric Emergency Network for Transitional care; Q2 = median; Q1-Q3 = interquartile range

Prediction of Hospitalization (table 2, table 3, supplementary table S1 and supplementary figure S4)

The majority of patients (527/787; 67%) was hospitalized following ED care. At cut-off two all screening tools had moderate or high sensitivity (ISAR: 0.90; fTRST: 0.76; iEDS: 0.80) combined with (very) low specificity (ISAR: 0.22; fTRST: 0.32; iEDS: 0.32) and low accuracy (ISAR: 0.67; fTRST: 0.61; iEDS: 0.65). PPV was moderate (0.71-1.00) for all tools at cut-off three or higher. At all cut-offs, all LRs had no or small impact on the posttest probability of the outcome. High LRs with small impact were reported for PLR of ISAR at cut-off five, PLR of fTRST at cut-off six and ILR_{5-6} of ISAR. These LRs varied between 2.22 and 3.95. Low LRs with small impact were reported for NLR of ISAR at cut-off one and two, NLR of fTRST at cut-off one and ILR_{0-1} of ISAR. These LRs varied between 0.46 and 0.49. AUC was low (ISAR: 0.62; fTRST: 0.56; iEDS: 0.60) for all tools.

Prediction of 30-day unplanned ED readmission (table 2, table 3, figure 2 and supplementary table S1)

Incidence of 30 day unplanned ED readmission was 12.2% (93/761). At cut-off two all screening tools had moderate sensitivity (ISAR: 0.84; fTRST: 0.71; iEDS: 0.84) combined with (very) low specificity (ISAR: 0.14; fTRST: 0.27; iEDS: 0.26) and (very) low accuracy (ISAR: 0.22; fTRST: 0.32; iEDS: 0.33). NPV was moderate to high (0.83-0.92) for all tools at all cut-offs. At all cut-offs, LRs had no impact on the posttest probability of the outcome. AUC was low (ISAR: 0.49; fTRST: 0.49; iEDS: 0.51) for all tools.

Prediction of 90-day unplanned ED readmission (table 2, table 3, figure 2 and supplementary table S1)

Incidence of 90-day unplanned ED readmission was 22.1% (168/761). At cut-off two all screening tools had moderate sensitivity (ISAR: 0.86; fTRST: 0.75; iEDS: 0.82) combined with (very) low specificity (ISAR: 0.14; fTRST: 0.27; iEDS: 0.26) and (very) low accuracy (ISAR: 0.30; fTRST: 0.38; iEDS: 0.39). NPV was moderate (0.78-0.84) for all tools at all cut-offs. At all cut-offs, LRs had no impact on the posttest probability of the outcome. AUC was low (ISAR: 0.52; fTRST: 0.53; iEDS: 0.53) for all tools.

TABLE 2. Accuracy of ISAR, fTRST and iEDS for predicting long emergency department length of stay, hospitalization, and unplanned readmission at 30 and 90 days

PROLONGED ED LOS															
	ISAR					**fTRST**					**iEDS**				
Cut-	SEN	SPE	PLR	NLR	ACC	SEN	SPE	PLR	NLR	ACC	SEN	SPE	PLR	NLR	ACC
≥1	1.00	0.03	1.03	0	0.12	0.94	0.08	1.02	0.77	0.17	/	/	/	/	/
≥2	0.88	0.14	1.03	0.83	0.21	0.82	0.28	1.13	0.65	0.33	0.85	0.25	1.12	0.62	0.31
≥3	0.67	0.38	1.07	0.89	0.41	0.55	0.57	1.29	0.78	0.57	0.81	0.29	1.15	0.65	0.35
≥4	0.40	0.69	1.26	0.88	0.66	0.32	0.76	1.35	0.89	0.72	0.55	0.53	1.17	0.85	0.53
≥5	0.18	0.88	1.50	0.93	0.81	0.10	0.91	1.09	0.99	0.83	0.42	0.65	1.20	0.89	0.62
=6	0.04	0.99	2.73	0.98	0.89	0.03	0.99	2.60	0.98	0.89	0.24	0.78	1.13	0.96	0.73
HOSPITALIZATION															
	ISAR					**fTRST**					**iEDS**				
Cut-	SEN	SPE	PLR	NLR	ACC	SEN	SPE	PLR	NLR	ACC	SEN	SPE	PLR	NLR	ACC
≥1	0.98	0.03	1.02	0.49	0.67	0.94	0.13	1.08	0.46	0.67	/	/	/	/	/
≥2	0.90	0.22	1.15	0.46	0.67	0.76	0.32	1.11	0.76	0.61	0.80	0.32	1.19	0.60	0.65
≥3	0.69	0.50	1.38	0.62	0.63	0.47	0.62	1.21	0.87	0.52	0.76	0.38	1.22	0.63	0.63
≥4	0.37	0.77	1.56	0.83	0.50	0.26	0.79	1.27	0.93	0.44	0.54	0.64	1.49	0.73	0.57
≥5	0.15	0.93	2.22	0.91	0.41	0.11	0.93	1.45	0.96	0.38	0.41	0.75	1.63	0.79	0.52
=6	0.02	1.00	0!	0.98	0.35	0.02	1.00	3.95	0.99	0.34	0.24	0.82	1.31	0.93	0.43

30-day UNPLANNED READMISSION															
	ISAR					fTRST					iEDS				
Cut-	SEN	SPE	PLR	NLR	ACC	SEN	SPE	PLR	NLR	ACC	SEN	SPE	PLR	NLR	ACC
≥1	0.98	0.02	1.00	0.90	0.14	0.88	0.08	0.96	1.52	0.18	/	/	/	/	/
≥2	0.84	0.14	0.97	1.17	0.22	0.71	0.27	0.97	1.09	0.32	0.84	0.26	1.13	0.63	0.33
≥3	0.63	0.38	1.02	0.97	0.41	0.42	0.56	0.96	1.03	0.55	0.77	0.30	1.11	0.75	0.36
≥4	0.29	0.68	0.92	1.04	0.64	0.27	0.76	1.14	0.96	0.70	0.47	0.53	1.00	1.00	0.52
≥5	0.10	0.88	0.78	1.03	0.78	0.08	0.91	0.82	1.02	0.81	0.30	0.64	0.83	1.10	0.60
=6	0.01	0.99	0.80	1.00	0.87	0.00	0.99	0	1.01	0.87	0.18	0.78	0.83	1.05	0.71
90-day UNPLANNED READMISSION															
	ISAR					fTRST					iEDS				
Cut-	SEN	SPE	PLR	NLR	ACC	SEN	SPE	PLR	NLR	ACC	SEN	SPE	PLR	NLR	ACC
≥1	0.98	0.03	1.01	0.71	0.24	0.92	0.08	1.01	0.92	0.27	/	/	/	/	/
≥2	0.86	0.14	1.00	1.02	0.30	0.75	0.27	1.03	0.91	0.38	0.82	0.26	1.11	0.68	0.39
≥3	0.65	0.38	1.05	0.92	0.44	0.48	0.58	1.14	0.90	0.56	0.77	0.31	1.11	0.75	0.41
≥4	0.34	0.69	1.11	0.95	0.62	0.29	0.77	1.29	0.92	0.67	0.50	0.54	1.08	0.93	0.53
≥5	0.13	0.88	1.11	0.99	0.72	0.09	0.91	1.00	1.00	0.73	0.35	0.64	0.98	1.01	0.58
=6	0.01	0.99	0.88	1.00	0.77	0.00	0.99	0	1.01	0.77	0.22	0.78	1.02	0.99	0.66

ACC = accuracy; ED LOS = emergency department length of stay; fTRST = Flemish version of the Triage Risk Screening Tool; iEDS = interRAI Emergency Department Screener©; ISAR = Identification of Senior At Risk; NLR = negative likelihood ratio; PLR = positive likelihood ratio; SEN = sensitivity; SPE = specificity.

TABLE 3. Interval likelihood ratios of ISAR, fTRST and iEDS for predicting prolonged emergency department length of stay, hospitalization, and unplanned readmission at 30 and 90 days

INTERVAL LIKELIHOOD RATIOS												
	Prolonged ED LOS			Hospitalization			30-day UR			90-day UR		
Interval	ISAR	fTRST	iEDS	ISAR	fTRST	iEDS	ISAR	fTRST	iEDS	ISAR	fTRST	iEDS
0-1	0.83	0.65	/	0.46	0.76	/	1.17	1.09	/	1.02	0.91	/
1-2	0.95	0.79	0.65	0.63	0.97	0.63	0.97	0.95	0.75	0.93	0.89	0.75
2-3	0.89	1.02	1.05	0.97	1.04	0.85	1.00	0.89	1.34	0.93	0.92	1.18
3-4	0.97	1.35	1.10	1.25	1.16	0.94	1.08	1.00	1.42	1.04	1.18	1.25
4-5	1.19	1.30	1.21	1.46	1.22	1.66	0.92	1.19	1.16	1.12	1.36	1.13
5-6	1.50	1.09	1.20	2.22	1.45	1.63	0.78	0.82	0.83	1.11	1.00	0.98

ED LOS = emergency department length of stay; fTRST = Flemish version of the Triage Risk Screening Tool; iEDS = interRAI Emergency Department Screener; ISAR = Identification of Senior At Risk; UR = unplanned readmission

DISCUSSION

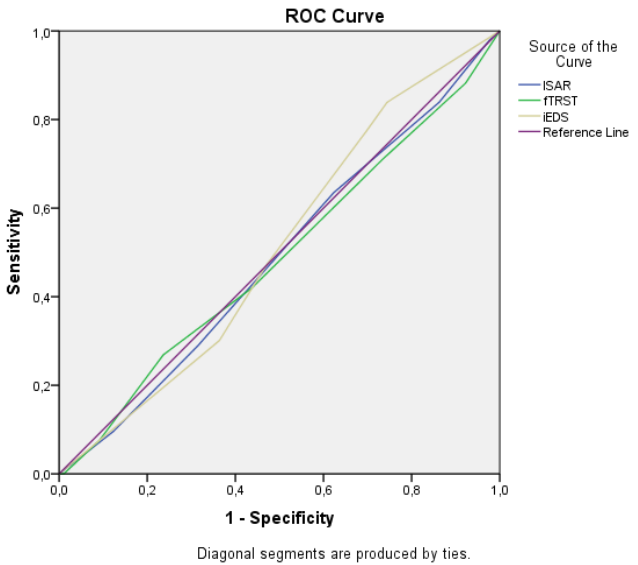
Short and easy-to-administer screening tools seem necessary in the ED to identify older patients who can benefit from additional geriatric interventions (e.g. ED-based, inhospital, community care, day clinics,…).[6] The iEDS is a relatively new tool that embodies different principles (e.g. use of diagram) for case identification and prioritization in contrast to the most widely studied tools with dichotomous cut-offs, such as the ISAR and the fTRST. While the accuracy of these were reported insufficient in distinguishing between patients with and without adverse outcomes, an identical study using the iEDS as screening tool has not yet been reported.[1,7,8] Thus, the study aim was to compare the predictive accuracy of the ISAR, the fTRST and the iEDS.

Despite their architectural differences, the clinimetric characteristics of the three tools were comparable. Several trends were present in table 2. First, with a moderate to high sensitivity at low cut-off points, the tools seemed good in detecting patients at risk for the outcomes. Second, with a moderate to high specificity at high cut-off points, the tools –with a slight benefit for fTRST and ISAR- seemed good to identify patients at low risk for the outcomes. Third, no tool demonstrated PLR or NLR with significant impact on the posttest probability of an outcome. Fourth, there was an important trade-off between sensitivity and specificity in all cases, which was also reflected in the low AUC of the tools (0.49-0.62). This clearly demonstrates that none of the studied tools were sufficiently accurate to distinguish between high- and low-risk patients.

Important arguments in the discussion whether or not to use these screening tools in clinical practice are methodological considerations. Although prospective diagnostic accuracy studies with delayed verification (i.e. with future events as reference standard) are easy to conduct, their scientific value is limited.[29] Examples of possible methodological flaws are the 'treatment paradox' (i.e. when accurate clinical judgement of caregivers leads to measures that prevent the event and consequently lower diagnostic accuracy) and the unpredictable nature of a patients' future health status (e.g. a new disease can lead to ED readmissions that are not related to the index ED visit).[29] Therefore, instead of scrutinizing diagnostic accuracy of these screening tools, it seems more appropriate to test how clinical interventions,

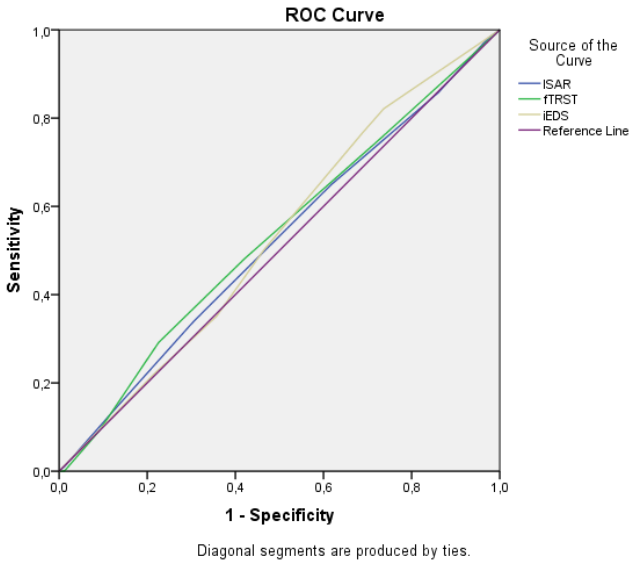
FIGURE 2. Receiver operating characteristics curves of ISAR, fTRST and iEDS for predicting (A) 30-day and (B) 90-day unplanned readmission

A



Tool	AUC	95% CI	
		LB	UB
ISAR	0.49	0.43	0.55
fTRST	0.49	0.42	0.55
iEDS	0.51	0.45	0.57

B



Tool	AUC	95% CI	
		LB	UB
ISAR	0.52	0.47	0.57
fTRST	0.53	0.48	0.58
iEDS	0.53	0.48	0.58

AUC = area under the receiver operating characteristics curves; CI = confidence interval; fTRST = Flemish version of the Triage Risk Screening Tool; iEDS = interRAI Emergency Department Screener©; ISAR = Identification of Senior At Risk; ROC = receiver operating characteristics curves; LB = lower bound; UB = upper bound.

that are initiated following the administration of such a screening tool, improve patient and/or operational outcomes.[29] As such studies need to integrate elements of clinical effectiveness and implementation research, future studies should use effectiveness-implementation hybrid designs, preferably type 1 in which a clinical intervention is tested while information on its delivery is gathered.[30-32] Although a few such studies (mainly with ISAR) demonstrate clinician- and patient-benefit with integration of screening tools into daily practice, uncertainties remain about these instruments' overall value and between tool comparative efficacy.[6,13,33-35] This indicates that there is no ideal design for evaluating and comparing screening tools and justifies the design of the current study.

Another explanation for the insufficient diagnostic accuracy of the tools is that it might be impossible to capture the complexities of the heterogeneous group of older adults in a screening tool (score). Other arguments against the "isolated" use of these tools are clinical, ethical and epidemiological. From a clinical point of view, it is surprising that not all tools include important geriatric areas of concern, such as short-term cognitive alterations, recent falls, and acute functional decline. From an ethical point of view, it is questionable if patients with one single geriatric problem and, thus, often with a screening tool score below the cut-off for further intervention receive appropriate care. This is especially relevant when cut-off scores would be increased to scale down the intervention population for feasibility reasons. As geriatric problems are prevalent among older ED patients (e.g. 43.2%, 46.8% and 71.2% of study participants reported a fall in the last 90 days, cognitive impairment and polypharmacy, respectively), screening to identify patients who might benefit from ED-based geriatric assessment seems redundant as the majority will need a more comprehensive approach anyhow. For these reasons, despite the obvious value in geriatricizing ED care, it seems logical to shift the objective away from the concept of multipurpose, multiple outcome screening tools.[36] As an alternative in settings with established geriatric awareness and appropriate skill-mix, clinicians, policy makers, and researchers should take it further and explore the clinical effectiveness and implementation aspects of ED-specific minimum geriatric assessment strategies.[30] This includes using objectively validated instruments for initial detection (or exclusion) of high-priority geriatric problems (e.g. delirium, fall risk, inappropriate medication) to activate geriatric emergency protocols, as part of standard care and with the final objective to determine the patient's most appropriate discharge destination (e.g. observation unit/short-stay unit, inpatient unit, rehabilitation clinic, usual living place with referral to

community care/general practitioner/geriatric day clinic,…).[36-38] The Geriatrics 5M's model (i.e. Mind, Mobility, Medications, Multicomplexity and Matters Most) might be useful to conceptualize this ED-specific minimum geriatric assessment, which would ideally be just one element in an age-friendly health system that includes good linkage between inpatient and outpatient geriatric resources.[36,39]

As far as the authors know, this is the first study comparing diagnostic accuracy of ISAR, fTRST and iEDS for both proximal (i.e. hospitalization and prolonged ED LOS) and distal (i.e. 30- and 90-day unplanned ED readmission) outcomes. The rationale to report proximal and distal outcomes is the hypothesis that events in the distal future are more difficult to predict. Although outcome incidences were in line with those of other studies,[40,41] this study did not confirm the hypothesis.

This study has other limitations that might have influenced study findings besides those already mentioned. First, study nurses did not manage to include all patients consecutively, which is due to the unpredictable nature of patient flow in the ED. This might have led to some form of selection bias. Second, inter-rater and intra-rater reliability were not evaluated before data collection. Third, clinimetric analyses were not conducted in subgroups based on discharge destination. The authors expect that diagnostic characteristics in both hospitalized and non-hospitalized patients are similar, as reported in one of our previous studies.[40] Fourth, this study included community-dwelling patients who were able to give an interview. It is unclear how excluded patients might have influenced diagnostic test results. Fifth, this is a monocentric study that was conducted in an academic hospital with an observation unit embedded in its ED. Study findings –especially concerning ED LOS- might not be generalizable for EDs with different size (e.g. no observation unit in or near the ED) or processes (e.g. ED stay with four hour time limit). In addition, outcomes are difficult to compare at international level, since their incidence depends on local health care systems' characteristics.

In Belgium, there is unrestricted access to any primary, secondary and tertiary care facility.[42] Health care is predominantly based on a fee-for-service system with direct payments, that are (partly) reimbursed by obligatory health insurance or third party payment.[42] General practitioners can easily be consulted. On weekend days, holidays and at night, persons with unplanned care needs can dial one central number (1733) for assessment of urgency and referral.[42] In case of emergency, the paneuropean number (112) can be

dialled. ED care is easily accessible, even without referral. Nearly all hospitals have a 24/7 ED with specialized nurses and physicians on site.[43] Although there are no specific requirements by law for care of older adults in EDs, collaborations between EDs and geriatric services are emerging (e.g. availability of a geriatrician or geriatric liaison team on the ED).[43,44]

In this study, the iEDS was operationalised as a stand-alone tool. Although this is a valid option in case of limited resources, it must be reported that the iEDS was designed as the first part of a two-step screening (i.e. iEDS) and assessment (i.e. interRAI ED Contact Assessement©) protocol, called the interRAI ED Assessment System. It is clear that this two-step protocol was not evaluated in the current study.

CONCLUSIONS

This study reported that diagnostic characteristics of ISAR, fTRST and iEDS are comparable and that none of these tools accurately predicts prolonged ED LOS, hospitalization and unplanned ED readmission at 30 and 90 days, when used as a stand-alone index. Besides methodological limitations in diagnostic accuracy studies with delayed verification, there are other counter-arguments to the use of score-based tools in 'geriatricized' ED contexts (i.e. EDs with routine presence of geriatric expertise and referral options) that are conceptual, clinical, ethical and epidemiological in nature. Future studies should explore the clinical effectiveness and implementation aspects of ED-specific minimum geriatric assessment strategies.

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CHAPTER 3

SUPPLEMENTAL FILES

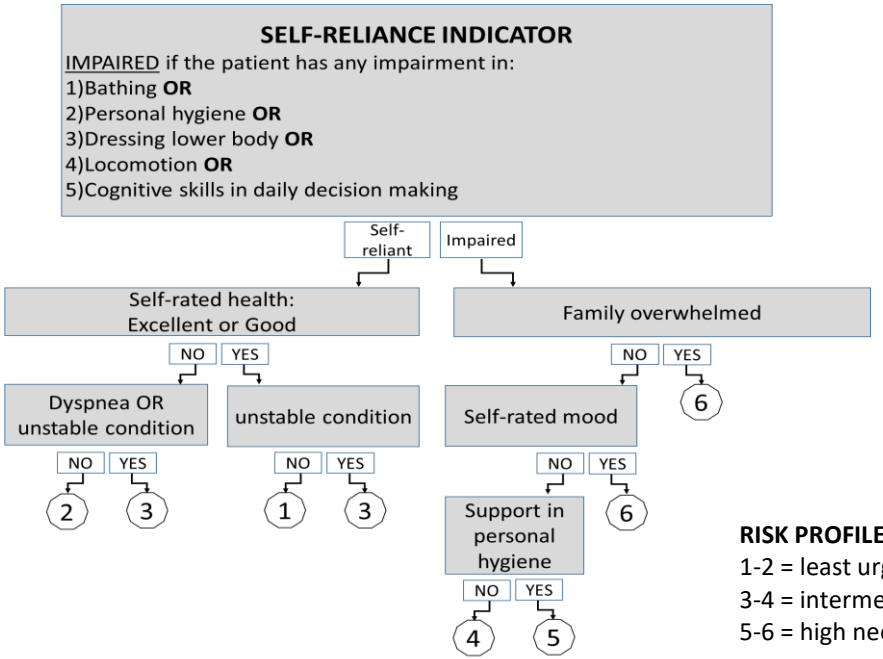
SUPPLEMENTARY FIGURE S1: identification of senior at risk (ISAR) and Flemish version of the Triage Risk Screening Tool (fTRST), old generation tools

Identification of senior at risk (ISAR)		
ITEM	Yes	No
Needs assistance[1] (premorbid)	1	0
Increased assistance[2]	1	0
Hospitalized past 6 months	1	0
Visual impairment	1	0
Memory impairment	1	0
Polypharmacy: > 3 medications	1	0
TOTAL SCORE	/6	

Flemish version of Triage Risk Screening Tool (fTRST)		
ITEM	Yes	No
Presence of cognitive impairment (disorientation, diagnosis of dementia, or delirium)	2	0
Lives alone or no caregiver available, willing, or able	1	0
Difficulty in walking, transferring or fall(s) in past 6 months	1	0
Hospitalized past 3 months	1	0
Polypharmacy: ≥ 5 medications	1	0
TOTAL SCORE	/6	

[1]Before the illness of injury that brought you to the ED, did you need someone to help you on a regular basis?
[2]Since the illness or injury that brought you to the ED, have you needed more help ten usual to take care of yourself?

SUPPLEMENTARY FIGURE S2: interRAI ED Screener© (iEDS), a new generation tool



RISK PROFILE:
1-2 = least urgent need for referral or geriatric assessment
3-4 = intermediate need for referral or geriatric assessment
5-6 = high need for referral or geriatric assessment

The interRAI ED Screener© is publicly available as a free-of-charge smartphone or tablet application for Android and iOS with versions in multiple languages.The presented figure is a simplified representation of the original algorithm which is under copyright of interRAI™. A manual is available for item definition and clinical use.[11]
(https://www.interrai.org/emergency-department.html)

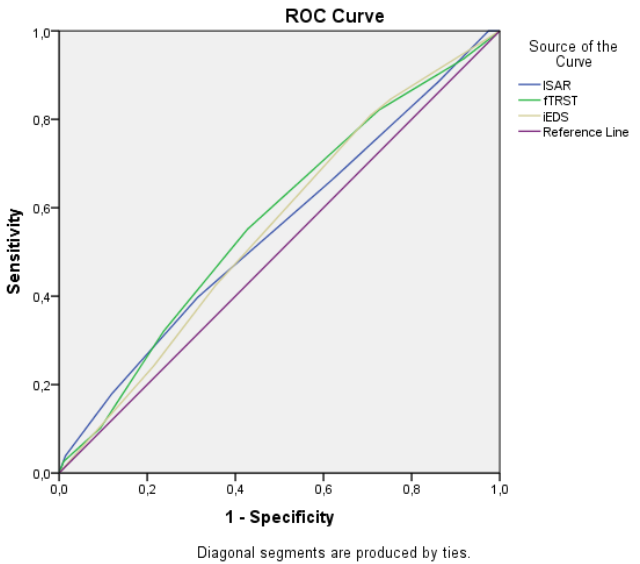
SUPPLEMENTARY TABLE S1: negative and positive predictive value of ISAR, fTRST and iEDS for predicting long emergency department length of stay, hospitalization and unplanned readmission at 30 and 90 days

PROLONGED EMERGENCY DEPARTMENT LENGTH OF STAY															
	ISAR					fTRST					iEDS				
Cut-off	SEN	SPE	NPV	PPV	ACC	SEN	SPE	NPV	PPV	ACC	SEN	SPE	NPV	PPV	ACC
≥1	1.00	0.03	1.00	0.10	0.12	0.94	0.08	0.92	0.10	0.17	/	/	/	/	/
≥2	0.88	0.14	0.92	0.10	0.21	0.82	0.28	0.93	0.11	0.33	0.85	0.25	0.94	0.11	0.31
≥3	0.67	0.38	0.91	0.11	0.41	0.55	0.57	0.92	0.12	0.57	0.81	0.29	0.93	0.11	0.35
≥4	0.40	0.69	0.91	0.12	0.66	0.32	0.76	0.91	0.13	0.72	0.55	0.53	0.91	0.11	0.53
≥5	0.18	0.88	0.91	0.14	0.81	0.10	0.91	0.90	0.11	0.83	0.42	0.65	0.91	0.12	0.62
=6	0.04	0.99	0.90	0.23	0.89	0.03	0.99	0.90	0.22	0.89	0.24	0.78	0.90	0.11	0.73
HOSPITALIZATION															
	ISAR					fTRST					iEDS				
Cut-off	SEN	SPE	NPV	PPV	ACC	SEN	SPE	NPV	PPV	ACC	SEN	SPE	NPV	PPV	ACC
≥1	0.98	0.03	0.50	0.67	0.67	0.94	0.13	0.52	0.69	0.67	/	/	/	/	/
≥2	0.90	0.22	0.52	0.70	0.67	0.76	0.32	0.39	0.69	0.61	0.80	0.32	0.45	0.71	0.65
≥3	0.69	0.50	0.44	0.74	0.63	0.47	0.62	0.36	0.71	0.52	0.76	0.38	0.44	0.71	0.63
≥4	0.37	0.77	0.37	0.76	0.50	0.26	0.79	0.35	0.72	0.44	0.54	0.64	0.40	0.75	0.57
≥5	0.15	0.93	0.35	0.82	0.41	0.11	0.93	0.34	0.75	0.38	0.41	0.75	0.39	0.77	0.52
=6	0.02	1.00	0.34	1.00	0.35	0.02	1.00	0.33	0.89	0.34	0.24	0.82	0.35	0.73	0.43

30-day UNPLANNED READMISSION															
	ISAR					**fTRST**					**iEDS**				
Cut-off	SEN	SPE	NPV	PPV	ACC	SEN	SPE	NPV	PPV	ACC	SEN	SPE	NPV	PPV	ACC
≥1	0.98	0.02	0.89	0.12	0.14	0.88	0.08	0.83	0.12	0.18	/	/	/	/	/
≥2	0.84	0.14	0.86	0.12	0.22	0.71	0.27	0.87	0.12	0.32	0.84	0.26	0.92	0.14	0.33
≥3	0.63	0.38	0.88	0.12	0.41	0.42	0.56	0.87	0.12	0.55	0.77	0.30	0.91	0.13	0.36
≥4	0.29	0.68	0.87	0.11	0.64	0.27	0.76	0.88	0.14	0.70	0.47	0.53	0.88	0.12	0.52
≥5	0.10	0.88	0.87	0.10	0.78	0.08	0.91	0.88	0.10	0.81	0.30	0.64	0.87	0.10	0.60
=6	0.01	0.99	0.88	0.10	0.87	0.00	0.99	0.88	0.00	0.87	0.18	0.78	0.87	0.10	0.71
90-day UNPLANNED READMISSION															
	ISAR					**fTRST**					**iEDS**				
Cut-off	SEN	SPE	NPV	PPV	ACC	SEN	SPE	NPV	PPV	ACC	SEN	SPE	NPV	PPV	ACC
≥1	0.98	0.03	0.83	0.22	0.24	0.92	0.08	0.79	0.22	0.27	/	/	/	/	/
≥2	0.86	0.14	0.78	0.22	0.30	0.75	0.27	0.80	0.23	0.38	0.82	0.26	0.84	0.24	0.39
≥3	0.65	0.38	0.79	0.23	0.44	0.48	0.58	0.80	0.24	0.56	0.77	0.31	0.83	0.24	0.41
≥4	0.34	0.69	0.79	0.24	0.62	0.29	0.77	0.79	0.27	0.67	0.50	0.54	0.79	0.23	0.53
≥5	0.13	0.88	0.78	0.24	0.72	0.09	0.91	0.78	0.22	0.73	0.35	0.64	0.78	0.22	0.58
=6	0.01	0.99	0.78	0.20	0.77	0.00	0.99	0.78	0.00	0.77	0.22	0.78	0.78	0.22	0.66

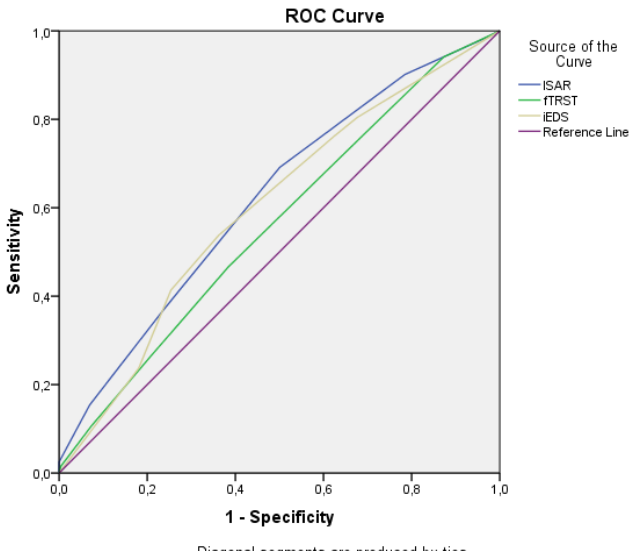
ACC = accuracy; fTRST = Flemish version of the Triage Risk Screening Tool; iEDS = interRAI Emergency Department Screener©; ISAR = Identification of Senior At Risk; NPV = negative predictive value; PPV = positive predictive value; SEN = sensitivity; SPE = specificity. Clinimetric scores were categorized as low (≤0.69), moderate (0.70-0,89) and high (≥0.90).

SUPPLEMENTARY FIGURE S3: receiver operating characteristics (ROC) curves of ISAR, fTRST and iEDS for predicting prolonged emergency department length of stay



Test Result Variables	Area under the curve	95% Confidence Interval	
		Lower Bound	Upper Bound
Identification of Senior At Risk (ISAR)	0.55	0.48	0.62
Flemish version of the Triage Risk Screening Tool (fTRST)	0.57	0.51	0.64
interRAI Emergency Department Screener© (iEDS)	0.56	0.49	0.62

SUPPLEMENTARY FIGURE S4: receiver operating characteristics (ROC) curves of ISAR, fTRST and iEDS for predicting hospitalization (following index emergency department stay)



Test Result Variables	Area under the curve	95% Confidence Interval	
		Lower Bound	Upper Bound
Identification of Senior At Risk (ISAR)	0.62	0.58	0.66
Flemish version of the Triage Risk Screening Tool (fTRST)	0.56	0.52	0.60
interRAI Emergency Department Screener© (iEDS)	0.60	0.56	0.64

CHAPTER 4

Structure and processes of emergency observation units with a geriatric focus: a scoping review

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ABSTRACT

Background: Combining observation principles and geriatric care concepts is considered a promising strategy for risk-stratification of older patients with emergency care needs. We aimed to map the structure and processes of emergency observation units (EOUs) with a geriatric focus and explore to what extent the comprehensive geriatric assessment (CGA) approach was implemented in EOUs.

Methods: The revised scoping methodology framework of Arksey and O'Malley was applied. Manuscripts reporting on dedicated areas within hospitals for observation of older patients with emergency care needs were eligible for inclusion. Electronic database searches were performed in MEDLINE, EMBASE and CINAHL in combination with backward snowballing. Two researchers conducted data charting independently. Data-charting forms were developed and iteratively refined. Data inconsistencies were judged by a third researcher or discussed in the research team. Quality assessment was conducted with the Methodological Index for Non-Randomized Studies.

Results: Sixteen quantitative studies were included reporting on fifteen EOUs in seven countries across three continents. These units were located in the ED, immediately next to the ED or remote from the ED (i.e. hospital-based). All studies reported that staffing consisted of at least three healthcare professions. Observation duration varied between 4 and 72 hours. Most studies focused on medical and functional assessment. Four studies reported to assess a patients' medical, functional, cognitive and social capabilities. If deemed necessary, post-discharge follow-up (e.g. community/primary care services and/or outpatient clinics) was provided in eleven studies.

Conclusion: This scoping review documented that the structure and processes of EOUs with a geriatric focus are very heterogeneous and rarely cover all elements of CGA. Further research is necessary to determine how complex care principles of 'observation medicine' and 'CGA' can ideally be merged and successfully implemented in clinical care.

Keywords: Acute care, Emergency Department, Observation Unit, Older Adults, Geriatric Emergency Medicine, Comprehensive Geriatric Assessment.

BACKGROUND

Between 12 and 24% of patients presenting to emergency departments (ED) are 65 years or older.[1] This growing segment of the ED population includes a vulnerable subgroup, which is characterized by multimorbidity, polypharmacy and reduced physical and psychosocial reserves. Under these circumstances, older ED patients are at increased risk for unfavorable outcomes, such as death, prolonged ED length of stay (LOS), unnecessary admission and unplanned readmission, compared to their younger counterparts.[2-5] To enhance these outcomes and better meet the complex needs of this vulnerable group, geriatric emergency guidelines recommend to integrate principles of comprehensive geriatric assessment (CGA) in emergency care.[6,7] CGA has been defined as "a multidimensional, interdisciplinary diagnostic process focusing on determining a vulnerable older person's medical, functional, cognitive and social capabilities in order to develop a coordinated and integrated plan for treatment and long term follow up".[8]

As CGA can be time consuming and EDs can have short targets for LOS (e.g. four hour rule in United Kingdom and Australia[9,10]), integrating geriatric emergency guidelines in the regular ED setting is perceived challenging. Indeed, integration of these guidelines seems more compatible with the concept of emergency observation units (EOUs).[11-13] These units traditionally focus on patients requiring a longer period of time (often 8-24 hours) for further diagnostic testing, reassessment, therapeutic interventions or consultations, which is beyond the scope of the conventional ED stay. Generally, EOUs do not qualify for "buffering" patients in need of an inpatient bed.[11,14] The reported benefits of EOUs for general patient populations at the patient, hospital and care system level include higher patient satisfaction, shorter LOS, decreased ED crowding, fewer inpatient admissions, and lower cost.[15-17] However, the certainty of the reported evidence is very low.[18] For vulnerable older adults, the additional available time in EOUs provides an opportunity for comprehensive, interdisciplinary assessment and focused geriatric care as a means for more appropriate risk stratification, management or disposition planning.[11,12]

As we could not identify any published review on EOUs with a geriatric focus, a scoping review was conducted to map and summarize the existing literature on this topic. Our aim was to explore the structure and processes of EOUs with

a geriatric focus in an international context. More specifically, we explored to what extent the geriatric focus in EOUs corresponded to the concept of CGA, which is considered the gold standard approach in geriatric care models.[8,19]

METHODOLOGY

A scoping review was conducted, using the refined methodological framework of Arskey and O'Mally.[20,21] This manuscript was reported using the PRISMA guidelines and its extensions for Scoping Reviews.[22]

Identification of relevant studies

Two phases were used to identify relevant studies. First, electronic database searches were conducted after tailoring the search strategy to the thesaurus of MEDLINE, EMBASE and CINAHL. Final search strings are available in supplementary table S1. These comprised three concepts (i.e. emergency medical services AND older patients AND observation units) and had one restriction: only papers published in English, Dutch or French were considered for inclusion. Second, reference lists of pertinent literature review studies were screened to find additional relevant publications (i.e. backward snowballing).

Selection of studies

A four-stage study selection process was conducted. First, duplicates were removed with Endnote software. Second, all records were screened for suitability based on title and abstract. In this stage, the three concepts of the final search strings were used as initial selection criteria. PH screened all identified records, while JC and AH each screened half. Third, each study, considered potentially relevant by at least one researcher in the previous stage, underwent full-text screening. This was conducted by PH, JC and AH, who completed this independent of each other. During this stage, iterative consensus meetings were organised to discuss how initial selection criteria could be refined, taking into account the retrieved manuscripts and the study aim. Fourth, the reference list of included studies was screened to find additional relevant publications (i.e. backward snowballing).

The final inclusion criteria set out four requirements for including a paper. The first three delineated the population (i.e. adults of 65 years and older or a

median sample age of at least 70 years old), setting (i.e. dedicated areas within hospitals for observation of patients during a predefined time period following emergency admission) and design (i.e. quantitative and qualitative studies reporting primary data analyses). The fourth inclusion criterion was having a geriatric focus. This was defined as "providing some form of additional assessment or intervention for older adults compared to usual care from the perspective that older adults have different needs than younger patients". Studies reporting on pathology specific interventions (e.g. delirium, hip fracture) were excluded, as well as care models on inpatient wards or intensive care units. Other exclusion criteria focused on study design (i.e. review papers, editorials, letters to the editor, published abstracts and conference proceedings) and the extensiveness of reporting. The latter implied exclusion of manuscripts that did not describe intervention components, processes or outcome measures.

Data charting

The initial data charting forms were based on two items: Conley and colleagues' overview of key elements to consider when establishing an observation unit[23] and Moseley and colleagues' summary of observation unit characteristics[11]. Initial data-charting forms included methodological items (i.e. study characteristics and quality appraisal items) and general characteristics of EOUs (e.g. design, staffing, admission policy, workflow). An iterative approach (i.e. continually updating the data-charting forms) was used by three researchers (PH, JC and AH) to elaborate these characteristics based on included studies. Consensus meetings within the research team guided refinement of data charting.

The methodological quality of quantitative studies was described with the twelve-item Methodological index for non-randomized studies (MINORS).[24] Each item was assigned a score zero (i.e. not reported), one (i.e. reported but inadequate) or two (i.e. reported and adequate). Included studies were assessed independently by PH (who scored all studies) and JC or AH (who each scored half of the studies). MS assessed inconsistent scores together with PH, JC and AH. The Standard for Reporting Qualitative Research was selected to assess the quality of qualitative studies.[25]

Sorting, summarizing and reporting results

Data were grouped by methodological and EOU-specific characteristics of each included paper. EOU-specific data were initially mapped according structural and procedural characteristics of EOUs and subsequently discussed

according the key elements of the CGA definition[8] (i.e. interdisciplinary processes, target population, multidimensionality and plan for treatment and follow-up).

RESULTS

Identification and selection of relevant studies

Database searches resulted in 7138 papers. After removing duplicates (n=1628), 5510 papers remained. After screening of titles and abstracts 5394 papers were excluded. Full-text screening was conducted for 116 papers, resulting in 15 included studies. We included one additional study through screening the reference lists of the included studies. Figure 1 shows the flowchart of the study identification and selection process.

Characteristics of included studies (table 1)

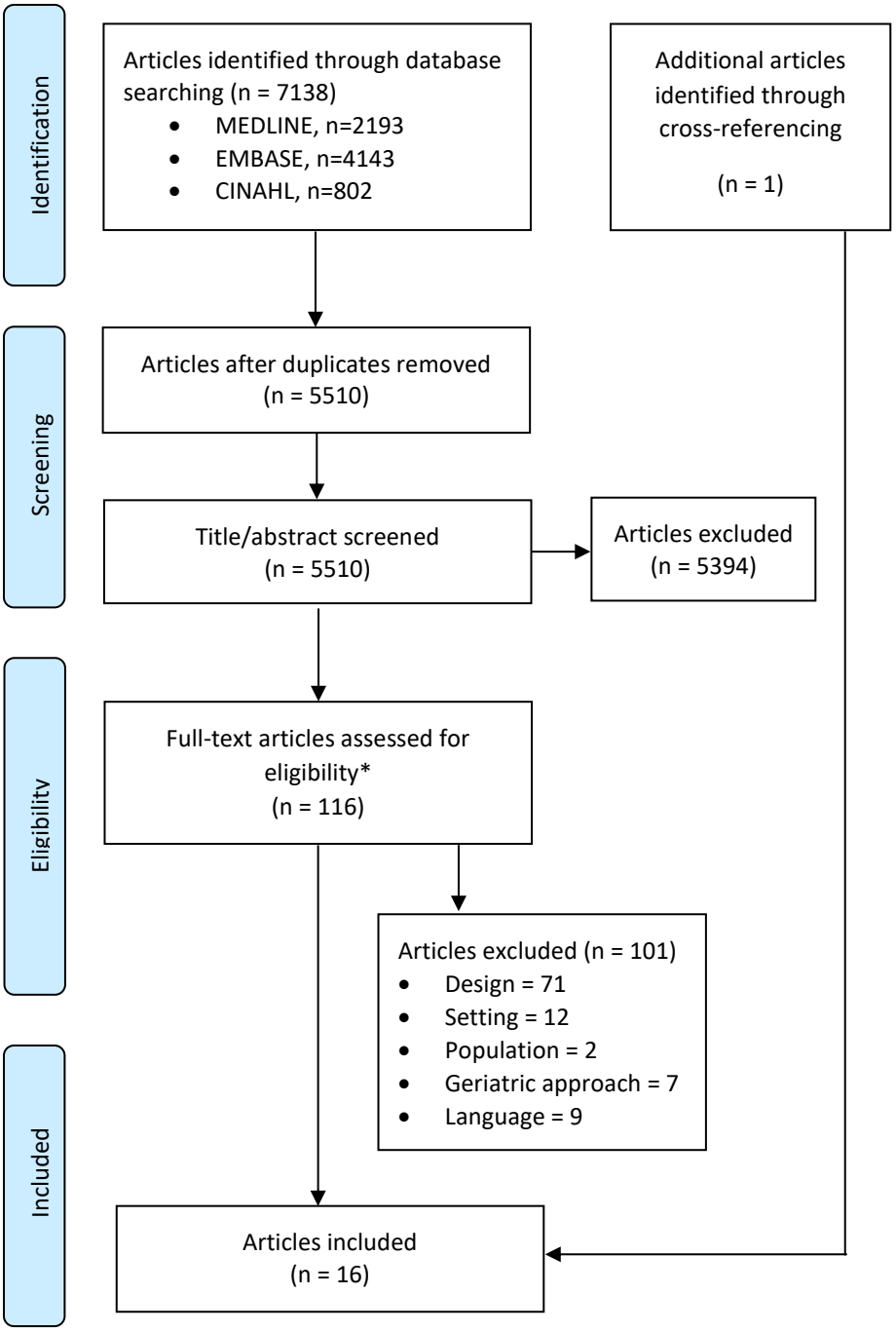
The sixteen included studies reported on fifteen different EOUs with a geriatric focus in seven countries: six in the UK[26-31], four in Denmark[32-35], two in Australia[36,37] and one in Singapore[38], Hong Kong[39], Switzerland[40] and the USA[41]. All publications had a quantitative design. Six papers reported retrospective data collection.[29,31,36,37,39,41] Papers with prospective data collection used following designs: observational study (n=3)[26,29,40], pre-post study (n=2)[26,27], system redesign study[30], non-randomized quasi-experimental trial[33], two-way factorial randomized clinical trial[32], pragmatic randomized clinical trial[35] and randomized controlled trial[28]. The only multicenter study collected data in two hospitals.[28] Risk for bias of included studies varied from moderate to high (supplementary table S2; e.g. seven studies included consecutive patients, baseline equivalence of groups was considered adequate in two studies).

Structure of EOUs with a geriatric focus

Unit design (supplementary table S3)

Thirteen papers reported the location of the EOU. These had been positioned at three places: in the ED[32,33,39-41], immediately next to the ED[27,29,34,35,38] and remote from the ED (i.e. hospital-based)[26,30,37]. The available bed count varied from 6 to 32 beds and varied according to demand.[26,27,29,31,34,35,37-39,41] One Danish EOU had six chairs available for daytime patients.[34,35] Four studies reported a distinct zone specifically reserved for older patients.[27,30,31,39]

FIGURE 1. PRISMA flowchart



Staffing (supplementary table S4)

Fifteen out of sixteen studies reported that staffing consisted of at least three healthcare professions.[26-39,41] In thirteen studies, the interdisciplinary team comprised at least one physician, nurses and one or more allied health care professionals.[26-28,30-33,35-39,41] These included physiotherapists (n=14), occupational therapists (n=12), social workers (n=6), pharmacists (n=3) and/or discharge planning coordinators (n=1). Extended nursing roles included mental health liaison nurse (n=1)[31], nurse case manager (n=4)[27,31,39,41] and advanced nurse practitioner/advanced practice provider (n=3)[36,38,41]. Two studies did not report the presence of a nurse.[29,34] Input of a geriatrician was reported in six studies and varied between a consultant role and complete coverage during daytime.[27,28,30,31,39,41]

Seven studies reported some details on availability of the interdisciplinary team. Three and two studies reported operating periods from Monday until Friday[29,31,33] and from Monday until Saturday[38,41], respectively. Two studies reported daily geriatrician coverage.[27,30]

Processes of EOUs with a geriatric focus

Admission policy (supplementary table S5)

Seven publications reported whether the admission procedure of the EOU was 'closed' (i.e. admission only after assessment by ED physician; n=5)[26,29,34,35,41] or 'open' (i.e. admission after referral of a physician, such as a general practitioner; ED evaluation may or may not be required; n=2)[31,37].

Fourteen studies described that the EOU focused on subacute patients with potential for discharge within a predefined observation period, which varied between 4 and 72 hours. Five, four and two papers reported a targeted observation period of 72 hours[26,28,34,35,39], 24 hours[27,29,40,41] and 48 hours[33,36], respectively. Three studies reported flexible observation periods, ranging between 4-24 hours[38], 36-48 hours[37] and 48-72 hours[32].

One study used an international validated screening tool (i.e. Identification of Seniors at Risk or ISAR) to guide selection of older patients for a geriatric approach.[28] Another study reported that all older patients being identified with at least one of four predefined criteria (i.e. falls, delirium, dementia or care home/intermediate care residents) were eligible for CGA.[31] Additional criteria that were used for narrowing down the observation population focused on pathology (e.g., only patients suffering from specific conditions[38] or fulfilling criteria of chief complaint-focused protocols[41]), social profile (e.g.

TABLE 1. Study characteristics

Study	Country	Study design	Population	Sample	Age*	Care model name
Anpalahan 2002[36]	Australia	Retrospective, record review study; monocentre	≥ 70 years General medical patients	n=500	NR	Rapid assessment medical unit
Bruun 2018[32]	Denmark	Prospective, two-way factorial randomised clinical trial; monocentre	≥ 65 years Non-trauma patients at risk of functional decline	Group I; n=82 Group II; n=84 Group III; n=86 Group IV; n=84	78 (72-85)	SSU
Chu 2007[26]	UK	Prospective, observational study; monocentre	≥ 60 years	n=120	77 (60-96)	Short-stay medical unit
Conroy 2014[27]	UK	Prospective, pre-post study (historical cohort); monocentre	≥ 85 years	n=6895 (CG) n=9035 (IG)	NR	Emergency Frailty Unit
Edmans 2013[28]	UK	Prospective, randomised controlled trial; multicentre (2 locations)	≥ 70 years Length of stay ≤ 72 hours ISAR score ≥ 2/6	n=217 (CG) n=216 (IG)	83 (±7)	Acute Medical Assessment Unit
Foo 2012[38]	Singapore	Prospective, pre-post study; monocentre	≥ 65 years Community-dwelling No poor premorbid cognition or functionality	n=172 (CG) n=315 (IG)	75 (NR) in CG 76 (NR) in IG	Emergency Department Observation Unit

Khan 1997[29]	UK	Retrospective, observational study; monocentre	≥ 65 years	n=502	NR	Short-stay ward
Leung 2019[39]	Hong Kong	Retrospective, parallel group study; monocentre	≥ 65 years Living alone	n=40 (CG) n=150 (IG)	82.1 (±8.2) in CG 83.5 (±7.7) in IG	Frailty unit
Misch 2014[40]	Switzerland	Prospective, observational delayed type cross-sectional diagnostic study; monocentre	Non-trauma patients emergency severity index score 2 or 3 non-specific complaints	n=669	81 (72-87)	Emergency Department Observation Unit
Nielsen 2018[33]	Denmark	Prospective, non-randomised quasi-experimental trial; monocentre	≥ 65 years Non-trauma Community-dwelling	n=231 (CG) n=144 (IG)	78 (±9) in CG 81 (±8) in IG	SSU
Ong 2012[37]	Australia	Retrospective, case-control study; monocentre	≥ 65 years 4 most common diagnosis-related groups	n=42 (CG) n=47 (IG)	80 (±8) in CG 84 (±8) in IG	Medical Assessment Unit
Silvester 2012[30]	UK	Prospective system redesign study; monocentre	≥ 75 years	n=16953	NR	Frailty unit

Southerland 2018[41]	USA	Retrospective, chart review study; monocentre	≥ 65 years	n=221	73 (±7)	Emergency Department Observation Unit
Strøm 2017[34]	Denmark	Prospective, observational study; monocentre	≥ 75 years Non-emergent triage score internal medicine disease	n=225 (SSU) n=225 (IMW)	82 (78-86) in SSU 82 (78-86) in IMW	SSU
Strøm 2018[35]	Denmark	Prospective, pragmatic randomised clinical trial; monocentre	≥ 75 years Less urgent triage score internal medicine disease	n=208 (SSU) n=210 (IMW)	81 (77-86) in SSU 82 (78-86) in IMW	SSU
Taylor 2016[31]	UK	Retrospective, pre-post study; monocentre	> 75 years Medical patients	n=398 (CG) n=413 (IG)	85 (75-101) in CG 84 (75-101) in IG	Comprehensive Older Person's Evaluation Zone

*median (range) or mean (±standard deviation) in years
CG = control group; IG = intervention group; IMW = internal medicine ward; NR = not reported; ISAR = Identification of Senior At Risk; SSU = short-stay unit; UK = United Kingdom; USA = United States of America.

only community-dwelling patients[38,39]) and premorbid cognition or function (e.g., no patients with advanced dementia or bed-bound profiles [38,39]). One study reported no details on admission criteria.[30]

Procedural elements of EOUs with a focus on older patients (table 2)

To manage patients within the predefined observation period, all studies except one reported to use fast-track principles (n=15).[26,27,29-41] These comprised care pathways to streamline patients from the ED into the observation unit (n=2)[27,31], early senior medical input (n=6) (e.g. geriatricians of a frailty unit could have an in-reach function to the ED)[26,27,30,31,37,40] and fast-track access to diagnostic tests and therapeutic procedures (n=8).[26,31,34,35,37,39-41] Other fast-track principles comprised early initiation of discharge planning (n=11)[26,29-31,35-41] and stimulation of self-care or early mobilization (n=2).[32,35]

Interdisciplinary processes included making proactive and integrated referrals to available consultants and/or ancillary services (e.g. social work, physical therapy, occupational therapy) as part of standard observation care.[26-39,41] Reported initiatives to improve standard care were very heterogeneous. One study reported integrating systematic cognitive screening in routine assessment by nurses or junior physicians.[36] Two studies described an initiative for systematic functional assessment and early rehabilitation conducted by physiotherapists or occupational therapists.[32,33] One study integrated geriatric assessment by emergency nurses trained in geriatric care.[38] Other initiatives comprised the introduction of specific geriatric protocols (i.e. frailty protocol and fragility fracture protocol) (n=2)[39,41] or the integration of geriatrician-led CGA (n=3).[27,28,31] Regarding comprehensiveness of assessments, five studies clearly reported assessing cognitive function.[27,28,31,36,38] In total, four of the included studies reported to assess a patient's medical, functional, cognitive and social capabilities.[27,28,31,38]

Nine studies reported who coordinated the interdisciplinary team. Seven studies had a physician-led interdisciplinary process (i.e. emergency physician, acute physician or geriatrician).[27,28,31,34,35,39,40] In one study, advanced nurse practitioners were available to work across disciplines and coordinate patient management.[36] Another study described that ED nurses reported geriatric assessment findings to an ED physician or a geriatric nurse clinician.[38] Use of case discussion and team meetings were reported in two[27,38] and five[27,31,37,38,40] studies, respectively. Reported frequencies of team meetings were once daily[37], twice daily[31] and twice weekly[38].

TABLE 2. Procedural elements of observation stays with geriatric focus

	Anpalahan 2002[36]	Bruun 2018[32]	Chu 2007[26]	Conroy 2014[27]	Edmans 2013[28]	Foo 2012[38]	Khan 1997[29]	Leung 2019[39]	Misch 2014[40]	Nielsen 2018[33]	Ong 2012[37]	Silvester 2012[30]	Southerland 2018[41]	Strøm 2017[34]	Strøm 2018[35]	Taylor 2016[31]
Fast-track principles																
- Diagnostic tests/treatment			X					X	X		X		X	X	X	X
- Early senior medical input			X	X					X		X	X				X
- Stimulation of self-care / early mobilization		X								X					X	
- Referral pathway to observation unit				X												X
- Early initiation of discharge planning	X		X			X	X	X	X		X	X	X		X	X
(Early) Geriatric-focused assessment																
- Medical				X	X	X		X	X			X	X			X
- Functional		X		X	X	X		X	X	X	X	X	X	X	X	X
- Cognitive	X			X	X	X										X

- Psychological				X	X	X										X
- Social				X	X	X		X			X	X	X			X
- Drug review				X	X								X			X
- Unspecified			X		X		X		X							
- All four items of CGA				X	X	X										X
Unit rounds	X			X			X	X								
Interdisciplinary collaboration																
- Interdisciplinary coordination	X			X	X	X		X	X					X	X	X
- Team meeting				X		X			X		X					X
- Case discussion				X		X										
Observation pathway																
- Frailty pathway								X					X			
- ED-based fragility fracture pathway													X			
Follow-up																
- Post-discharge follow-up		X		X	X	X	X	X	X	X		X	X			X
- Transmural information transfer		X		X	X	X	X			X						
- Transmural pathways				X	X					X						X

CGA = comprehensive geriatric assessment; ED = emergency department.

Eleven studies described reporting some form of post-discharge follow-up.[27-33,38-41] Its extensiveness was variable, ranging between one specific option (e.g. immediate rehabilitation or not) and a package of follow-up possibilities in primary (i.e. general practitioner), secondary (e.g. geriatric outpatient clinics), community (e.g. home nursing), intermediate (e.g. rehabilitation hospital) and/or social care.[27,28,32,33,38] Four studies described these initiatives as 'transmural or direct referral pathways'.[27,28,31,33] Six of the studies also reported to engage in transmural information transfer.[27-29,32,33,38]

DISCUSSION

Although the conceptual integration of EOUs and CGA seems highly compatible, only four studies [27,28,31,38] described a geriatric focus meeting all main elements of the CGA definition.[8]

Interdisciplinary processes

The low amount of CGA-labelled studies could not be attributed to a lack of interdisciplinary processes (i.e. availability of at least two disciplines collaborating and sharing expertise to deliver optimal care[8]), as all included studies met this CGA element. Even more, all studies, except for one, reported availability of at least three disciplines, with physicians, nurses, physical therapists and occupational therapists as most frequent reported members. Remarkably, only seven studies reported availability of at least one geriatric practitioner (e.g. geriatrician or nurse with geriatric expertise)[27,28,30,31,38,39,41] Absence of a geriatric practitioner in the current review can be explained by three reasons. First, staffing characteristics of routine ED care and interventions (e.g. minimal educational backgrounds, fulltime equivalent availability, roles and responsibilities of different interdisciplinary team members) were often poorly described or not reported. Second, in an international perspective, shortage of geriatricians and nurses with geriatric expertise remains a problem.[42-44] Third, specific for the ED and EOU setting, absence of geriatric practitioners can be caused by the limited ability to bill or charge for geriatric interventions.[42] One might say, with or without a dedicated geriatric practitioner, an EOU should always strive delivering the most appropriate care for older patients. Clearly, in absence of a geriatric practitioner, the individual role of all interdisciplinary team members and their mutual collaboration becomes more essential.[42]

Target population

Admission criteria varied widely from one setting to another but appeared appropriate for local feasibility, as no study reported challenges with implementing. Clinicians contemplating to initiate geriatric-focused observation services, need to consider both geriatric and observation selection criteria. Regarding geriatric selection criteria, it is remarkable that only one study reported usage of an international validated geriatric screening tool, which continues to be promoted as best practice despite its limitations.[28,45-47] The value of other geriatric selection criteria of included studies remains unknown, as their description was often insufficiently detailed or relied on clinical judgement only. For example, Taylor and colleagues defined a set of four objective and straightforward criteria to guide patient selection (i.e. falls, delirium, dementia or care home/intermediate care), but no information was reported on how these concepts were operationalized (e.g. use of validated screening tools/definitions, screening moment, person performing the screening).[31]

Observation selection criteria of included studies focused predominantly at avoiding unnecessary admissions. This means that all patients requiring a prolonged ED stay without clear qualification for inpatient care were referred to the observation unit if possible (e.g. social problems). As the general accepted 'discharge to home' and 'inpatient conversion' rates are 80% and 20%, respectively, it is clear that 'observational failure' (i.e. admission of an observation patient) is a part of observation care, as well.[23] For older patients, this means that EOUs can be an ideal area to exclude atypical presentation of severe pathology in patients with non-specific complaints.[3,40]

Multidimensionality

The multidimensional character of assessments, described in the included studies, is very questionable and should get more attention, as only four studies clearly reported to assess a patient's medical, functional, cognitive and social capabilities.[27,28,31,38] However, one might consider that these aspects were poorly reported, as well. Therefore, authors, reviewers and editors should make more efforts to ensure that readers of a manuscript can clearly understand the content of an assessment and by extension the entire intervention if applicable. The TIDieR guidelines can be helpful for this purpose.[48] Important to know for non-geriatric trained caregivers in EOUs is that subjective, self-reported patient or caregiver data might be unreliable. Therefore a (C)GA uses objectively, validated instruments to assess the risk for specific problems.[49,50] After the initial assessment, (possible) problems should

be discussed with the patient and/or informal caregiver to develop tailored aims for further assessment, treatment and/or follow-up. A specific advantage of an observation stay, is the opportunity for patient reassessment. For researchers, this unexplored territory can deliver dynamic predictors for vulnerability algorithms that possibly outperform classic geriatric screening tools.[45,47]

Plan for treatment and follow-up

It is noteworthy that only one study reported using a type 1 observation unit structure (i.e. an EOU with a dedicated space for observation and clearly predetermined protocols to guide clinical care, as defined by Ross and colleagues[16]), which is considered superior to the three other types that are not protocol-based, lack a dedicated space or have neither.[23] Although one might say that protocol-driven EOUs can only admit older patients with a (working) diagnosis corresponding to a regular available protocol (e.g. low-risk chest pain protocol), it is also possible to develop specific, stand-alone geriatric protocols (e.g. frailty protocol, fragility fracture protocol). So, clinicians favoring protocol-driven observation care need to make a conceptual choice when initiating a geriatric approach: either add geriatric evaluation to existing protocols as a modular component or develop stand-alone geriatric protocols and possibly allow a patient to be observed according multiple protocols at once.

Since EOUs are pivotal points between primary, inpatient, outpatient, intermediate and residential care, it is important that different networks are available to smoothen care transitions (e.g. automated health data transfer). Obviously, proper arrangements with ambulance services are necessary, as well, to ensure that patients can leave the EOU as soon as possible.

Clinicians considering to "geriatricize" their EOU or start a geriatric-focused observation unit can use for this purpose the accreditation framework for geriatric emergency departments[51], the "Silver book"[7] or the McCusker framework[52]. As these documents offer a range of possibilities to enhance the care for older adults with emergency care needs, stepwise integration of quality improvement initiatives using properly selected implementation strategies seems recommended.[53]

Limitations and strengths

Following methodological limitations of this study need to be considered when interpreting the study results. First, possibly not all relevant studies

were identified, as the search was limited to three databases and did not include grey literature. Theoretically, some papers which did not report having a geriatric focus in its emergency observation unit could have been improperly excluded. However, we estimate these odds are relatively small as geriatric emergency care initiatives are rather novel and emerging. Another restriction regarding retrieved articles could be due to the language skills of the research team (i.e. only studies in English, French and Dutch were considered for inclusion). Second, the last stage of the revised methodological framework for scoping reviews (i.e. consultation of stakeholders for study finding validation) was not performed.[20,21] However, this stage was reported to be optional. Strengths of this study are the rigorous application of the essential stages in the methodological framework for scoping reviews, the systematic literature search and assessment of study quality.

CONCLUSIONS

This scoping review documented that the structure and processes of EOUs with a geriatric focus are very heterogeneous and rarely cover all elements of CGA. Further research is necessary to determine how complex care principles of 'observation medicine' and '(C)GA' can ideally be merged and successfully implemented in clinical care.

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CHAPTER 4

SUPPLEMENTAL FILES

SUPPLEMENTARY TABLE S1. Final search strings per database on March 5th, 2020

MEDLINE (n=2193)	((Emergency Medical Services[Mesh] OR Emergency Medical Service*[tiab] OR Emergency health service*[tiab] OR Emergency Treatment[Mesh] OR Emergency Treatment*[tiab] OR Emergencies[Mesh] OR "Emergencies"[tiab] OR "emergency"[tiab] OR Emergency Service, Hospital[Mesh] OR "Hospital Emergency Service"[tiab] OR Emergency Nursing[Mesh] OR "Emergency Nursing"[tiab] OR "emergency care"[tiab] OR emergency department*[tiab] OR emergency room*[tiab] OR emergency ward*[tiab] OR emergency unit*[tiab] OR "ED"[tiab] OR "EDs"[tiab] OR Acute Medical Unit*[tiab]) **AND** (aged[Mesh] OR "Aged"[tiab] OR "geriatric care"[tiab] OR "Gerontologic Care"[tiab] OR Geriatric Nursing[Mesh] OR "Geriatric Nursing"[tiab] OR "Gerontologic Nursing"[tiab] OR "elderly"[tiab] OR "elder"[tiab] OR "elders"[tiab] OR older patient*[tiab] OR older person*[tiab] OR "older people"[tiab] OR older adult*[tiab] OR "senior"[tiab] OR "seniors"[tiab] OR geriatric patient*[tiab] OR "geriatric"[tiab]) **AND** (Clinical Observation Units[Mesh] OR observation unit*[tiab] OR observation stay*[tiab] OR short stay hospital*[tiab] OR short stay unit*[tiab] OR short stay*[tiab] OR assessment unit*[tiab] OR frailty unit*[tiab] OR "observation medicine"[tiab] OR "observation status"[tiab] OR "Observation"[tiab]))
EMBASE (n=4143)	('emergency medical services':ti,ab,kw OR 'emergency health service'/exp OR 'emergency health service*':ti,ab,kw OR 'emergency treatment'/exp OR 'emergency treatment*':ti,ab,kw OR 'emergencies':ti,ab,kw OR 'emergency'/exp OR 'emergency':ti,ab,kw OR 'hospital emergency service'/exp OR 'hospital emergency service*':ti,ab,kw OR 'emergency nursing'/exp OR 'emergency nursing':ti,ab,kw OR 'emergency care'/exp OR 'emergency care':ti,ab,kw OR 'emergency department*':ti,ab,kw OR 'emergency room*':ti,ab,kw OR 'emergency ward'/exp OR 'emergency ward*':ti,ab,kw OR 'emergency unit*':ti,ab,kw OR 'ed':ti,ab,kw OR 'eds':ti,ab,kw OR 'acute medical unit*':ti,ab,kw) **AND** ('aged'/exp OR 'aged':ti,ab,kw OR 'geriatric care'/exp OR 'geriatric care':ti,ab,kw OR 'gerontologic care':ti,ab,kw OR 'geriatric nursing'/exp OR 'geriatric nursing':ti,ab,kw OR 'gerontologic nursing':ti,ab,kw OR 'elderly':ti,ab,kw OR 'elder':ti,ab,kw OR 'elders':ti,ab,kw OR 'older patient*':ti,ab,kw OR 'older person*':ti,ab,kw OR 'older people'/exp OR 'older people':ti,ab,kw OR 'older adult'/exp OR 'older adult*':ti,ab,kw OR 'senior':ti,ab,kw OR 'seniors':ti,ab,kw OR 'geriatric patient*':ti,ab,kw OR 'geriatric':ti,ab,kw) **AND** ('observation unit'/exp OR 'observation

	unit*':ti,ab,kw OR 'observation stay*':ti,ab,kw OR 'short stay hospital'/exp OR 'short stay hospital*':ti,ab,kw OR 'short stay unit'/exp OR 'short stay unit*':ti,ab,kw OR 'short stay*':ti,ab,kw OR 'assessment unit*':ti,ab,kw OR 'frailty unit*':ti,ab,kw OR 'observation medicine':ti,ab,kw OR 'observation status':ti,ab,kw OR 'Observation':ti,ab,kw)
CINAHL (n=802)	MH "Emergency Medical Services+" OR TI "Emergency Medical Service*" OR AB "Emergency Medical Service*" OR TI "emergency health service*" OR AB "emergency health service*" OR MH "Emergency Treatment+" OR TI "Emergency (Treatment*" OR AB "Emergency Treatment*" OR MH "Emergencies+" OR TI "Emergencies" OR AB "Emergencies" OR TI "Emergency" OR AB "Emergency" OR MH "Emergency Service+" OR TI "Emergency Service*" OR AB "Emergency Service*" OR MH "Emergency Nursing+" OR TI "Emergency Nursing" OR AB "Emergency Nursing" OR MH "Emergency Care+" OR TI "Emergency Care" OR AB "Emergency care" OR TI "Emergency Department*" OR AB "Emergency Department*" OR TI "Emergency Room*" OR AB "Emergency Room*" OR TI "Emergency Ward*" OR AB "Emergency Ward*" OR TI "Emergency Unit*" OR AB "Emergency Unit*" OR TI "ED" OR AB "ED" OR TI "EDs" OR AB "EDs" OR TI "Acute Medical Unit*" OR AB "Acute Medical Unit*") **AND** (MH "Aged+" OR TI "Aged" OR AB "Aged" OR TI "Geriatric Care" OR AB "Geriatric Care" OR MH "Gerontologic Care" OR TI "Gerontologic Care" OR AB "Gerontologic Care" OR TI "Geriatric Nursing" OR AB "Geriatric Nursing" OR MH "Gerontologic Nursing+" OR TI "Gerontologic Nursing" OR AB "Gerontologic Nursing" OR TI "Elderly" OR AB "Elderly" OR TI "Elder" OR AB "Elder" OR TI "Elders" OR AB "Elders" OR TI "Older Patient*" OR AB "Older Patient*" OR TI "Older Person*" OR AB "Older Person*" OR TI "Older People" OR AB "Older People" OR TI "Older Adult*" OR AB "Older Adult*" OR TI "Senior" OR AB "Senior" OR TI "Seniors" OR AB "Seniors" OR TI "Geriatric Patient" OR AB "Geriatric Patient" OR TI "Geriatric" OR AB "Geriatric") **AND (**MH "Observation Units" OR TI "Observation Unit*" OR AB "Observation Unit*" OR TI "Observation Stay*" OR AB "Observation Stay*" OR TI "Short Stay Hospital*" OR AB "Short Stay Hospital*" OR TI "Short Stay Unit*" OR AB "Short Stay Unit*" OR TI "Short Stay*" OR AB "Short Stay*" OR TI "Assessment Unit*" OR AB "Assessment Unit*" OR TI "Frailty Unit*" OR AB "Frailty Unit*" OR TI "Observation Medecine" OR AB "Observation Medecine" OR TI "Observation Status" OR AB "Observation Status" OR TI "Observation" OR AB "Observation")

SUPPLEMENTARY TABLE S2. Quality appraisal of included studies with Methodological Index for Non-Randomized Studies

	Anpalahan 2002[36]	Bruun 2018[32]	Chu 2007[26]	Conroy 2014[27]	Edmans 2013[28]	Foo 2012[38]	Khan 1997[29]	Leung 2019[39]	Misch 2014[40]	Nielsen 2018[33]	Ong 2012[37]	Silvester 2012[30]	Southerland 2018[41]	Strøm 2017[34]	Strøm 2018[35]	Taylor 2016[31]
A clearly stated aim	2	2	1	2	2	2	1	1	2	2	1	1	1	2	2	1
Inclusion of consecutive patients	1	2	2	2	1	1	2	1	2	1	1	2	1	1	1	2
Prospective data collection	1	2	2	1	2	2	1	1	2	2	1	2	1	2	2	1
Endpoints appropriate to the aim of the study	1	2	1	2	2	2	1	2	2	2	2	2	1	2	2	2
Unbiased assessment of the study endpoint	0	1	2	2	2	1	1	2	2	2	1	1	0	2	2	0

Follow-up period appropriate to study aim	2	2	2	2	2	2	1	2	2	2	2	2	2	2	2	2
Loss to follow up less than 5%	0	1	1	2	1	1	0	0	2	2	0	2	0	2	2	0
Prospective calculation of the study size	0	2	0	2	2	0	0	0	0	2	0	0	0	0	2	0
An adequate control group	NA	2	NA	1	2	1	NA	1	NA	1	1	NA	NA	1	2	0
Contemporary groups	NA	2	NA	1	2	1	NA	2	NA	2	0	NA	NA	2	2	1
Baseline equivalence of groups	NA	2	NA	1	1	2	NA	1	NA	1	1	NA	NA	1	1	0
Adequate statistical analyses	NA	2	NA	2	2	2	NA	1	NA	2	2	NA	NA	2	2	2

The twelve items were scored NA (not applicable), 0 (not reported), 1 (reported but inadequate) or 2 (reported and adequate).

SUPPLEMENTARY TABLE S3. Design of emergency observation units with a geriatric focus

Study	Location	Dedicated area	Protocol availability	Hybrid unit*	Capacity	Accommodation, equipment and supplies
Anpalahan 2002[36]	NR	Yes	NR	NR	NR	NR
Bruun 2018[32]	ED[1]	Yes	NR	NR	NR	NR
Chu 2007[26]	HB	Yes	NR	NR	32 beds	NR
Conroy 2014[27]	ED[2]	Yes	NR	NR	8-12 beds	NR
Edmans 2013[28]	NR	Yes	NR	NR	NR	NR
Foo 2012[38]	ED[2]	Yes	NR	NR	24 beds	NR
Khan 1997[29]	ED[2]	Yes	NR	NR	8 beds	NR
Leung 2019[39]	ED[1]	Yes	Yes	NR	6 beds	NR
Misch 2014[40]	ED[1]	Yes	NR	Yes	NR	NR
Nielsen 2018[33]	ED[1]	NR	NR	NR	NR	NR
Ong 2012[37]	HB	Yes	NR	NR	13 beds	NR
Silvester 2012[30]	HB	Yes	NR	NR	NR	NR
Southerland 2018[41]	ED[1]	Yes	Yes	NR	20 beds	NR
Strøm 2017[34]	ED[2]	Yes	NR	NR	16 beds and 6 chairs	NR
Strøm 2018[35]	ED[2]	Yes	NR	NR	16 beds and 6 chairs	NR
Taylor 2016[31]	NR	Yes	NR	NR	12 beds, but flexible	NR

*Hybrid units: these units allow the dedicated space to be used by both observation patients and other patient populations (e.g. recovering elective procedure patients).; ED[1] = within main ED; ED[2] = immediately next to ED; HB = hospital-based; NR = not reported.

Chapter 4: Scoping review

SUPPLEMENTARY TABLE S4. Staffing of emergency observation units with a geriatric focus

	PHYSICIAN				NURSES				ALLIED HEALTH CARE PROFESSIONALS					
	G	CP	EDP/ AP	JMS	N	ANP/ APP	NCM/ PCC	MHL	SW	PT	DPC	OT	P	UN
Anpalahan 2002[36]		X		X	X	X								X
Bruun 2018[32]			X		X					X		X		
Chu 2007[26]		X	X		X				X	X	X	X		
Conroy 2014[27]	X	X	X		X		X			X		X		
Edmans 2013[28]	X	X	X		X					X		X		
Foo 2012[38]			X		X	X			X	X				
Khan 1997[29]		X	X						X	X		X		
Leung 2019[39]	X		X		X		X			X		X		
Misch 2014[40]			X		X									

Nielsen 2018[33]			X		X					X		X		
Ong 2012[37]				X	X				X	X		X		
Silvester 2012[30]	X			X	X				X	X		X	X	
Southerland 2018[41]	X	X	X		X	X	X			X			X	
Strøm 2017[34]			X							X		X		
Strøm 2018[35]		X	X	X	X					X		X		
Taylor 2016[31]	X	X	X	X	X		X	X	X	X		X	X	

G = geriatrician; CP = consultant physician (e.g. acute medical consultant, internal medicine consultant), EDP = emergency department physician, AP= acute physician, JMS = junior medical staff; N = nurse; ANP = advanced nurse practitioner; APP = advanced practice provider; NCM = nurse case manager; PCC = primary care coordinators; MHL=mental health liaison nurse; SW = social worker; PT = physiotherapist; DPC = discharge planning coordinator; OT = occupational therapist; P = pharmacist;, UN = unspecified

SUPPLEMENTARY TABLE S5. Admission policy of emergency observation units with a geriatric focus

Study	Time cut-off	Admission procedure	Process variation	Observation unit population
Anpalahan 2002[36]	48 hours	NR	NR	Medical patients who are generally (but not necessarily) old with multisystem diseases
Bruun 2018[32]	48-72 hours	NR	NR	Common complaints include infection, thromboembolic disease, musculoskeletal disease, cardiovascular disease, but not obvious signs of stroke or myocardial infarction.
Chu 2007[26]	72 hours	Closed	NR	Patients of all ages (over 16 years) who are likely to be investigated, managed and discharged within 72 hours.
Conroy 2014[27]	24 hours	NR	No; daily geriatrician coverage	Older people who are likely to be discharged home within 24 hours
Edmans 2013[28]	up to 72 hours	NR	NR	Patients with medical crises (no age-related criteria)
Foo 2012[38]	4-24 hours	NR	Yes: Monday till Saturday	Following conditions are accepted: allergy, appendicitis, asthma, blunt trauma, cellulitis, gastroenteritis, gout, heart failure, head injury, hypoglycaemia, pneumonia, pyelonephritis and seizure
Khan 1997[29]	up to 24 hours	Closed	Yes: Monday till Friday	Patients who appear to need a brief period of assessment or treatment. Diagnoses of patients who are frequently discharged home are: falls, injury, infection, constipation, collapse, stroke or TIA, social problems

Leung 2019[39]	72 hours	NR	NR	Older community-dwelling patients who were premobid independent for activities of daily living, with acute deconditioning due to an acute illness, increasing fall risk and need for post-discharge community support service
Misch 2014[40]	24 hours	NR	NR	NR
Nielsen 2018[33]	48 hours	NR	Yes: Monday till Friday	NR
Ong 2012[37]	36-48 hours	Open	NR	Sub-acute, undifferentiated patients with complex or multiple co-morbidities with functional impairment. Patients with low acuity triage score who require further assessment and investigations with potential for discharge within 48 hours.
Silvester 2012[30]	NR	NR	No; daily geriatrician coverage	NR
Southerland 2018[41]	24 hours	Closed	Yes: Monday through Saturday	Fulfilling criteria of 1 out of 37 protocols, including a protocol for patients who do not easily fit into any defined protocol. Criteria for consultations were left up to the ED physician.
Strøm 2017[34]	72 hours	Closed	NR	Patients in whom a short stay is realistic according to physician's assessment in the ED. Patients are discharged if there is no treatment ongoing and no tests should be applied on fast-track basis.

Strøm 2018[35]	72 hours	Closed	Unclear	Patients with no immediate life-threatening disease (e.g. minor medical ailments, deterioration of chronic diseases or diffuse symptoms), capable of walking from bed to bathroom without assistance. Patients dependent on extensive nursing care are excluded.
Taylor 2016[31]	NR. Mean LOS ≈ 24 hours	Open	Monday till Friday 8:30am-5:00pm	Patients identified on referral to medicine with at least one of following criteria: falls, delirium, dementia or care home/intermediate care residents

NR = Not reported; LOS = length of stay.

CHAPTER 5

A multicentre survey on geriatric care in emergency departments anno 2020: Part 1, staffing characteristics

This chapter is in preparation for submission as:
Heeren P, Lombaert L, Janssens P, Flamaing J, Sabbe M, Milisen K. A multicentre study on geriatric care in emergency departments anno 2020: Part 1, staffing.

ABSTRACT

Objective. The aim of this study was to describe staffing characteristics for care of older adults in emergency departments (EDs) and to identify related improvement opportunities.
Methods. A multicentre survey design was used. The head nurse of 63 Flemish EDs was contacted to complete a four-part questionnaire in collaboration with the chief physician of the ED. Part one to three collected following data: 1) demographic data of respondents, 2) general views on geriatric emergency care and 3) availability of geriatric practitioners and allied healthcare workers (HCWs). Part 4 explored the availability, relevance and feasibility of staffing standards.
Results. Data analysis was based on 32 questionnaires (response rate = 50.8%). The majority of respondents indicated that initiatives are necessary to improve geriatric care in EDs (n=30; 93.8%) and continuity of care after ED discharge (n=28; 87.5%). During daytime on weekdays, 31 (96.9%) and 23 (71.9%) EDs had the possibility to phone a geriatrician and the inpatient geriatric consultation team (IGCT) for bedside assessment of specific cases, respectively. The possibility for bedside assessment by a geriatrician on call decreased to 22 (68.8%) EDs during daytime in weekends and to almost half of EDs (51.6-56.3%) during nights. During nighttime and weekends, the IGCT was never or seldom (0-6.3%) available. Allied HCW were generally available for EDs by phone during daytime hours on weekdays. Region-wide improvement opportunities concerned the need for training in geriatric care aspects for both ED physicians and ED nurses.
Conclusion. Flemish EDs added specific expertise (i.e. geriatric practitioners and allied HCW) to ED staff at particular moments to respond better to the complex needs of older patients. To minimize disparities of care within and between EDs, training ED caregivers in geriatric care aspects is an important improvement opportunity. This should be set-up as part of an initiative to establish region-specific minimum standards for geriatric emergency care.

Keywords: Geriatric Emergency Medicine, Acute care, Emergency Department, Older Adults.

BACKGROUND

Emergency departments (EDs) focus traditionally on fast-paced assessment of acute complaints, early initiation of (time-critical) therapy and rapid disposition. While this approach remains essential for guaranteeing high quality care to the majority of ED patients, it has proved suboptimal for the growing group of vulnerable older adults.[1-4] Worldwide, plenty of studies have shown that integration of geriatric principles in emergency care can ameliorate the clinical and operational outcomes of this subgroup.[3,5,6] However, geriatric emergency guidelines remain poorly integrated in most EDs, which can be explained by two important reasons.[7,8] First, the evidence underpinning these guidelines is heterogeneous and lacks proven cost-effectiveness.[9] Second, these guidelines include a large number of recommendations without indicating priorities for their integration in clinical care.[10] To stimulate prioritised integration of geriatric emergency guidelines, the American College of Emergency Physicians (ACEP) introduced in 2018 the geriatric ED accreditation program, which provides standards across seven domains (i.e. staffing, education, policies/protocols/guidelines/procedures, quality improvement, outcome measurement, equipment/supplies, physical environment) and differentiates three accreditation levels for geriatric emergency care (i.e. basic, advanced and high-advanced geriatric EDs).[10,11]

In Belgium, EDs do not have to comply with specific requirements for delivering care to older patients. Nonetheless, in 2014, a survey on geriatric support in Belgian EDs described that collaboration between EDs and geriatric departments were emerging.[12] Therefore, the authors aimed to explore to what extent the American geriatric ED accreditation standards were available in Belgian EDs. The overall aim of this two-part study was to describe how Flemish EDs deliver care to older adults and identify improvement opportunities based on the ACEP Geriatric ED Accreditation Program. This manuscript reports findings concerning staffing characteristics and staffing-related accreditation standards only. Findings concerning geriatric-appropriate protocols, equipment and physical environment criteria were reported in part 2 of this study (i.e. chapter 6 of this dissertation).[13]

METHODOLOGY

Study design and setting

We conducted a cross-sectional, multicentre survey in Belgian EDs with Dutch as working language (N=63). These EDs were predominantly located in Flanders (i.e. the Dutch-speaking area of Belgium that is geographically located in its northern part). One ED in the Brussels-Capital Region, which is considered bilingual (i.e. French and Dutch), was eligible, as well.

Participants

The Flemish Emergency Nurses Association contacted all ED head nurses available in their membership database to complete a questionnaire in collaboration with the chief physician of the ED.

Development and validation of the questionnaire

Two documents inspired the development of a new questionnaire for the current study. These documents were the ACEP Geriatric ED Accreditation Program and the questionnaire of a previous survey on geriatric support in Belgian EDs.[11,12]

The new questionnaire included four parts. Part 1 focussed on characteristics of hospitals, EDs and respondents. Part 2 collected general views on geriatric emergency care, using a five-point Likert scale (i.e. "strongly disagree", "disagree", "no opinion / neutral", "agree" and "strongly agree") to rate six statements. Part 3 explored the availability of geriatric practitioners (i.e. geriatricians and members of the inpatient geriatric consultation team (IGCT) -which are generally geriatric trained nurses-) and allied health care workers (HCWs) (i.e. social worker, occupational therapist, physiotherapist, clinical pharmacist and dietician) on Flemish EDs. In part 4 of the questionnaire, operational standards focusing on staffing, protocols, equipment and physical environment characteristics were scored according three criteria. First, a dichotomous (yes or no) question (i.e. “Does current practice correspond to this standard?”) was scored to identify availability of each standard in Flemish EDs. Second, relevance of each operational standard was explored using a four-point Likert scale (i.e. not relevant/rather not relevant/rather relevant/very relevant). Third, feasibility of each operational standard was explored using a four-point Likert scale (not feasible/rather not feasible/rather feasible/very feasible).

The questionnaire was developed in two phases. The first phase consisted of three rounds in which the senior authors (JF, MS and KM) gave feedback on the readability, comprehensibility and completeness of a draft version developed by the junior authors (LL, PJ and PH). Subsequently, in the second phase, the board of the Flemish Emergency Nurses Association assessed the readability, comprehensibility and completeness of the questionnaire during one board meeting.

Data collection

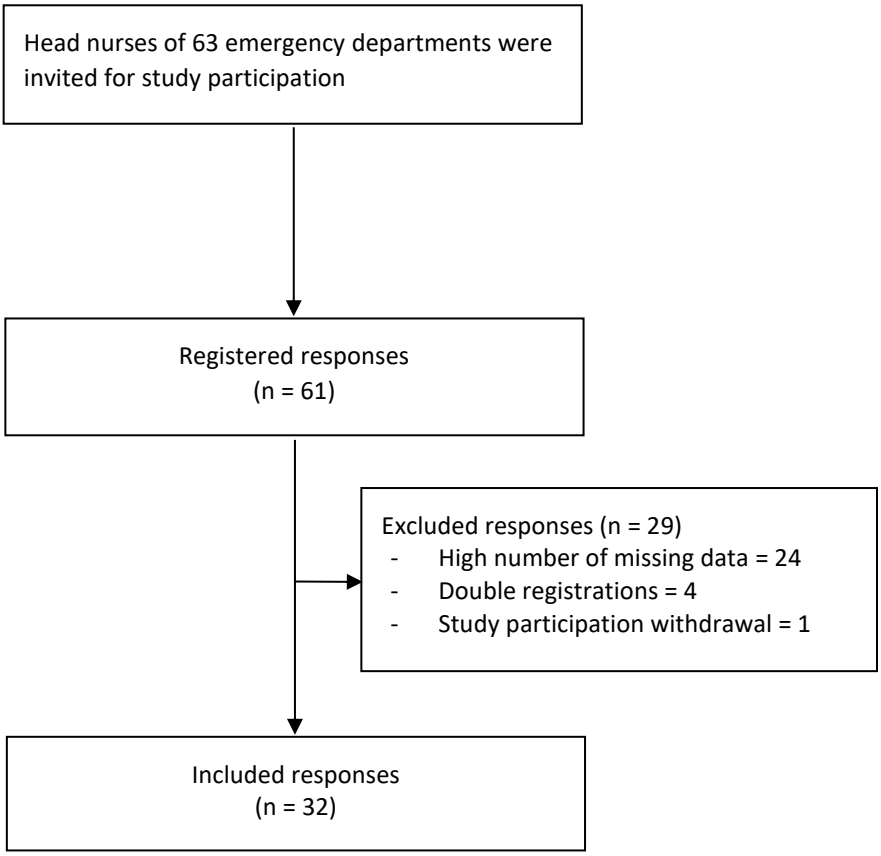
The Flemish Emergency Nurses Association e-mailed all ED head nurses in its membership database an invitation for study participation on 9 January 2020. This e-mail contained a weblink/url to the questionnaire, which was programmed in an online platform, Qualtrics.[14] One month after the study invitation, the Flemish Emergency Nurses Association e-mailed the first reminder. From 7 February 2020 until 27 February 2020, we contacted all eligible head nurses (N=63) by telephone to clarify the rationale of the study and ask engagement for study participation. Finally, on 4 March 2020, the Flemish Emergency Nurses Association e-mailed the second reminder. Data collection was closed on 13 March 2020.

Data analysis

Descriptive data analyses were conducted using SPSS (version 25) and Excel 2016. Absolute and relative frequencies, mode, median, mean, standard deviation, quartiles and interquartile range (IQR) were calculated, as appropriate.

The extent to which an operational standard was available on Flemish EDs was categorized into five groups: never (0%), seldom (1-25%), occasionally (26-50%), often (51%-75%) and very often (76-100%). Operational standards that were never to occasionally (0-50%) available on Flemish EDs and were scored (rather or very) relevant by at least 75% of respondents were labelled '*region-wide improvement opportunities'*. These region-wide improvement opportunities were categorized as 'high-threshold' and 'low-threshold' if at least 50% of respondents scored the operational standard 'not (or rather not) feasible' and '(rather or very) feasible', respectively.

FIGURE 1. Recruitment flowchart



RESULTS

Sample (figure 1)

A total of 61 responses were registered in the Qualtrics database. Twenty-nine were excluded. Exclusion reasons were high number of missing data (n=24), double registrations (n=4) and withdrawal of study participation (n=1). Data-analyses were based on 32 questionnaires (response rate is 50.8%), representing an equal number of EDs. These were located in three university and 28 non-university hospitals. One non-university hospital was allowed to

register two questionnaires, as it comprised two different EDs, each located on a separate campus and with a different head nurse.

Responding head nurses had a median age of 49 years old (IQR = 44-56) and were predominantly male (n=22; 69%). Chief ED physicians had a male/female ratio of 56:44 and a median age of 48 years old (IQR = 42-55). Median seniority in the current job was 12 years (IQR = 5-15) for head nurses and 7 years (IQR=7-13) for chief ED physicians.

General views on geriatric emergency care (table 1)
All respondents (100%) agreed or strongly agreed that older patients need a different clinical, medical and nursing approach compared to younger adults. Except for one person with a neutral opinion, all respondents (n=31; 96.9%) agreed that older patients need adapted equipment and infrastructural facilities. The majority of respondents indicated that initiatives are necessary to improve both geriatric care in EDs (n=30; 93.8%) and continuity of care after ED discharge (n=28; 87.5%)

Availability of geriatric practitioners on Flemish EDs (table 2)
In almost all EDs, a geriatrician was available by phone for advice during daytime on weekdays (n=32; 100%) including the possibility for bedside assessment of specific cases if deemed necessary during the phone call (n=31; 96.9%). Availability by phone for advice decreased to 23 EDs (71.9%) during daytime in the weekend and to 62.5% and 61.3% of EDs during nights on week and weekend days, respectively. The possibility for bedside assessment of specific cases decreased to 22 (68.8%) EDs during daytime in weekends and to 56.3% and 51.6% of EDs during nights on week and weekend days, respectively. A minority of EDs organised systematic presence of a geriatrician during daytime on weekdays. For example, during these moments, 10 (31.3%) EDs had a geriatrician available on a specific moment and 1 ED (3.1%) had a geriatrician physically present at all times.

Approximately 3 out of 4 respondents stated that the IGCT could be contacted by telephone during daytime on weekdays (n=24; 75%), including the possibility for bedside assessment if deemed necessary during this phone call (n=23; 71.9%). During nighttime and weekends, the IGCT was never or very seldom available (i.e. in maximum 1 ED (3.1%) during nighttime on weekdays and maximum 2 EDs (6.3%) during daytime in weekends). A few EDs organized systematic presence of the IGCT during daytime on weekdays. For example,

TABLE 1. General views on geriatric emergency care

STATEMENT	Strongly Disagree n (%)	Disagree n (%)	Neutral n (%)	Agree n (%)	Strongly agree n (%)
Older patients need a **different clinical approach** in comparison to younger adults.	0 (0)	0 (0)	0 (0)	17 (53,1)	15 (46,9)
Older patients need a **different medical approach** in comparison to younger adults.	0 (0)	0 (0)	0 (0)	18 (56,3)	14 (43,8)
Older patients need a **different nursing approach** in comparison to younger adults.	0 (0)	0 (0)	0 (0)	17 (53,1)	15 (46,9)
Older patients need **adapted equipment and infrastructural facilities** in comparison to younger adults.	0 (0)	0 (0)	1 (3,1)	17 (53,1)	14 (43,8)
Initiatives to **improve geriatric care on emergency departments** are necessary.	0 (0)	2 (6,3)	0 (0)	15 (46,9)	15 (46,9)
Continuity of care after emergency department discharge needs further optimization.	0 (0)	3 (9,4)	1 (3,1)	12 (37,5)	16 (50)

TABLE 2. Availability of geriatric practitioners on Flemish emergency departments

	Daytime on weekdays		Nighttime on weekdays		Daytime in weekend		Nighttime in weekend	
	GER*	IGCT*	GER*	IGCT*	GER*	IGCT*	GER°	IGCT*
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
By phone	32 (100)	24 (75,0)	20 (62,5)	1 (3,1)	23 (71,9)	2 (6,3)	19 (61,3)	0 (0)
Bedside, after phone call								
Specific cases	31 (96,9)	23 (71,9)	18 (56,3)	0 (0)	22 (68,8)	1 (3,1)	16 (51,6)	0 (0)
All cases	25 (78,1)	13 (40,6)	12 (37,5)	0 (0)	14 (43,8)	2 (6,3)	11 (35,5)	0 (0)
On a specific moment	10 (31,3)	4 (12,5)	3 (9,4)	0 (0)	5 (15,6)	0 (0)	3 (9,7)	0 (0)
Physically present on ED at all times	1 (3,1)	3 (9,4)	0 (0)	0 (0)	1 (3,1)	0 (0)	0 (0)	0 (0)

*No missing data; °Amount of missing data =1; GER = geriatrician; IGCT = inpatient geriatric consultation team

during these moments, 4 EDs (12.5%) had an IGCT member available on a specific moment and 3 EDs (9.4%) reported that an IGCT member was physically present at all times.

Availability of allied HCW on Flemish EDs (table 3)
Allied HCW (i.e. social workers, occupational therapists, physiotherapists, clinical pharmacists and dieticians) were generally available for EDs by phone during daytime hours on weekdays, with social workers (n=31; 96,9%), clinical pharmacists (n=25; 78,1%) and dieticians (n=22; 68,8%) having the highest availability. If deemed necessary during the phone call, all to more than half of EDs can count on social workers (n=32; 100%), clinical pharmacists (n=19; 59,4%) and physiotherapists (n=18; 56,3%) for bedside assessment of specific patients. During the weekend, clinical pharmacists were the most available allied HCW, with availability by phone on 13 EDs (40,6%) during day hours and 11 EDs (35,4%) during nighttime.

Staffing related geriatric emergency standards (table 4)
Two out of nine staffing standards were very often available in Flemish EDs at the moment of the survey. Regarding the first standard, 25 (78,1%) respondents confirmed continuously having at least one physician on duty capable to detect and initially treat urgent conditions in geriatric patients, including atypical presentations. Regarding the second standard, 25 (78,1%) respondents stated that the ED physician on duty was able to consult a geriatrician during daytime on week and weekend days according predetermined arrangements.

Two low-threshold region-wide improvement opportunities were identified. These concerned the need for training in geriatric care aspects for both ED physicians and ED nurses. No high-threshold region-wide improvement opportunities were identified. Two staffing standards scored slightly below the requirements to be a high-threshold region-wide improvement opportunity. These were considered relevant by 59.4% and 62.5% of respondents -which is below the threshold of 75%. The first standard stated that ED nursing staff must always have at least one nurse available who received further training on geriatric emergency care. The second standard stated that ED physicians and ED nursing staff must be able to engage a nursing case manager during daytime (on week and weekend days) to tailor an interdisciplinary plan for complex geriatric patients.

TABLE 3. Availability of allied healthcare workers on Flemish emergency departments

	Daytime on weekdays					Nighttime on weekdays				
	SOC*	**OT***	**PT***	**PH***	**DI***	**SOC°**	**OT***	**PT***	**PH°**	**DI***
	n (%)	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**
By phone	31 (96,9)	13 (40,6)	17 (53,1)	25 (78,1)	22 (68,8)	3 (9,7)	0 (0)	2 (6,3)	11 (35,4)	0 (0)
Bedside, after phone call										
- **Specific cases**	32 (100)	12 (37,5)	18 (56,3)	19 (59.4)	16 (50)	4 (12,9)	0 (0)	2 (6,3)	4 (12,9)	0 (0)
- **All cases**	29 (90,6)	7 (21,9)	13 (40,6)	13 (40,6)	7 (21,9)	1 (3,2)	0 (0)	1 (3,1)	2 (6,5)	0 (0)
On a specified moment	8 (25,0)	2 (6,3)	1 (3,1)	6 (18,8)	2 (6,3)	1 (3,2)	0 (0)	0 (0)	0 (0)	0 (0)
Physically present on ED at all times	3 (9,4)	1 (3,1)	0 (0)	4 (12,5)	1 (3,1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

	Daytime in weekend					**Nighttime in weekend**				
	SOC*	**OT***	**PT***	**PH***	**DI***	**SOC°**	**OT***	**PT***	**PH°**	**DI***
	n (%)	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**
By phone	5 (15,6)	0 (0)	11 (34,4)	13 (40,6)	2 (6,3)	3 (9,7)	0 (0)	2 (6,3)	11 (35,4)	0 (0)
Bedside, after phone call										
- **Specific cases**	6 (18,8)	0 (0)	12 (37,5)	8 (25,0)	1 (3,1)	4 (12,9)	0 (0)	2 (6,3)	4 (12,9)	0 (0)
- **All cases**	4 (12,5)	0 (0)	8 (25)	5 (15,6)	1 (3,1)	1 (3,2)	0 (0)	1 (3,1)	2 (6,5)	0 (0)
On a specified moment	2 (6,3)	0 (0)	0 (0)	1 (3,1)	0 (0)	1 (3,2)	0 (0)	0 (0)	0 (0)	0 (0)
Physically present on ED at all times	0 (0)	0 (0)	0 (0)	1 (3,1)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

SOC = social services; OT = occupational therapist; PT = physiotherapist; PH = clinical pharmacist; DI = dietician
*No missing data; °Amount of missing data =1

TABLE 4. Staffing related geriatric emergency care standards

Statement	Does current practice correspond to this standard?	
	Yes	No
The **ED physicians** need to be **trained in geriatric care.** This can be achieved through various options, such as participation in a course, further training, congress/symposium, e-learning.	6 (18,8)	26 (81,3)
The **ED physician** or one of the ED physicians on duty must be capable to **detect and initially treat urgent conditions** in geriatric patients. This includes **atypical presentations.**	25 (78,1)	7 (21,9)
The **ED nurses** need to be **trained in geriatric care.** This can be achieved through various options, such as participation in a course, further training, congress/symposium, e-learning.	8 (25)	24 (75)
The **ED nursing staff** must always have **at least one nurse** available who received **further training** on geriatric emergency care.	6 (18,8)	26 (81,3)
The **ED physician** on duty must be able to **consult a geriatrician** at least during daytime hours (on weekdays and weekends) according predetermined arrangements.	25 (78,1)	7 (21,9)
ED physicians and ED nursing staff must be able to engage a **nursing case manager** during **daytime** (on week and weekend days) to tailor an interdisciplinary plan for complex geriatric patients. This interdisciplinary plan documents problems, risks and actions to optimize ED care and guarantee continuity of care and follow-up.	1 (3,1)	31 (96,9)

How relevant is this standard?				How feasible is this standard?			
Not relevant	Rather not relevant	Rather relevant	Very relevant	Not feasible	Rather not feasible	Rather feasible	Very feasible
0 (0)	6 (18,8)	19 (59,4)	7 (21,9)	3 (9,4)	8 (25)	15 (46,9)	6 (18,8)
0 (0)	0 (0)	13 (40,6)	19 (59,4)	0 (0)	3 (9,4)	19 (59,4)	10 (31,3)
0 (0)	4 (12,5)	16 (50)	12 (37,5)	2 (6,3)	9 (28,1)	13 (40,6)	8 (25)
1 (3,1)	12 (37,5)	13 (40,6)	6 (18,8)	7 (21,9)	15 (46,9)	8 (25)	2 (6,3)
0 (0)	3 (9,4)	7 (21,9)	22 (68,8)	0 (0)	2 (6,3)	9 (28,1)	21 (65,6)
2 (6,3)	10 (31,3)	16 (50)	4 (12,5)	8 (25)	15 (46,9)	9 (28,1)	0 (0)

Statement	Does current practice correspond to this standard?	
	Yes	**No**
One of the **physicians** must have the **assigned responsibility to organise and coordinate** the geriatric emergency care programme.	1 (3,1)	31 (96,9)
At least **one person of the administrative department** needs to **follow up the geriatric emergency care programme** as part of his/her portfolio. This person should also be **actively involved** in this programme with the aim to facilitate its development.	1 (3,1)	31 (96,9)
The emergency department needs to appoint a **patient representative or patient council** for delivering at least monthly input on potential improvement opportunities for the geriatric emergency care programme.	4 (12,5)	28 (87,5)

How relevant is this standard?				How feasible is this standard?			
Not relevant	**Rather not relevant**	**Rather relevant**	**Very relevant**	**Not feasible**	**Rather not feasible**	**Rather feasible**	**Very feasible**
6 (18,8)	13 (40,6)	10 (31,3)	3 (9,4)	13 (40,6)	11 (34,4)	7 (21,9)	1 (3,1)
8 (25)	10 (31,3)	12 (37,5)	2 (6,3)	9 (28,1)	15 (46,9)	6 (18,8)	2 (6,3)
5 (15,6)	11 (34,4)	13 (40,6)	3 (9,4)	6 (18,8)	16 (50)	9 (28,1)	1 (3,1)

DISCUSSION

The classic ED approach has shown suboptimal to guarantee high quality care and outcomes for older adults.[1-3] To stimulate integration of geriatric emergency guidelines in clinical care, ACEP introduced a Geriatric ED Accreditation Program.[7,11] The aim of this study was to describe staffing characteristics for care of older patients in Flemish EDs and to identify improvement opportunities based on the staffing standards of the American Geriatric ED Accreditation Program.

An important finding of this study was that head nurses and chief physicians of Flemish EDs acknowledged that older adults need a different approach in various areas and that initiatives are necessary to improve ED-based geriatric care and continuity of care after ED discharge. This result should be interpreted as an important precondition to start harmonizing geriatric-friendly initiatives of individual EDs (e.g. heterogeneous availability of geriatric practitioners and allied HCW in EDs) towards minimum standards for geriatric emergency care, which are government-supported and financed. While these initiatives should focus predominantly on what constitutes high quality geriatric emergency care, it also remains essential to reflect on who is responsible for what aspect in age-attuned care processes.

Integrating a HCW qualified in geriatrics in the ED might be an ideal strategy to ensure high quality geriatric emergency care.[15-18] This is especially the case if these persons can be continuously present on the ED and if the daily number of older ED patients remains rather limited. However, many countries, including Belgium, report shortage of HCWs qualified in geriatrics and increasing numbers of older ED patients.[3,10,19,20] In this survey, no respondent reported that a geriatric practitioner or allied HCW was permanently present on the ED. Therefore, it seems indispensable to start a debate on the minimum competencies in geriatric medicine of ED physicians and nurses to minimise disparities in care when expertise is not available. This matches with the identified region-wide improvement opportunities, indicating the need for training both ED physicians and ED nurses in geriatric care aspects. The European curriculum in Geriatric Emergency Medicine can be a useful resource to start from when initiating such an endeavour on a macro-level (i.e. regional and/or national).[21]

Although determining minimum competencies in geriatric medicine for ED caregivers might also lower the need for having allied HCWs available in EDs, the odds for this assumption are quite limited. This is mainly explained by the fact that these professionals deliver extended assessments that are time consuming and therefore difficult to integrate within the responsibilities of ED caregivers. ED-based availability of most allied HCWs depends heavily on two factors: ED workflow and billing opportunities.[10] EDs with rather short targets for length of stay (e.g. 4-hour rule[22,23]) have few possibilities for organizing multidisciplinary assessments in the ED. A possible solution for this lack of assessment time is setting up observation units or frailty units within or next to the main ED to provide extended assessments and possibly prevent avoidable hospital admissions.[17,24,25] In the absence of billing possibilities for the ED-based activities of allied HCW, the resources intended for inpatients are often fully or partly used for this purpose -which is beneficial for ED patients but obviously to the detriment of inhospital patients. So, as allied health care resources might be scarce and can impede patient flow, ED caregivers should always consider whether these extended assessments can be organized outside the ED (e.g. outreach assessment, geriatric day clinic, during hospitalisation). Therefore, it is interesting to discuss what criteria define a discharge to the place of origin that is sufficiently safe.[26] A case manager on the ED (e.g. geriatric trained ED nurse, social worker, geriatric nurse practitioner) could facilitate this in practice (i.e. help the patient integrate clinical recommendations).[5] In this study, more than half of respondents considered a case manager relevant but less feasible, which is presumably related to lack of (financial) resources.

A limitation of this study is that some original standards of the Geriatric ED Accreditation Program needed adaptations to become unambiguous questions that were also adapted to the Belgian context. Although this might hamper the possibility to explore whether an ED fulfils staffing-related standards of a specific accreditation level, the available data suggest that at the moment of the survey, none of the Flemish EDs could be considered an advanced (i.e. level II) or high-advanced (i.e. level I) geriatric ED according the American Geriatric ED Accreditation Program. For example, only one ED had assigned responsibility to a physician to organise and coordinate the geriatric programme and one other ED reported to have a person of the administrative department available to monitor the geriatric emergency programme. Presumably, five EDs could met the staffing criteria of a basic (i.e. level III) geriatric ED, which requires permanent availability of at least one physician and one registered nurse who both received geriatric-focused training.

Although this data interpretation does not imply that the care for older patients in Flemish EDs is of poor quality, it should prompt care providers and policymakers to consider how the care for this vulnerable population can be structurally improved and what human resources should be allocated in support of this. The difficulty in this policy choice is lack of pertinent data on which staffing characteristics guarantee, improve or optimise the (cost-) effectiveness of geriatric emergency care interventions in the ED.[9] Based on best available evidence in an international perspective, one might assume that the beneficial effects of relevant studies are mainly realised by adding healthcare workers qualified in geriatrics to the ED team (i.e. geriatrician or (geriatric) nurse practitioner).[9,15-18] Although it seems logical that both ED physicians and ED nurses receive training in geriatric care and adopt a role in the geriatric emergency approach -as described earlier in this discussion-, there are at this moment no data available on the (cost-)effectiveness of such initiatives.

This study has other limitations that might have influenced study findings. First, study findings might not be generalizable to all ED head nurses and chief physicians, as the survey response rate was 50.8%. Second, this was a self-report questionnaire. As a consequence, the researchers cannot ensure that responses reflect reality or that respondents interpreted questions accurately.[27] Despite these limitations, this study is important because it is the first reporting the perspectives of Flemish ED leaders (i.e. head nurses and chief physicians) on geriatric emergency care and related improvement opportunities.

CONCLUSIONS

Head nurses and chief physicians of Flemish ED reported that efforts are necessary to improve care for older ED patients. Initiatives already pursuing this purpose predominantly focused at adding specific expertise (i.e. geriatric practitioners and allied HCWs) to ED staff at particular moments and much less on providing geriatric-focused training to ED physicians and ED nurses, which is an important improvement opportunity to minimize disparities in care. As the American geriatric ED accreditation standards cannot be easily transferred to the Flemish context, it seems appropriate for policy makers and clinicians to develop region-specific minimum standards for geriatric emergency care.

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CHAPTER 6

A multicentre survey on geriatric care in emergency departments anno 2020: Part 2, protocols, equipment and physical environment

This chapter is in preparation for submission as:
Heeren P, Lombaert L, Janssens P, Flamaing J, Sabbe M, Milisen K. A multicentre study on geriatric care in emergency departments anno 2020: Part 2, protocols, equipment and physical environment.

ABSTRACT

Objective. The aim of this study was to explore availability of geriatric-friendly protocols, equipment and physical environment criteria in emergency departments (EDs) and to identify related improvement opportunities.
Methods. A multicentre survey design was used. The head nurse of 63 Flemish EDs was contacted to complete a questionnaire in collaboration with the chief physician of the ED. The questionnaire was inspired on the American Geriatric ED Accreditation Program and explored the availability, relevance and feasibility of geriatric-friendly protocols, equipment and physical environment criteria. Descriptive analyses were performed. A region-wide improvement opportunity was defined as an accreditation standard that was never to occasionally (0-50%) available on Flemish EDs and was scored (rather or very) relevant by at least 75% of respondents.
Results. Thirty-two questionnaires were used for data analyses (response rate is 50.8%). All surveyed standards were available in at least one ED. Eighteen out of 52 standards (34.6%) were available in more than half of EDs. Ten region-wide improvement opportunities were identified. These comprised 7 protocols and 3 physical environment characteristics: 1) a geriatric approach initiated from physical triage, 2) elder abuse, 3) discharge to residential facility, 4) frequent geriatric pathologies, 5) standardised delirium screening, 6) medication reconciliation, 7) minimising nihil per os designation, 8) a large-face, analogue clock in each patient room, 9) raised toilet seats and 10) non-slip floors.
Conclusions. Care for older adults in Flemish EDs is very heterogeneous. Researchers, clinicians and policy makers need to define which geriatric-friendly protocols, equipment and physical environment criteria should become region-wide minimum operational standards. Findings of this study might facilitate the development process of this endeavour.

Keywords: Geriatric Emergency Medicine, Acute care, Emergency Department, Older Adults.

BACKGROUND

Older emergency department (ED) patients are characterized by interacting multi-domain problems and outcomes that are generally poorer compared to those of younger counterparts.[1-4] As the classic, complaint-oriented approach in EDs is suboptimal to manage this vulnerable subgroup of the ED population, geriatric emergency guidelines were developed.[5,6] To facilitate its integration in clinical care, the American College of Emergency Physicians (ACEP) launched in 2018 the Geriatric ED Accreditation Program, which focusses on seven domains (i.e. staffing, education, policies/protocols/guidelines/procedures, quality improvement, outcome measurement, equipment/supplies, physical environment) and differentiates EDs that deliver basic, advanced and high-advanced geriatric care.[7] A particular strength of this framework is that it is the first initiative introducing priorities for the integration of the numerous geriatric emergency care recommendations.[8]

Although Flemish EDs have no legal obligation to adapt their care to the needs of older patients, a survey reported in 2014 that the majority of these EDs had already set up collaborations with geriatric departments.[9] As the amount of EDs getting a Geriatric ED Accreditation label is increasing –with even one European ED involved-, the authors aimed to explore to what extent the American geriatric ED accreditation standards were available in Flemish EDs.[7] The overall aim of this two-part study was to describe how Flemish EDs deliver care to older adults and identify improvement opportunities, based on the ACEP Geriatric ED Accreditation Program. This second manuscript describes findings related to geriatric-friendly protocols, equipment and physical environment characteristics. Findings related to staffing characteristics were reported in part 1 of this study (i.e. chapter 5 of this dissertation).[10]

METHODOLOGY

Study design

A cross-sectional, multicentre survey was conducted in Flemish EDs (i.e. Belgian EDs with Dutch as working language; N=63). Detailed information concerning setting, questionnaire development and data collection were reported in part 1 of this study.[10]

Participants
The Flemish Emergency Nurses Association invited all ED head nurses of their membership database to complete one questionnaire in collaboration with the chief physician of the ED.

Questionnaire
A four-part questionnaire was developed based on the ACEP Geriatric ED Accreditation Program and the questionnaire of a previous survey on geriatric support in Belgian EDs.[7,9] Part 1 and 2 of the questionnaire focussed on sample characteristics and general views on geriatric emergency care. Part 3 explored the availability of geriatricians, inpatient geriatric consultation teams and allied healthcare workers on Flemish EDs. In part 4 of the questionnaire, operational standards regarding staffing, protocols, equipment and physical environment were scored according three criteria. First, a dichotomous (yes or no) question (i.e. "Does current practice correspond to this standard?") was scored to identify availability of each standard. Second, relevance of each standard was measured using a four-point Likert scale (i.e. not relevant/rather not relevant/rather relevant/very relevant). Third, feasibility of each standard was measured using a four-point Likert scale (not feasible/rather not feasible/rather feasible/very feasible).

Data collection
Data were collected from 9 January 2020 until 13 March 2020 using an online platform, Qualtrics.[11] Three initiatives were taken to stimulate study participation. The Flemish Emergency Nurses Association sent eligible participants an electronic reminder at two time points (i.e. at one month and two months after onset of data gathering). In February 2020, we contacted all eligible participants (N=63) by telephone to clarify the rationale of the study and ask engagement for study participation.

Data analysis
SPSS (version 25) and Excel 2016 were used to conduct descriptive data analyses. Absolute and relative frequencies, mode, median, mean, standard deviation, quartiles and interquartile range (IQR) were calculated, as appropriate.

Availability of standards on Flemish EDs was categorized into five groups: never (0%), seldom (1-25%), occasionally (26-50%), often (51%-75%) and very often (76-100%). '*Region-wide improvement opportunities*' were defined as

operational standards that were never to occasionally (0-50%) available on Flemish EDs and were scored (rather or very) relevant by at least 75% of respondents. These region-wide improvement opportunities were categorized as 'high-threshold' and 'low-threshold' if at least 50% of respondents scored the operational standard 'not (or rather not) feasible' and '(rather or very) feasible', respectively.

RESULTS

Sample

Thirty-two of 61 registered questionnaires were included for data analyses (response rate of 50.8%). Included questionnaires represented 32 EDs, located in three university and 28 non-university hospitals. Responding head nurses had a median age of 49 years old (IQR = 44-56) and were predominantly male (n=22; 69%). Chief ED physicians had a male/female ratio of 56:44 and a median age of 48 years old (IQR = 42-55). More sample characteristics can be consulted in part 1 of this study.[10]

Protocols

Out of 27 surveyed protocols, one ED (3.1%) reported to have none, while another (3.1%) had 22. The majority of respondents (n=21; 65.6%) reported having 1 to 9 protocols. Nine EDs (i.e. 28.1%) had 10 to 19 protocols.

One protocol was very often available in Flemish EDs; a protocol to inform a patient's general practitioner after ED discharge (n=25/32; 78.1%). Often available protocols focused on physical restraint use (n=23/32; 71.9%), fall risk assessment (n=22/32; 68.8%), access to patient transport services (n=20/32; 62.5%), pain management (n=18/32; 56.3%), and urinary catheter use (n=17/32; 53.1%). (Table 1)

Four low-threshold region-wide improvement opportunities were identified. These included i) a protocol with criteria for access to a geriatric approach starting from physical triage, ii) an elder abuse protocol, iii) a protocol to facilitate discharge to a residential facility and iv) protocols for work-up and initial treatment of frequent geriatric pathologies. Three standards were identified as high-threshold region-wide improvement opportunities. These focused on standardised delirium screening, medication reconciliation and a

protocol to minimise nihil per os status and improve access to appropriate drinks and food.

Equipment

Out of 14 surveyed elements, 14 (43.8%) EDs reported to have 1 to 4, while 17 (53.1%) had 5 to 9. One (3.1%) ED had 11 elements.

Four elements of the equipment list were very often available in Flemish EDs: i) pressure-ulcer reducing mattresses and pillows (n=27/32; 84.4%), ii) blanket warmer (n=26/32; 81.3%), iii) bedside commodes (n=26/32; 81.3%) and iv) low beds or high-low beds (n=28/32; 87.5%). The only equipment element that was often available were reclining arm chairs (n=19/32; 59.4%). Each type of walking aid (i.e. cane, four-point cane, walking frame, two wheeled walker and four wheeled walker) was available in only 1 (3.1%) or 2 (6.3%) EDs. One ED had both a cane and walker available. Non-slip socks were available in 12 (37.5%) EDs. No region-wide improvement opportunity was identified. (Table 2)

Physical environment

Out of 11 surveyed criteria, half of EDs (n=16; 50.0%) reported to have 1 to 4 criteria, while the other half (53.1%) had 5 to 9.

Two physical environment criteria were very often available on Flemish EDs: i) seating for visitors (i.e. at least two seats per room) (n=27/32; 84.4%) and ii) wheel-chair accessible toilets (n=27/32; 84.4%). Five elements were often available: i) easy access to food and drink (n=24/32; 75%), ii) efforts at noise reduction (n=17/32; 53.1%), iii) enhanced lightning (n=17/32; 53.3%), iv) adequate hand rails in sanitary facilities (n=24/32; 75%) and v) high quality signage and way-finding (n=22/32; 68.8%). Two low-threshold region-wide improvement opportunities were identified. These included having a large-face, analogue clock in each patient room and availability of raised toilet seats. Availability of non-slip floors was the only identified high-threshold region-wide improvement opportunity. (Table 3)

Chapter 6: Survey, part 2

TABLE 1. Availability, relevance and feasibility of geriatric emergency guidelines in Flemish EDs

	Does current practice correspond to this standard? Rather relevant n (%)		**How relevant is this standard?** n (%)				**How feasible is this standard?** n (%)			
	Yes	**No**	**Not relevant**	**Rather not relevant**	**Rather relevant**	**Not relevant**	**Not feasible**	**Rather not feasible**	**Rather feasible**	**Very feasible**
A guideline to define **criteria** for access to **Geriatric Emergency Department Care from ED triage**	8 (25)	24 (75)	2 (6,3)	4 (12,5)	20 (62,5)	6 (18,8)	4 (12,5)	11 (34,4)	14 (43,8)	3 (9,4)
A **standardized delirium screening** guideline with appropriate follow-up	3 (9,4)	29 (90,6)	2 (6,3)	8 (25)	15 (46,9)	7 (21,9)	2 (6,3)	17 (53,1)	9 (28,1)	4 (12,5)
A **standardized dementia screening** process	2 (6,3)	30 (93,8)	7 (21,9)	13 (40,6)	8 (25)	4 (12,5)	8 (25)	20 (62,5)	1 (3,1)	3 (9,4)
A guideline for **standardized assessment of function and functional decline** with appropriate follow-up	1 (3,1)	31 (96,9)	6 (18,8)	14 (43,8)	9 (28,1)	3 (9,4)	8 (25)	19 (59,4)	3 (9,4)	2 (6,3)

A guideline for **standardized fall assessment** guideline with appropriate follow-up	22 (68,8)	10 (31,3)	1 (3,1)	3 (9,4)	19 (59,4)	9 (28,1)	1 (3,1)	7 (21,9)	17 (53,1)	7 (21,9)
A guideline for identification of **elder abuse** with appropriate follow-up	7 (21,9)	25 (78,1)	0 (0)	6 (18,8)	21 (65,6)	5 (15,6)	2 (6,3)	10 (31,3)	16 (50)	4 (12,5)
A guideline for **medication reconciliation** in conjunction with a pharmacist	5 (15,6)	27 (84,4)	2 (6,3)	4 (12,5)	13 (40,6)	13 (40,6)	4 (12,5)	17 (53,1)	6 (18,8)	5 (15,6)
A guideline for to minimize the use of **potentially inappropriate medications**	4 (12,5)	28 (87,5)	3 (9,4)	10 (31,3)	8 (25)	11 (34,4)	3 (9,4)	17 (53,1)	7 (21,9)	5 (15,6)
A guideline for **pain control** in elder patients	18 (56,3)	14 (43,8)	2 (6,3)	2 (6,3)	10 (31,3)	18 (56,3)	1 (3,1)	4 (12,5)	14 (43,8)	13 (40,6)
A guideline for accessing **palliative care consultation** in the ED	16 (50)	16 (50)	3 (9,4)	7 (21,9)	13 (40,6)	9 (28,1)	3 (9,4)	10 (31,3)	8 (25)	11 (34,4)
A guideline for accessing **Geriatric Psychiatry consultation** in the ED	10 (31,3)	22 (68,8)	5 (15,6)	8 (25)	14 (43,8)	5 (15,6)	8 (25)	11 (34,4)	7 (21,9)	6 (18,8)

Chapter 6: Survey, part 2

Use of a **protocol** for the **work-up and initial treatment** of at least three **frequently occurring ED presentations** in older patients (e.g. delirium, hip fracture, syncope, sepsis, myocardial infarction, stroke, etc.). These protocols not only standardise the request for technical tests and order sets, but also include management plans (including geriatric-appropriate medications and dosing).	13 (40,6)	19 (59,4)	0 (0)	2 (6,3)	17 (53,1)	13 (40,6)	0 (0)	5 (15,6)	17 (53,1)	10 (31,3)
A guideline to standardize and minimize **urinary catheter use**	17 (53,1)	15 (46,9)	0 (0)	0 (0)	20 (62,5)	12 (37,5)	0 (0)	3 (9,4)	18 (56,3)	11 (34,4)
A guideline to **minimize NPO designation** and to promote access to appropriate food and drink	5 (16,1)*	26 (83,9)*	3 (9,4)	3 (9,4)	15 (46,9)	11 (34,4)	2 (6,3)	16 (50)	8 (25)	6 (18,8)
A guideline to **promote mobility**	4 (12,5)	28 (87,5)	6 (18,8)	10 (31,3)	9 (28,1)	7 (21,9)	6 (18,8)	18 (56,3)	4 (12,5)	4 (12,5)

A guideline to guide the use of **volunteer engagement**	9 (28,1)	23 (71,9)	4 (12,5)	5 (15,6)	11 (34,4)	12 (37,5)	5 (15,6)	9 (28,1)	10 (31,3)	8 (25)
A **standardized discharge guideline** for patients discharged home that addresses age-specific communication needs (large-font, lay person's language, clear follow-up plan, evidence of patient communication)	2 (6,3)	30 (93,8)	3 (9,4)	6 (18,8)	14 (43,8)	9 (28,1)	2 (6,3)	10 (31,3)	15 (46,9)	5 (16)
A guideline for **general practitioner notification**	25 (78,1)	7 (21,9)	0 (0)	0 (0)	13 (40,6)	19 (59,4)	0 (0)	0 (0)	16 (50)	16 (50)
A guideline to address **transitions of care to residential care**	13 (40,6)	19 (59,4)	1 (3,1)	4 (12,5)	10 (31,3)	17 (53,1)	0 (0)	8 (25)	13 (40,6)	11 (34,4)
A guideline to **minimize use of physical restraints**	23 (71,9)	9 (28,1)	0 (0)	1 (3,1)	14 (43,8)	17 (53,1)	0 (0)	3 (9,4)	16 (50)	13 (40,6)

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Standardized access to **geriatric specific follow-up clinics**: comprehensive geriatric assessment clinic, falls clinic, memory clinic, other	9 (28,1)	22 (68,8)	6 (18,8)	2 (6,3)	16 (50)	8 (25)	7 (21,9)	6 (18,8)	14 (43,8)	5 (15,6)
A guideline for **post-discharge follow up** (phone, telemedicine, other)	3 (9,4)	29 (90,6)	7 (21,9)	8 (25)	11 (34,4)	6 (18,8)	9 (28,1)	13 (40,6)	4 (12,5)	6 (18,8)
Access to **transportation services** for return to residence	20 (62,5)	12 (37,5)	0 (0)	2 (6,3)	16 (50)	14 (43,8)	2 (6,3)	6 (18,8)	12 (37,5)	12 (37,5)
A pathway program providing **easy access to short- or long-term rehabilitation services**, including inpatient	7 (21,9)	25 (78,1)	8 (25)	7 (21,9)	9 (28,1)	8 (25)	8 (25)	14 (43,8)	5 (15,6)	5 (15,6)
Access to an **outreach program providing home assessment** of function and safety	2 (6,3)	30 (93,8)	8 (25)	12 (37,5)	5 (15,6)	7 (21,9)	10 (31,3)	15 (46,9)	2 (6,3)	5 (15,6)
Access to and an active relationship with **community paramedicine follow up services**	7 (21,9)	25 (78,1)	7 (21,9)	7 (21,9)	13 (40,6)	5 (15,6)	7 (21,9)	14 (43,8)	7 (21,9)	4 (12,5)

An **outreach program to residential care homes** to enhance quality of care and of ED transfers	3 (9,4)	29 (90,6)	4 (12,5)	5 (15,6)	12 (37,5)	11 (34,4)	6 (18,8)	14 (43,8)	7 (21,9)	5 (15,6)

*(n=31)

TABLE 2. Availability, relevance and feasibility of equipment for optimal geriatric care in Flemish emergency departments

	Does current practice correspond to this standard? n (%)		How relevant is this standard? n (%)				How feasible is this standard? n (%)			
	Yes	No	Not relevant	Rather not relevant	Rather relevant	Not relevant	Not feasible	Rather not feasible	Rather feasible	Very feasible
Non-slip socks	12 (37,5)	20 (62,5)	6 (18,8)	6 (18,8)	8 (25)	12 (37,5)	6 (18,8)	9 (28,1)	5 (15,6)	12 (37,5)
Pressure-ulcer reducing mattresses and pillows	27 (84,4)	5 (15,6)	1* (3,2)	1* (3,2)	10* (32,3)	19* (61,3)	1* (3,2)	0* (0)	11* (35,5)	19* (61,3)
Blanket warmer	26 (81,3)	6 (18,8)	3* (9,7)	0* (0)	14* (45,2)	14* (45,2)	2* (6,5)	0* (0)	12* (38,7)	17* (54,8)
Hearing assist devices	2 (6,3)	30 (93,8)	10 (31,3)	14 (43,8)	6 (18,8)	2 (6,3)	21 (65,6)	9 (28,1)	0 (0)	2 (6,3)
Bedside commodes	26 (81,3)	6 (18,8)	1 (3,1)	8 (25)	15 (46,9)	8 (25)	2 (6,3)	1 (3,1)	13 (40,6)	16 (50)
Condom catheters	12* (38,7)	19* (91,3)	3 (9,4)	11 (34,4)	12 (37,5)	6 (18,8)	1 (3,1)	7 (21,9)	11 (34,4)	13 (40,6)
Bedside step stool	7 (21,9)	25 (78,1)	12 (37,5)	5 (15,6)	11 (34,4)	4 (12,5)	9 (28,1)	6 (18,8)	9 (28,1)	8 (25)
Reclining arm chairs	19 (59,4)	13 (40,6)	3 (9,4)	6 (18,8)	14 (43,8)	9 (28,1)	2 (6,3)	10 (31,3)	8 (25)	12 (37,5)

Low beds/ high-low beds	28 (87,5)	4 (12,5)	1 (3,1)	1 (3,1)	7 (21,9)	23 (71,9)	1 (3,1)	0 (0)	7 (21,9)	24 (75)
Cane	2 (6,3)	30 (93,8)	12 (37,5)	10 (31,3)	9 (28,1)	1 (3,1)	8 (25)	6 (18,8)	12 (37,5)	6 (18,8)
4-point cane	1 (3,1)	31 (96,9)	11 (34,4)	9 (28,1)	10 (31,3)	2 (6,3)	9 (28,1)	7 (21,9)	12 (37,5)	4 (12,5)
Walking frame	2 (6,3)	30 (93,8)	10 (31,3)	8 (25)	11 (34,4)	3 (9,4)	9* (29)	8* (25,8)	9* (29)	5* (16,1)
Two wheeled walker	2 (6,3)	30 (93,8)	11 (34,4)	9 (28,1)	10 (31,3)	2 (6,3)	7 (21,9)	9 (28,1)	9 (28,1)	7 (21,9)
Four wheeled walker	2 (6,3)	30 (93,8)	11 (34,4)	10 (31,3)	9 (28,1)	2 (6,3)	8 (28,1)	9 (28,1)	10 (31,3)	5 (15,6)

*(n=31)

TABLE 3. Availability, relevance and feasibility of physical environment criteria for optimal geriatric care in Flemish emergency departments

	Does current practice correspond to this standard? n (%)		How relevant is this standard? n (%)				How feasible is this standard? n (%)			
	Yes	No	Not relevant	Rather not relevant	Rather relevant	Not relevant	Not feasible	Rather not feasible	Rather feasible	Very feasible
A **separate, physically delineated area** is available to exploit the geriatric emergency care function.	2 (6,3)	30 (93,8)	11 (34,4)	9 (28,1)	8 (25)	4 (12,5)	18 (56,3)	8 (25)	6 (18,8)	0 (0)
Easy access to **food and drink**	24 (75)	8 (25)	0 (0)	6 (18,8)	19 (59,4)	7 (21,9)	1 (3,1)	4 (12,5)	19 (59,4)	8 (25)
Ample seating for visitors and family (**at least 2 seats per room**)	27 (84,4)	5 (15,6)	1 (3,2)*	3 (9,7)*	16 (51,6)*	11 (35,5)*	2 (6,5)*	3 (9,7)*	10 (32,3)*	16 (51,6)*
A **large-face analog clock** in each patient room	16 (50)	16 (50)	1 (3,1)	4 (12,5)	13 (40,6)	14 (43,8)	3 (9,4)	1 (3,1)	16 (50)	12 (37,5)
Efforts at **noise reduction** (separate enclosed rooms)	17 (53,1)	15 (46,9)	0 (0)	10 (31,3)	17 (53,1)	5 (15,6)	4 (12,5)	11 (34,4)	13 (40,6)	4 (12,5)

Enhanced lighting (e.g. natural light, artificial skylight or window,…)	17 (53,1)	15 (46,9)	1 (3,1)	1 (3,1)	21 (65,6)	9 (28,1)	2 (6,3)	11 (34,4)	9 (28,1)	10 (31,3)
Non-slip floors	6 (18,8)	26 (81,3)	0 (0)	6 (18,8)	18 (56,3)	8 (25)	5 (15,6)	12 (37,5)	13 (40,6)	2 (6,3)
Adequate **hand rails in sanitary facilities**	24 (75)	8 (25)	0 (0)	0 (0)	13 (40,6)	19 (59,4)	0 (0)	3 (9,4)	10 (31,3)	19 (59,4)
High-quality signage and way-finding	22 (68,8)	10 (31,3)	0 (0)	4 (12,5)	12 (37,5)	16 (50)	1 (3,1)	4 (12,5)	12 (37,5)	15 (46,9)
Wheel-chair accessible toilets	27 (84,4)	5 (15,6)	0 (0)	0 (0)	10 (31,3)	22 (68,8)	1 (3,1)	1 (3,1)	8 (25)	22 (68,8)
Availability of **raised toilet seats**	11 (34,4)	21 (65,6)	2 (6,3)	1 (3,1)	14 (43,8)	15 (46,9)	3 (9,4)	3 (9,4)	15 (46,9)	11 (34,4)

*(n=31)

DISCUSSION

To encourage incorporation of geriatric emergency guidelines in clinical care, the Geriatric ED Accreditation Program was initiated.[7,8] The aim of this study was to explore availability of geriatric-friendly protocols, equipment and physical environment characteristics in Flemish EDs and identify related improvement opportunities based on the American Geriatric ED Accreditation Program.

This study described that Flemish EDs have taken initiatives on individual basis to adapt their activities to the needs of older patients. Although this is beneficial for numerous patients, it has introduced disparities in care between EDs. For example, out of 27 surveyed protocols, one ED reported having 22 protocols available, while one other reported to have none. Though it is unknown to what extent this might impact quality of care and outcomes, these findings should prompt clinicians and policymakers to determine which protocols, equipment and environmental characteristics should become minimum operational standards in Flemish EDs, by analogy with region-wide legislation for the care of children in these EDs.

Determining minimum operational standards for geriatric emergency care is not expected to be a straight-forward exercise, as each surveyed standard was already available in at least one Flemish ED. Therefore, it would be appropriate to conduct this exercise with a systematic approach including predefined decision-making rules (i.e. Delphi study methodology).[12,13] In some respects, described availability of surveyed standards can enable this decision-making process. For example, a surveyed standard that was already very often available in Flemish EDs is expected to have increased odds to become an operational standard, as well. However, excessive focus on already available initiatives could make the minimum standards merely a harmonisation of care. Of course, the purpose is to focus especially on what constitutes high quality geriatric emergency care.

To guarantee a reflection of high quality geriatric emergency care in operational standards, these are ideally defined with an interdisciplinary panel (e.g. ED physicians, ED nurses, geriatricians and geriatric nurses). This should avoid care-related inconsistencies, which are also present in the results of this study. For example, in the current survey, almost 70% of the respondents

reported having a standardized fall assessment guideline with follow-up possibilities ((n=22/32; 68.8%). Knowing this, it is remarkable that all surveyed walking aids were only available in one or two EDs. Even more, the majority of respondents scored walking aids not or rather not relevant, while their purpose should be preventing falls during ED stay and avoiding unnecessary admissions among patients with balance difficulties (e.g. some patients with balance difficulties can return home safely if they can use a walking aid correctly during ED stay). As availability of mobility aids is for these reasons one of the few minimum requirements to obtain a geriatric ED accreditation label, it is obvious that purchasing walking aids and learning how to use them is an important improvement opportunity for Flemish EDs.[7]

Among all the improvement opportunities identified according the definition in the methodology section, systematic screening for delirium is probably one of the most important, as delirium can be an atypical presentation of acute disease (e.g. sepsis).[14-18] Although its onset can also be caused by other interacting factors (e.g. premorbid cognitive deficit and sensory impairments), consequences of undetected delirium have shown to be associated with increased risk of mortality and progressive functional decline.[19,20] As emergency admissions in vulnerable older adults and the onset of delirium in this population are often medication-related, it is a relevant finding that medication reconciliation was identified as an improvement opportunity, as well.[14] However, as both systematic screening for delirium and medication reconciliation were identified as high-threshold region-wide improvement opportunities, further research is necessary to explore which factors impede the feasibility of elaborating these items.

A limitation of this study (besides those already mentioned in part 1[10]) was that the questionnaire only explored those domains of the American Geriatric ED Accreditation Program that were directly related to patient care. As a result, the domains on quality improvement and outcome measurement were not surveyed. Keeping the questionnaire as short as possible and the assumption that geriatric emergency care initiatives in Flanders were rather in a premature phase led to this choice. In spite of this, these domains play an indispensable role in EDs aiming to provide high-quality geriatric care. Therefore, future research should aim to map geriatric-oriented monitoring initiatives of Flemish EDs. Ideally, consensus is sought on a region-wide set of quality indicators, as well, which can allow benchmarking activities, as was done in the German 'GeriQ-ED project'.[21]

CONCLUSIONS

Flemish EDs have taken initiatives on individual basis to adapt their activities to the needs of older patients. As these have introduced disparities in care between EDs, there is a need to define which geriatric-friendly protocols, equipment and physical environment characteristics should become region-wide minimum operational standards. Findings of this study can facilitate researchers, clinicians and policy makers in the development process of these operational standards.

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CHAPTER 7

A consensus statement on minimum operational standards for geriatric emergency care in Belgium: a modified Delphi study

This chapter is in preparation for submission as:
Heeren P, Islam F, Desruelles D, Flamaing J, Sabbe M, Milisen K, on behalf of the Belgian URGENT Delphi Group. A consensus on minimum operational standards for geriatric emergency care in Belgium: a modified Delphi study.

ABSTRACT

Purpose. As emergency department (ED) leaders started integrating geriatric emergency guidelines on a facultative basis, important variations have emerged between EDs in care for older patients. The aim of this study was to establish a clinical consensus on minimum operational standards for geriatric ED care in Belgium.
Methods. A 20-person expert panel participated in a two-stage modified Delphi study. In stage 1, an online survey was conducted to identify and define all possible elements of geriatric emergency care. Next, in stage 2, an online survey and online expert panel meeting were organized consecutively to determine which elements should be minimum operational standards.
Results. Between March 2020 and February 2021, the expert panel developed a broad consensus including 10 statements focusing on the target population, specific goals, availability of geriatric practitioners and quality assurance. In addition, the expert panel also determined which protocols, materials and accommodation criteria should be available in conventional EDs (39 standards) and in observational EDs (57 standards).
Conclusion. This study presents a consensus on minimum operational standards for geriatric emergency care specific for the Belgian healthcare system. These findings may serve as a starting point towards broadly supported standards of care stipulated by law.

Keywords: Acute care, Emergency Department, Observation Unit, Older Adults, Geriatric Emergency Medicine

BACKGROUND

The traditional fast-paced and complaint-focused emergency department (ED) model does not succeed in delivering optimal care to the growing group of older adults (i.e. persons over 65 years of age).[1,2] This is illustrated by several studies reporting that important problems specific to this vulnerable population (e.g. cognitive impairment, falls) are often not considered during ED disposition planning.[3] Therefore, older adults are in comparison to their younger counterparts at increased risk for adverse events, such as death, unplanned readmission and functional decline.[4,5]

Although there is a clear need for geriatric ED care, convincing policymakers to invest in this new branch of Emergency Medicine remains a global challenge. The main reason is that geriatric emergency care models have not been compellingly (cost)effective.[6] However, as these findings are affected by methodological limitations, it is not ethical to withhold older adults from safe and low complex care improvements (e.g. delirium and fall prevention) until robust evidence is available.[7] Therefore, several ED leaders (i.e. mainly physicians and registered nurses) started operationalising geriatric emergency guidelines.[8,9] While some EDs managed to achieve comprehensive, high-quality standards in this field, other focus much less on this topic.[10,11] Consequently, important variations in geriatric ED care have emerged. To tackle these variations in care, formal frameworks adapted to individual healthcare system characteristics are necessary.

In Belgium, legislation establishes the minimum operational standards for (in)hospital care. For example, there is a Royal Decree on the hospital-based care programme for geriatric patients that is both recognised and financed by the government.[12] In addition, there is also a similar Royal Decree organizing the function 'specialised emergency care'.[13] However, the focus on geriatric care in the ED is lacking in both documents, which is a remarkable gap, as the ED is the gateway to inhospital care for many vulnerable older adults. The majority of healthcare workers in Belgian EDs recognising the need for a specific approach in older patients, are awaiting national standards for geriatric ED care.[14,15] As a first step towards such standards fulfilling the legislation gap, the objective of this study is to establish clinical consensus on minimum operational standards for geriatric ED care in Belgium.

METHODOLOGY

Study design

A two stage modified Delphi study was conducted, based on Veugelers' guide for design choices in Delphi studies.[16,17] The first part of the current study aimed, via an online survey, at identifying and defining all possible elements of geriatric emergency care. The second part envisaged prioritization of geriatric emergency care elements, which was obtained via an online survey and online consensus meeting.

Ethics approval or formal informed consent was not obtained for this study, as it did not include patient data or information. E-mails and an introduction for each questionnaire were used to inform expert panel members about the objectives and study procedures. Completion of the questionnaire was considered as an informed consent. All analyses were performed anonymously.

Expert panel

Since care for older adults involves different healthcare professionals, the expert panel reflected this feature.[18] A 20-person expert panel was established from December 2019 to January 2021, including 3 ED physicians, 5 geriatricians, 4 ED nurses, 5 geriatric nurses and 3 health care policy experts. This panel was well balanced and diverse for several reasons. For example, expert panel members had on average 19 years of relevant professional experience (minimum-maximum: 2-33 years) and 6 persons were appointed to management positions (i.e. 2 heads of departments, 4 head nurses). In total, 8 persons were affiliated to Flemish hospitals (i.e. Dutch speaking and in the northern part of Belgium) and nine to Walloon hospitals (i.e. French speaking and in the southern part of Belgium), respectively. Three persons were working for a bilingual health care policy organization. Six panel members were affiliated to a university hospital.

Pre-defined decision-making rules

The following decision-making rules were applied during this study. First, consensus was achieved when at least 70% of the expert panel members agreed (positive consensus) or disagreed (negative consensus) on every aspect of a question. Second, items reaching consensus were rediscussed when two panellists raised the same comment. Third, the request for adjusting an

element (definition) or adding answer categories was accepted if at least two panellists had this similar request. The relevance and value of requests coming from one panellist only were discussed during research team meetings.

Stage 1: identifying and defining all possible geriatric emergency care elements

Stage 1 included one part. Based on core documents in geriatric emergency medicine (i.e. the Silver book[9], the American geriatric ED guidelines[8], the American geriatric ED accreditation framework[19] and the McCusker framework[20]), PH drafted an initial list of geriatric emergency care elements and their definitions in Dutch. This list was customised during two research team meetings and, finally, converted into a questionnaire, in which following question was asked for each element: "Do you agree that this element (and its definition) is a component of geriatric emergency care?" If yes, no additional question was provided. If no, an open text field was available to argument why not and to propose adjustments. In addition, panel members could also propose to add or delete elements. The final questionnaire was translated into French. Depending on the panel member's working language, the respondent completed the Dutch or French version of the questionnaire via 'Qualtrics' software.[21] PH analysed expert panel input based on the predefined decision-making rules. Results were discussed during research team meetings.

Stage 2: Prioritizing geriatric emergency care elements for the Belgian context

Stage 2 included two consecutive parts. In part 1 of stage 2, a two-section questionnaire was sent to all participants by an email invitation which could be completed in Dutch or French via the 'Qualtrics' software.[21] In the first section, expert panel members were asked to rate the necessity of geriatric emergency care elements in the Belgian context within two different ED models of care, i.e. the 'conventional ED' and the 'observational ED' models of care. (The definition of these care models is described in the results section under art. 3 and 4 of the minimum operational standards for geriatric emergency care). The necessity of each item in both care models was measured using a 9-point Likert scale, ranging from 1 (clearly not necessary) to 9 (clearly necessary).[22] Respondents knew before completing the questionnaire, that Likert scale scores would be transformed into three groups (based on the MoSCoW-method[23]). These were 'MUST HAVE OR MINIMUM STANDARD' (score 7-9: without this element, it is not feasible to deliver adequate emergency care for older patients), 'SHOULD HAVE' (score 4-6; this

element is very desirable, but without its availability, it is feasible to deliver adequate emergency care for older patients) and 'COULD HAVE' (score 1-3; this item will only be available in case of sufficient time and resources). In the second section of this questionnaire, panel members rated to what extent they agreed (i.e. not at all/partly/completely) on statements concerning organisational aspects of minimum operational standards for geriatric emergency care in Belgium. If a panellist did not completely agree with a statement, an open text field was provided to argument why not and to make suggestions. Expert panel input was analysed and discussed as reported in stage 1.

In part 2 of stage 2, one online consensus meeting was organized. After introducing panel members to each other, findings of stage 1 were presented and discussed until consensus was reached according the decision rules described above.

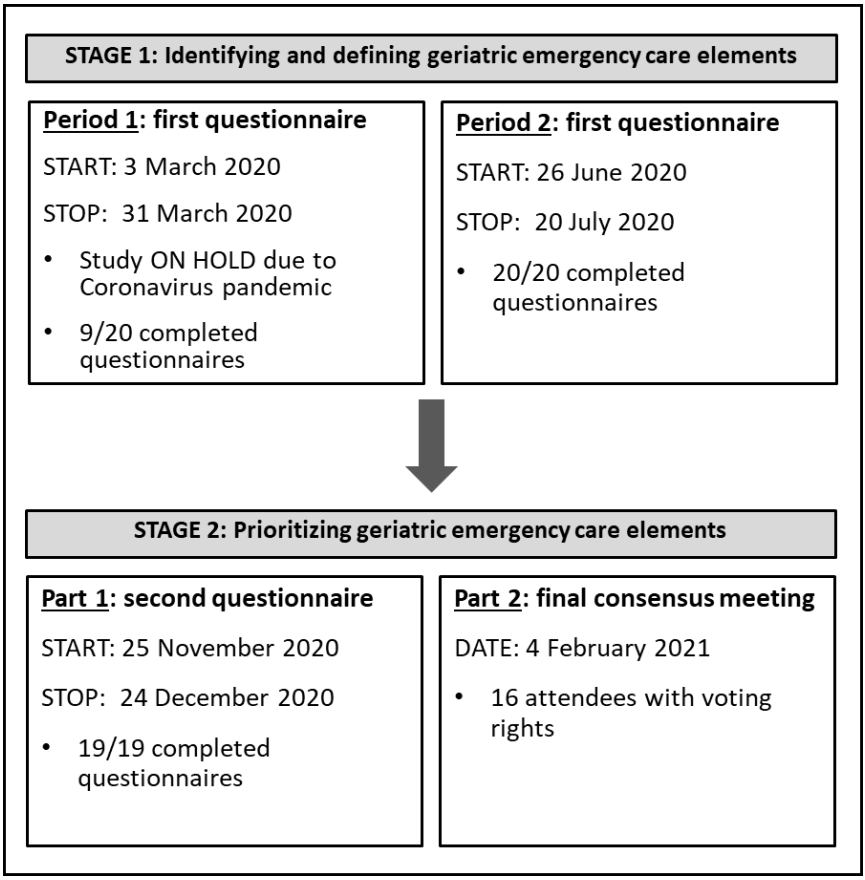
RESULTS

Research process (Figure 1)
The first questionnaire aiming to identify and define geriatric emergency care elements was sent on the 3th of March 2020. On the 31th of March 2020, the study was put on hold due to the Coronavirus (COVID-19) pandemic. At that moment, 9 panel members had completed the questionnaire. The first stage was restarted on the 26th of June 2020. The e-mail announcing the study relaunch invited expert panel members to complete the questionnaire within a month or adapt their responses where necessary, as the experience of the Coronavirus pandemic might have led to new insights and opinions. On the 20th of July 2020, all respondents had completed the questionnaire. Analyses yielded positive consensus for 41 out of 50 proposed elements and their definitions.

The second questionnaire (i.e. part 1 of stage 2) aiming to prioritise geriatric emergency care elements in two different models of care was sent to the expert panel members on the 25th of November 2020. One expert panel member with valuable knowledge in the field of health care policy decided not to complete this questionnaire due to lack of clinical experience. All 19 remaining respondents had completed the questionnaire on the 24th of

December 2020. Results indicated that if consensus was found, this only concerned positive consensus about elements that should be minimal standards (or "must haves") to deliver adequate geriatric emergency care. For conventional and observational EDs, 29 and 47 geriatric emergency care elements (table 1, 2 and 3) were determined as minimal standards, respectively. Positive consensus was found for 3 statements (table 4) describing organisational aspects of minimum standards for geriatric emergency care in Belgium.

FIGURE 1. Research process



The online consensus meeting (i.e. part 2 of stage 2) was organized on the 4th of February 2021. Thirteen expert panel members and 5 members of the research team attended this meeting. PH and FI were chairperson and reporter of the meeting, respectively. All attendees except the chairperson and reporter had voting rights during the meeting (n=16; 5 geriatricians, 4 ED physicians, 4 geriatric nurses, 2 ED nurses, 1 health care policy expert). After the consensus meeting, the minimum operational standards included 10 statements (table 4) with 39 and 57 geriatric emergency care elements for conventional and observational EDs (table 1, 2 and 3), respectively.

Minimum operational standards for geriatric emergency care in Belgium (table 4)

Art 1. The minimum standards for geriatric emergency care are targeted at:

- the population of older adults, as defined in Article 3 of the Royal Decree of the 29th of January 2007* establishing the standards to be met by the care programme for geriatric patients (text updated on the 18th of April 2014).
- the population of (younger) adults with a profile similar to that of the geriatric patient in the Royal Decree of the 29th of January 2007 (text updated on the 18th of April 2014).

These populations will be described as the **target group** in the following articles.

> **Article 3 in the Royal Decree of 29 January 2007 stipulates that the care programme for the geriatric patient addresses the population of geriatric patients, on average older than 75 years, who require a specific approach for several of the reasons listed below:*
>
> 1. *Fragility and limited homeostasis;*
> 2. *Active polypathology;*
> 3. *Atypical clinical presentation;*
> 4. *Disturbed pharmacokinetics;*
> 5. *Risk of functional deterioration;*
> 6. *Risk of deficient nutrition;*
> 7. *Tendency to inactivity and bedriddenness, with increased risk of institutionalisation and dependence in activities of daily living;*
> 8. *Psychosocial problems.*

Art 2. The **objective** of the minimum standards for geriatric emergency care is threefold and includes:
1. To assess the risk of atypical presentation of a serious condition
2. To orient the patient to the most appropriate location in the care system
3. To ensure continuity of geriatric care aspects.

Art 3. All EDs must meet at least the minimum standards of geriatric emergency care for **conventional EDs**. These are EDs with an intended length of stay of no more than 4 hours and whose main objective is, after physical triage, to obtain a differential diagnosis (mainly distinguishing between urgent and less urgent conditions), to start essential treatment and to refer the patient.

Art 4. The minimum standards of geriatric emergency care for conventional EDs are extended with additional criteria if the ED is equipped with observation facilities for the target group. This organisational model will hereinafter be defined as an '**ED with geriatric-focused observation beds' or an 'observational ED'**. An observation stay extends the intended ED length of stay to a maximum of 24 hours and combines the objectives of a conventional ED with the intention of avoiding unnecessary hospitalisation (and the associated risks and costs). The observation period is used for patients who presumably do not require hospitalisation, but still need to stay in the ED for more than 4 hours for reassessment or to conduct additional testing, treatments and/or consultations.[24,25]

Art 5. The minimum standards of geriatric emergency care are guaranteed by the use of:
1. Specific clinical protocols and guidelines (table 1)
2. Specific materials and equipment (table 2)
3. Specific accommodation criteria (table 3)
4. Availability of a geriatrician and/or a member of the inpatient geriatric consultation team
5. Quality control.

Art 6. Conventional EDs must ensure availability of a geriatrician and/or a member of the inpatient geriatric consultation team within the locoregional hospital network, according to predefined arrangements. This person must at least be available by telephone for advice during daytime hours on weekdays and weekends.

Art 7. EDs with geriatric-focused observation beds should be able during daytime hours on weekdays and weekends to call on a geriatrician and/or a member of the inpatient geriatric consultation team to establish a geriatric treatment plan and coordinate its implementation in consultation with the locoregional primary care network.

Art 8. The chief medical officer, the head of the ED and the head of the geriatric care programme must ensure that ED staff, geriatricians and members of the inpatient geriatric consultation team are sufficiently trained and equipped to guarantee the minimum standards of geriatric emergency care.

Art 9. The coordination and organisation of the minimum standards for geriatric emergency care are the responsibility of the head of the ED in consultation with the head of the care programme for the geriatric patient.

Art 10. If an ED is part of a hospital without a care programme for the geriatric patient, this ED must set up a functional collaboration with a hospital within the locoregional hospital network that does have a care programme for the geriatric patient.

DISCUSSION

All over the world, EDs started adapting their structure and care processes to the complex needs of older adults.[6] As these initiatives introduced variations in care within healthcare systems, healthcare system-specific minimum standards for geriatric ED care need to be established. As a first step towards such standards in Belgium, the objective of this study was to establish a clinical consensus on minimum operational standards for geriatric ED care nationally.

The obtained consensus is very broad and aligns to a considerable degree with the high quality geriatric emergency care level defined by the American Geriatric ED Accreditation Program.[8,19] The main difference between this high quality accreditation level and the current consensus is that the extent of standards in the current consensus is determined by ED type, namely a conventional ED or an observational ED, while this is not taken into account in

Table 1. Specific clinical protocols and guidelines within the minimum standards for geriatric emergency care in Belgium

Protocol/Guideline	P1	P2	Consensus definition
Medical referral data	18/19	-	A protocol, established by general practitioners, the ED and the geriatric department, to determine which patient-related data must be provided when an older adult is referred to the ED. (Sharing of these data should preferably take place electronically).
Nursing referral data	17/19	-	A protocol, established by community care nurses, residential care facilities, the geriatric department and the ED, to determine which patient-related data must be provided when an older adult is referred to the ED. (Sharing of these data should preferably take place electronically).
Prehospital care	16/19	-	A protocol, established by general practitioner organisations, the ED and the geriatric department to focus on geriatric care aspects in prehospital settings. For example: if possible, surveying important geriatric problems of the patient (such as a recent fall, attention function, memory...) and ensuring that all important items related to the patient, such as home medication schedule, glasses and hearing aids are brought to the ED.
Triage at the ED	17/19	-	A short protocol established by the ED and the geriatric department to allow the triage team to assess the risk of atypical presentations of serious conditions in patients.
Pain	18/19	-	A protocol established by the ED and the geriatric department enabling ED physicians and nurses to prevent, recognise and treat pain in older patients.
Delirium	17/19	-	A protocol established by the ED, the (geriatric) psychiatry department and the geriatric department for prevention, early recognition and treatment of delirium in patients.

Restraint measures	16/19	-	A protocol established by the ED and the geriatric department to minimise the use of restraint measures in patients.
Fall and fracture prevention	14/19	-	A protocol established by the ED and the geriatric department for primary and secondary fall and fracture prevention in patients. This protocol should also include different referral options.
Medication reconciliation	-	14/14	The report of the attending physician should describe that the current drug therapy was evaluated with particular attention to possible adverse drug events in patients.
Medication rationalisation	-	13/13	A protocol established by the ED, the geriatric department, the clinical pharmacy department and the locoregional general practitioners organisation(s) to minimise the use of unnecessary and/or potentially harmful drugs in patients who are not hospitalised. This is part of basic inhospital care in patients who are hospitalised.
Elder abuse	14/19	-	A protocol established by the ED and the geriatric department for the identification and management of elder abuse in patients (e.g. physical, psychological, financial, sexual and neglect).
Palliative and terminal care	15/19	-	A protocol established by the ED and the geriatric department enabling ED physicians and nurses to inform and support the patient (and their family) in their decision on therapeutic options and, if necessary, the initiation of palliative or terminal care.
Geriatric follow-up	-	14/15	Within the topic of 'geriatric follow-up', two protocols are proposed in function of the patient's discharge destination: 1. A protocol established by the ED and the geriatric department to provide a geriatric follow-up by the inpatient geriatric consultation team when necessary. 2. A protocol established by the ED, the geriatric department and the locoregional general practitioner organisation(s) to provide a geriatric follow-up at the geriatric day-hospital or geriatric consultation when necessary.
Discharge instructions for	14/19	-	A protocol established by the ED and the geriatric department on instructions for how to adapt and clearly communicate patient discharge-related information with

patients and informal caregivers			the patient and their (informal) caregiver. (e.g. large font, lay language, re-summarizing what has been discussed with the patient).
Discharge instructions for community nurses and nurses working in residential care facilities	17/19	-	A protocol to provide community nurses and/or nurses from residential facilities with patient-related data that are essential at the time of patient discharge and are necessary to optimise continuity of care.
*Functional screening**	15/19	-	A post-triage screening protocol established by the ED and the geriatric department enabling ED physicians and nurses to detect functional decline in the patient. This protocol should also include different referral options.
*Cognitive screening**	14/19	-	A post-triage screening protocol established by the ED, the (geriatric) psychiatry department and the geriatric department enabling ED physicians and nurses to detect and register cognitive problems in patients. This protocol should also include different referral options for cognitive problems.
*Behavioural and psychological symptoms of dementia**	15/19	-	A protocol established by the ED, the (geriatric) psychiatry department and the geriatric department for prevention and treatment of behavioural and psychological problems as part of dementia/neurocognitive diseases. This protocol should also include different referral options.
*Substance abuse**	14/19	-	A protocol established by the ED, the (geriatric) psychiatry department and the geriatric department for the detection and management of problems related to substance abuse (such as alcohol, medications and/or drugs). This protocol should also include different referral options.
*Skin problem**	14/19	-	A protocol established by the ED and the geriatric department for ED doctors and nurses to prevent and initially treat skin problems in patients (e.g. such as pressure ulcers, moisture lesions, dermatitis).

*Food and drinks**	15/19	-	A protocol established by the ED and the geriatric department for ED doctors and nurses to offer patients food and drinks as appropriate to their needs and to minimise the 'nihil per os' status (both for diagnostic/therapeutic reasons and when swallowing problems are presumed).
*Disposition planning**	17/19	-	A protocol, established by general practitioner organisations, community nurses organisations, the ED and the geriatric department to facilitate safe discharge planning of patients with attention for continuity of care and early involvement of informal (e.g. family) and formal caregivers in primary care.
*Transfer to residential care facility**	15/19	-	A protocol to facilitate patient transfers to a residential care facility.

ED = emergency department, e.g. = example given.

*This element is not a minimum standard for conventional EDs, but is for **EDs with geriatric-focused observation beds**.

P1 = The number of expert panel members that indicated during part 1 (of stage 2) that the element considered should be a minimum standard; P2 = The number of expert panel members that indicated during part 2 (of stage 2) that the element considered should be a minimum standard.

Table 2. Specific materials and equipment within the minimum standards for geriatric emergency care in Belgium

Materials and equipment for conventional EDs	P1	P2
Wheelchairs	17/19	-
High-low beds/ stretchers	17/19	-
Pressure-reducing seat cushions and mattresses	14/19	-
Materials to warm up a hypothermic patient	18/19	-
Bladder scan	16/19	-
Urinal	19/19	-
Toilet chair	18/19	-
Pictograms overview (in case of language barrier)	15/19	-
Cane	-	11/12
Four-wheeled walker	-	10/12
Two-wheeled walker	-	9/12
Walking frame	-	10/12
Non-slip socks	-	10/12
Lumbar belt and wrist and ankle straps	-	11/12
Front tray/table that can be fixed to a recliner chair	-	10/12
Toilet seat raiser*	14/19	-
Condom catheters*	14/19	-
Height-adjustable bedside table with lockable wheels*	18/19	-
Positioning cushions*	16/19	-
Patient lifting device*	16/19	-
Patient transfer board*	14/19	-
Adapted eating and drinking material (such as anti-tremor cup, adapted cutlery...)*	15/19	-

*This element is not a minimum standard for conventional EDs, but is for **EDs with geriatric-focused observation beds**.

P1 = The number of expert panel members that indicated during part 1 (of stage 2) that the element considered should be a minimum standard; P2 = The number of expert panel members that indicated during part 2 (of stage 2) that the element considered should be a minimum standard.

Table 3. Specific accommodation criteria within the minimum standards for geriatric emergency care in Belgium

Accommodation criteria for conventional EDs	P1	P2
Clear signage and way finding (e.g. colour contrast, large labelling of rooms...)	15/19	-
Non-slip floors	14/19	-
Efforts for noise reduction (e.g. silent alarms, closed rooms)	14/19	-
Handrails in sanitary facilities (toilet, shower)	18/19	-
Handrails in corridors	18/19	-
A wheelchair accessible toilet	19/19	-
A large-face analogue clock in each patient room	14/19	-
Opportunity for one visitor and the patient to sit beside the bed of the patient	17/19	-
Night-time lighting in the sanitary facilities	16/19	-
Natural light or dimmable lighting*	18/19	-
Raised toilet seats*	16/19	-
Calendar with day and date*	15/19	-

e.g. = example given.

*This element is not a minimum standard for conventional EDs, but is for **EDs with geriatric-focused observation beds**.

P1 = The number of expert panel members that indicated during part 1 (of stage 2) that the element considered should be a minimum standard; P2 = The number of expert panel members that indicated during part 2 (of stage 2) that the element considered should be a minimum standard.

Chapter 7: Minimum operational standards

TABLE 4. Minimum operational standards for geriatric emergency care in Belgium

Article	P1	P2	Remark
Article 1 – Target group	-	15/16	/
Article 2 – Objectives	17/19	16/16	Although this was a consensus-achieved item in part 1 of phase 2 (i.e. questionnaire), it was discussed during part 2 of phase 2 (i.e. meeting).
Article 3 – Conventional ED	-	14/16	/
Article 4 – Observational ED	-	13/16	/
Article 5 – Summary list	-	-	There was no formal voting on this article, as it summarizes specific action points for high quality geriatric emergency care (elaborated in tables 1-3 and articles 6-10).
Article 6 – Availability geriatrician and/or IGCT member in conventional ED	-	15/15	/

Article 7 - Availability geriatrician and/or IGCT member in observational ED	-	15/15	/
Article 8 – Training and equipment	18/19	14/15	Although this was a consensus-achieved item in part 1 of phase 2 (i.e. questionnaire), it was discussed during part 2 of phase 2 (i.e. meeting).
Article 9 – Coordination and organisation	15/19	14/15	Although this was a consensus-achieved item in part 1 of phase 2 (i.e. questionnaire), it was discussed during part 2 of phase 2 (i.e. meeting).
Article 10 – Functional partnership	-	14/15	/

P1 = The number of expert panel members that indicated during part 1 (of stage 2) that the element considered should be a minimum standard; P2 = The number of expert panel members that indicated during part 2 (of stage 2) that the element considered should be a minimum standard.

ED = emergency department; i.e. = id est; IGCT = inpatient geriatric consultation team.

the American Geriatric ED Accreditation Program. Another important difference between both concerns the possibility to determine the extensiveness of geriatric ED care quality, which is possible in the American Program (e.g. availability of three quality levels) and impossible in the current consensus. Of course, this is explained by the fundamental difference between accreditation initiatives and minimum requirements imposed by law.

Despite the differences between the instruments (e.g. accreditation, law text), which are available to achieve high quality geriatric emergency care on a health system level, the pathway towards this ultimate goal is assumed more or less similar. It is obvious that both require a step-by-step effort over several years. To create momentum for change in the beginning of this process, it is advisable that EDs -preferably in collaboration with professional organisations- start focusing as much as possible on easy-to-achieve goals, such as the acquisition and correct use of recommended materials (e.g. walking aids). Specifically, in integrating a law determining health system-wide geriatric emergency care standards, there is greater potential for policy and government representatives to push the boundaries of goals which are hard to achieve for individual EDs, such as development of performant digital communication platforms and stimulating collaborations between care organisations towards networks. In addition, system-wide uniformity in geriatric emergency care will also ensure that specific guidelines or protocols can be more easily integrated into the basic training of clinicians. These examples make it clear that organizing efficient geriatric emergency care requires efforts outside the ED, as well. Therefore, if the results of this study were to be consulted in order to stipulate a legal basis for geriatric emergency care in Belgium, necessary efforts outside the ED should also be considered in a strategic roadmap towards high quality unplanned care for older adults.

This study had several limitations. First, generalizability of study findings to other countries is limited, as the expert panel was instructed to reflect on the basis of the Belgian health care system. However, this study can inspire other countries to set up a similar exercise accounting their specific healthcare system characteristics. Second, the predefined level for consensus (i.e. agreement among at least 70% of expert panel members) might have influenced the consensus' extensiveness. However, there is no universal guideline for the recommended level of consensus.[16,17] Commonly applied levels vary between 51% and 80%. Applying the 80% consensus level post factum would reduce the consensus' extensiveness and might be helpful to identify broadly supported elements. However, this exercise also yields the

risk of excluding important items. For example, in part 1 of stage 2 (i.e. questionnaire), there was a 70% consensus for a fall and fracture prevention protocol, but for none of the walking aids. Following discussion during the expert panel meeting (i.e. part 2 of stage 2) about why walking aids are valuable in the ED (i.e. to prevent falls during ED stay, avoid unnecessary admissions and send a patient home safely), the expert panel agreed that availability of walking aids should be a minimum standard in EDs. Even more, 3 types of walking aids reached a consensus level of 80% during the meeting, while the consensus level related to a fall and fracture prevention protocol remained unchanged (i.e. 70%), as it was not revoted during the meeting. Third, one research team member and six expert panel members could not attend the online consensus meeting, which might have skewed the study findings. Nevertheless, it is noteworthy that the consensus reached during this meeting was generally high (i.e. 80% level). Fourth, it is also important to note that an external board did not review the study findings. As this is recommended before integrating Delphi study findings into practice, this is not a genuine limitation because the current study was intended as a basis for further debate.[26]

Further research activities will be necessary to elaborate geriatric emergency care in Belgium. These should focus on refinement of the current consensus and its protocols (e.g. delirium screening and treatment). This also includes exploring implementation aspects (e.g. acceptability, feasibility, barriers, facilitators) of protocols in multicentre studies and development of indicators to monitor and benchmark process variables and outcomes.[27,28] Indicator development was beyond the scope of this research aim but its importance was nevertheless expressed indirectly through the statement on quality assurance (i.e. art. 8-10).

CONCLUSIONS

This study presents a broad and interdisciplinary consensus on minimum operational standards for geriatric emergency care specific for the Belgian healthcare system. These findings may serve as starting point towards broadly supported standards of care stipulated by law.

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CHAPTER 8

General discussion

INTRODUCTION

EDs are traditionally conceived on a fast-paced, complaint-oriented approach. While this has proven effective for managing the general population, it does not succeed delivering optimal care and outcomes in the growing group of vulnerable older patients.[1-4] Creating a patient-oriented approach by integrating the concept of CGA in emergency medicine is considered the best available strategy to optimise care and outcomes of older ED patients. However, although CGA has proven effective on acute geriatric wards, the effects of ED-based CGA are still inconclusive.[5-7] As further research is necessary to strengthen the evidence base of geriatric emergency care, the starting point of this dissertation was a newly developed CGA-based care model for older patients in the ED of the University Hospitals Leuven (i.e. URGENT).[8] To explore the scaling possibilities of the URGENT care model, this doctoral dissertation reported its effectiveness (overall goal 1) and potential improvement opportunities (overall goal 2). These goals were accomplished with five studies (see Figure 4 on page 17 in chapter 1). The current chapter describes the main findings and reflections resulting from these studies. In addition, recommendations for clinical practice and future perspectives are discussed, as well.

MAIN FINDINGS

Effectiveness of the URGENT care model

Although the URGENT intervention was conceived as a transitional care model combining CGA-based interdisciplinary care planning in the ED and geriatric follow-up after ED discharge, it should mainly be recognized as first 'proof of concept' for geriatric emergency care in Belgium.[9] The arguments for this statement result from process registration data and are twofold. First, the URGENT study showed that CGA in the ED enriches the care processes of older patients. More specific, an at risk patient in the intervention group received during interdisciplinary care planning on average seven advices and referrals, which the patient would (presumably) not have received during usual care. Second, process registration data also show high adherence to advices and referrals that had to be completed during ED stay and low adherence to advices and referrals that had to be completed in community care. This means

that there was in fact no intervention in community care, making URGENT rather a 'geriatric emergency care model' instead of a 'transitional care model'. This also explains presence of intervention effects in ED-related outcomes (i.e. ED length of stay and hospitalization rate) and absence of intervention effects on post-discharge outcomes, including unplanned readmission (i.e. the primary outcome).

The direct lessons resulting from the URGENT care model are threefold. First, it is important to remember that geriatric-focused ED care -which is characterized by more extensive assessments and disposition planning- does not necessarily increase ED length of stay. Moreover, it has the potential to shorten ED length of stay and reduce the risks of ED crowding. Second, when looking at the URGENT study from the ED perspective as gatekeeper to inpatient beds, it is obvious that ED-based CGA is essential to determine appropriateness of hospital admission. More specific, additional problem detection through CGA probably contributed to the increased admission rate in the intervention cohort. Third, from an ethical point of view, one can conclude that the URGENT intervention made ED care more responsive to the older patient's needs, capacity and preferences. Unfortunately, no formal patient- or caregiver-reported data were obtained to support this statement.

When scrutinizing the reach of the URGENT intervention, one may question the equity of this care model, as data show that only one in five (i.e. 21%) patients aged 70 years or older were screened for study participation during the intervention period. This is not illogical given the intervention was mainly delivered during office hours by one person, the geriatric emergency nurse. However, although it is better to do something for a small group with limited resources rather than doing nothing at all, this fact should prompt considering how to scale up the intervention reach. If that were feasible, one could test the hypothesis that higher intervention reach increases the intervention effect size.

Diagnostic accuracy of screening tools

The interRAI ED Screener was used in the URGENT study to detect patients at risk for adverse events that might benefit from the intervention. As this instrument was rather new at the moment of the study and warranted further validation, we conducted a diagnostic accuracy study.[10] This study compared the ability of the interRAI ED Screener to those of classic geriatric screening tools (i.e. Identification of Seniors At Risk (ISAR) and the Flemish version of

Triage Risk Screening Tool (fTRST)) in predicting several outcomes. These were the primary outcome of the URGENT study (i.e. unplanned readmission) and the outcomes on which this care model had a significant effect (i.e. (prolonged) ED length of stay and hospitalisation after index ED visit). The study findings showed in all outcomes that the interRAI ED Screener did not perform better or worse than the classic tools. Although these data justified the use of the InterRAI ED screener in the URGENT study, the predictive values of the three screening tools were poor. As these findings align with decades of research in this field, researchers and clinicians should reflect on the clinical value of these single-moment, multipurpose screening tools and how their predictive accuracy can be improved.

Emergency observation units for older adults

Since the geriatric emergency nurse assessed most of the URGENT intervention patients in the observation unit within the ED of the University Hospitals Leuven, the research team decided to explore how the conceptual integration of CGA and observation principles can be improved. A scoping review was conducted to map the structure and processes of emergency observation units with a geriatric focus in an international perspective.[11] Fifteen studies were included. The URGENT study was not included because observation principles were not formally part of the URGENT intervention. More specific, this study could not be retained by the final search strings, as these comprised 'observation (principles)' as core component. Maybe, other similar studies could not be included for this particular reason, as well. The results of the scoping review describe that geriatric care is very heterogeneous in emergency observation units and rarely covers (n=4) all elements of CGA. This indicates that combining CGA and observation principles intentionally is not broadly known and should be elaborated. This idea is also implicitly supported by the Geriatric ED Accreditation Program of ACEP (American College of Emergency physicians), which promotes to shift the historical view on EDs as the 'front door' of the hospital into an emerging model that sees EDs as a 'front porch', allowing more in-depth examinations and consultations.[12]

Geriatric care in Flemish EDs anno 2020

In the fourth study of this dissertation, a questionnaire was developed based on ACEP's Geriatric ED Accreditation Program to explore how Flemish EDs deliver care to older adults and identify improvement opportunities.[12] This survey reported that ED head nurses and ED chief physicians agree that older patients need a different approach and that initiatives are necessary to

improve both geriatric care in EDs and continuity of care after ED discharge. These findings suggest that ED healthcare workers feel a sense of urgency to start up measures for these purposes. Even more, this study describes that most Flemish EDs have already taken initiatives in this matter (e.g. improved accessibility of healthcare workers qualified in geriatrics, integration of geriatric-friendly protocols, equipment and physical environment characteristics). However, these initiatives have introduced important disparities in care between EDs. For example, out of 27 surveyed protocols, one ED reported having 22 protocols available, while one other reported to have none. Consequently, there is a need to define region-wide minimum operational standards for geriatric emergency care. Although this study did not collect data in Walloon or French speaking EDs (i.e. EDs in the southern part of Belgium), there appear to be no arguments suggesting that the status of geriatric emergency care in Wallonia differs from that in Flanders. Therefore, efforts to harmonise and optimise geriatric emergency care should be organised at a national level.

Clinical consensus on minimal standards for geriatric care in Belgian EDs

The final study of this dissertation focused on developing a clinical consensus on minimum operational standards for geriatric ED care in Belgium. A broad and interdisciplinary consensus was established for two different ED types, the 'conventional ED' and the 'observational ED'. These envisage different lengths of stay and consequently different thresholds for patients to access inpatient beds. One might say that EDs with longer ED lengths of stay (i.e. observational EDs) have higher thresholds to hospitalise a patient, as these provide in-depth evaluations (i.e. additional diagnostic rounds and tests), extended assessments (i.e. functionality, cognition and social aspects) and initial treatments, allowing to avoid unnecessary admissions, associated risks and costs. For these purposes, observational EDs have greater availability of a geriatric practitioner and further-reaching geriatric(-friendly) protocols, equipment and accommodation criteria. In others words, observational EDs should be considered the ED type for (more) comprehensive and advanced geriatric care.

REFLECTIONS ON MAIN FINDINGS

The endpoint of this dissertation is a proposal with minimal operational standards to 'geriatricize' Belgian ED care. To guide further decision making in this matter, the next paragraphs will reflect in the view of this dissertation's main findings on four essential concepts to develop sustainable capacity for geriatric emergency care: structure, systems, staff and supplies.[13]

Structure (or space)

The minimal standards for geriatric care in 'conventional EDs', as defined in the Delphi study, should be interpreted as the proposed criteria to extend the legal standards for Belgian EDs, established by the Royal Decree of 27 April 1998. In other words, this proposal comprises that the minimal standards for geriatric care in conventional EDs become the absolute minimum of geriatric care that an older patient is guaranteed in each Belgian ED. In addition, the Delphi panel also formulated a proposal on minimum standards for an 'ED with an advanced geriatric care function', in which the minimal standards for geriatric care in conventional EDs are extended with supplementary criteria. These EDs were defined in the Delphi study as 'EDs with geriatric-focused observation beds' or 'observational EDs'. As conventional EDs are already required by law to have observation beds, it is even possible that hybrid models emerge. These are conventional EDs with some characteristics of observational EDs.

As currently EDs with an advanced geriatric function do not exist in Belgium, one most reflect on how these can be operationalised. Both literature on ED-based CGA and observation units recommend using a dedicated space within or next to the ED if possible.[6,11,14,15] This has several advantages. First, specific education can be focused on staff engaged to work in this area. Second, physicians from the main ED can easily reassess the patient during observation. Third, geriatric practitioners can have an in-reach function in the main ED. Fourth, accommodation can be adapted and equipment can be centralised. However, setting up a dedicated space, does not necessarily imply that these beds have to be completely separated from other patient groups (e.g. older patients waiting for inpatient bed, younger observation patients). If the dedicated space can be part of a larger unit intended for other purposes, as well, this will allow a flexible bed count and facilitate organising nursing permanence.

Systems

Systems should be designed to realise their objectives. The Delphi panel formulated three specific objectives for geriatric emergency care. First, to assess the risk of atypical presentation of a serious condition. Second, to orient the patient to the most appropriate location in the care system (i.e. optimal disposition planning). Third, to ensure continuity of geriatric care aspects. Although from a logistic perspective the first and second objective appear assignable to staff at the ED front door and the ED back door, respectively, the processes serving both objectives are intertwined.[16] More specifically, clinical data (e.g. presence of functional or cognitive decline) required to assess the risk of a serious condition with atypical presentation are also necessary for disposition planning. As ED lengths of stay should be as short as necessary and not all older ED patients need a geriatric approach, early identification of patients requiring a geriatric approach remains essential.

Although the limitations of geriatric screening tools were discussed comprehensively in chapter 3, these tools remain to date the best available strategy to identify older ED patients requiring a geriatric approach. However, these tools should only be used while being aware of their limitations. This implies that their use as stand-alone instruments might lead to inadequate patient selection. Persons scoring these tools should have received a training empowering them to overrule a screening tool score if necessary. Indeed, combining a geriatric screening tool with clinical judgement, as was done in the URGENT project seems recommended until more accurate risk-stratification methods are available. In an era of electronic medical records, it is evident that screening results should be registered and visualised in order to initiate geriatric-focused trajectories in an efficient manner.

The Delphi study describes a consensus on what protocols should be available in both ED types to determine the patient's most appropriate location in the care system. As conventional EDs have less time and protocols available, these units will define lower thresholds to hospitalise patients, as their admission decision will mainly be based on single-moment data. Observational EDs will not only perform in-depth evaluations and extended assessments, these units will also reassess patients at specific moments, allowing them to make decisions based on evolutions in clinical presentations. This aligns with the idea of refining the ED gatekeeper role to the profile of older patients. In short, conventional EDs determine a disposition plan based on one single photograph, whereas observational EDs do this by comparing several photographs over time.

Registering and sharing screening results and clinical findings on which an ED discharge decision is based, is necessary to facilitate care processes and continuity of care. For example, if an older ED patient with a high-risk geriatric screening score is admitted to a non-geriatric ward, this score should at least make this ward's staff reflect on the need for geriatric interventions (e.g. consultation of inpatient geriatric consultation team). ED head nurses and ED chief physicians indicated in the survey that initiatives are necessary to improve continuity of care after ED discharge. It is obvious that this aim was not accomplished by introducing a case manager during an ED stay in the URGENT project. Although this may be explainable by the presumption that the patients eligible for case manager follow-up were not mentally ready for this innovative care concept, another important reason may be the cost of the intervention. The visit of the case manager was free of charge, but the recommended interventions were not (e.g. additional professional help at home).

Staff

Except for the availability of geriatric practitioners and the responsibilities of coordinating physicians, no other staffing-related statements were part of the Delphi consensus. Although this appears to give a lot of possibilities to explore who should be assigned to perform geriatric screening and disposition planning, data on the URGENT project's reach made clear that ideally all ED staff should adopt a geriatric-focused approach or should have specific responsibilities in caring for older ED patients. More specifically, ED physicians and ED nurses should at least contribute to geriatric-focused problem detection (i.e. minimal geriatric-specific observations, such as mobility, attention, orientation), allowing them to engage another caregiver within or outside the ED to conduct a more targeted assessment.

Observational EDs require an interdisciplinary team to provide in-depth evaluations and extended assessments. Although the scoping review (chapter 4) described large variability in teams of emergency observation units with a geriatric focus, all except one of its included studies reported that staffing consisted of at least three healthcare professions. However, more important than having as many different disciplines available as possible, is the question of what competencies should be covered to provide adequate care. Starting from this question, each ED should make the exercise who should be assigned which responsibility and should provide training to stimulate care improvements. For example, the Delphi panel stated that a patient's drug therapy should be evaluated with particular attention to possible adverse drug

events. Although clinical pharmacists are experts in this field, it is due to time and budget constraints not feasible to organize pharmacist-led medication review for all older ED patients. Therefore, this usually remains a responsibility of physicians, who can contact a clinical pharmacist if necessary.[17] But, of course, this does not change the fact that an ED-based clinical pharmacist focusing on specific patient groups (e.g. older trauma patients with polypharmacy not eligible for admission) can be an important added value.[18] Despite the reasoning to focus on competences rather than the number of disciplines, it is still logical for an ED with an advanced geriatric function to be able to call on a geriatrician and/or a member of the inpatient geriatric consultation team, as stipulated in the Delphi study.

Supplies

The Delphi study (chapter 7) describes which specific materials and equipment are recommended to guarantee high quality geriatric emergency care in both ED types (i.e. conventional EDs and observational EDs). The survey study (chapter 8) reports to what extent most of these are already available in Flemish EDs. These findings may encourage group purchasing. In that respect, purchasing walking aids in particular would be a small investment with a large clinical value for many EDs.

Formalizing capacity for geriatric emergency care in Belgium

In Belgium, care standards are often -but not always- determined by Royal Decrees. As the current legal standards for Belgian EDs are established by the Royal Decree of 27 April 1998, it appears logical that the minimum standards for geriatric emergency care will be added to an updated version of this law. Another royal decree could be prepared to establish the national standards of an ED with an advanced geriatric function. However, there are also other possibilities to operationalize this proposal. For example, one could also integrate geriatric emergency care standards in the Royal Decree of 29 January 2007 (text updated on the 18 April 2014), establishing the standards to be met by the care programme for geriatric patients. Another possibility is setting up a local accreditation label or integrating the standards in a new quality model. How to introduce the standards of geriatric emergency care in Belgium is one example of items to be discussed and elaborated during intervisions with stakeholders, including among others the National Council for Hospital Facilities, the Federal Service of Public Health, Food Chain Safety and Environment and professional organizations.

Before intervisions can be organized, arguments are necessary to convince stakeholders why it is necessary to invest in geriatric emergency care while there is still no solid evidence of its benefits.[19] The following arguments should be used for this purpose.

- The Federal Advisory Council on Older Persons reported that Belgian hospitals pay too little attention to the needs of older persons and that, in particular, the reception and care on the ED is flawed (Annual Report 2019).[20] This indicates that the clinical need for geriatric emergency care standards exceeds the limitations of the current evidence base in this field, which is characterized by methodological disparities and inconsistent outcome effects.

- Introducing geriatric emergency care standards in clinical care at this moment would be in line with previous initiatives for special groups that were operationalised without solid proven effectiveness. For example, the effects of stroke certification per se had not been studied when the Joint Commission introduced it in 2003. In fact, it is precisely by putting these standards into practice that data could emerge showing that certified stroke centres have better care processes and beneficial patient outcomes.[21-23] This demonstrates that decisions to operationalise relevant and necessary interventions driven by clinical needs can strengthen the evidence base of a field.[24]

- Setting standards for geriatric emergency care will ensure that Belgian EDs can provide adequate care for all age groups, as envisaged by the ED definition of the International Federation of Emergency Medicine.[25,26]

- Adapting ED care to the needs of older patients contributes to finding optimal balance in ED input, throughput and output, which helps minimizing ED crowding and associated outcomes.[16,27,28]

- Adequate care for older adults is beneficial for younger patients with similar problems (e.g. mobility problems) or profiles (e.g. persons with slowly progressing chronic diseases, such as multiple sclerosis), as well.

RECOMMENDATIONS FOR CLINICAL PRACTICE

Both top down and bottom up initiatives are necessary to make the success of geriatric emergency care. Whilst waiting for a formal legislative framework, EDs need to start adapting care already. In chapter 6, several relevant opportunities for improvement were identified by both ED head nurses and ED chief physicians (e.g. standardised delirium screening). These should inspire ED leaders to start rethinking care processes and organise training initiatives –the latter was an identified improvement opportunity, as well (chapter 5). Ideally, these initiatives are supported -or even coordinated- by professional organisations. A next step would be integrating the adapted care processes and developed training materials into educational curricula of ED caregivers. Until such initiatives are available, it would be useful for these educational curricula to provide their students with at least an introduction to geriatric emergency care. In addition, it is also recommended to ensure a focus on acute geriatric care in the educational curricula of caregivers working outside the ED. This might improve timeliness and appropriateness of ED referrals and thus avoid unnecessary ED transfers.

FUTURE PERSPECTIVES

The studies in this dissertation have led to perspectives for future research and care. The following paragraphs will describe the main ideas for the future.

Monitoring and benchmarking systems

As the Delphi study focused on how to operationalise high-quality geriatric emergency care, indicator development was beyond its scope. However, the importance of minimal data registration was expressed indirectly through its statement on quality assurance. Ideally, a consensus is sought nationally on a set of parameters to be recorded in older ED patients. This will allow tracking of delivered care and outcomes on a local and national level. A valuable document that can be used as a starting point for such an initiative is the manuscript reporting on the German 'Geri-Q-ED' project.[29]

Hospital managers and ED leaders considering to set up an ED with geriatric-focused observation beds are recommended to determine their target

population in a data-driven way. This can be done by exploring characteristics of patients with short inhospital length of stay or early readmission. However, it seems also particularly relevant for health insurers and governments to conduct this exercise at the macro level.

Outcomes for geriatric emergency care research

The primary outcome of the URGENT project was 90-day unplanned readmission rate. Although preventing these events are of high importance to patients, the ED (i.e. ED input) and society (ED admissions are costly), one can use several arguments to indicate that this outcome parameter has limitations. First, not all readmissions are preventable. In some cases, a readmission is even considered good and appropriate. For example, some patients can be discharged to their place of origin with the instruction to return in case of specific symptoms. This implies that one must always tolerate a certain readmission rate because each case has diagnostic and therapeutic uncertainty. Second, the more time between discharge and outcome registration, the more likely it is that the readmission reason is not related to the index ED admission. Thirdly, the readmission rate of an ED and the extent to which this can be affected by ED-based interventions depends heavily on the local healthcare system. For example, one can expect the readmission rate and the expected intervention effect to be lower in a system with wide availability of general practitioners. This makes clear that it is not ideal to pool readmission rates and intervention effects from different systems, while it makes sense to monitor readmission rates within a care system and to compare those of different systems. For these reasons, researchers should consider using other outcomes which are more appropriate to document the benefits of geriatric emergency care interventions.

Future research should aim to operationalise a definition or score for appropriateness of care in older ED patients, as an important endpoint for geriatric emergency care research. This might include a combination of patient-reported outcome measures (PROMs) and patient-reported experience measures (PREMs).[30] The first comprise instruments and questionnaires focusing on patient's perceptions of current health state and health outcomes (e.g. pain, functionality, quality of life). The second include instruments and questionnaires focusing on patients' experiences with received care (e.g. satisfaction, the extent to which patients feel respected in their needs, preferences and opinions). Although combining PROMs and PREMs have the potential to describe the value of geriatric emergency care (i.e. better care and life quality), it cannot deliver a complete picture on

delivered care. Because patients have among other no insights in operational and organisational aspects of care, another instrument should be developed to capture the caregiver perspective, as well. Third, future research should also focus more on costs and cost-effectiveness of geriatric emergency care interventions. This includes estimating the cost of prevented events (e.g. falls, delirium).[31] By generating evidence for these outcomes, it might be possible to make the case that investing in geriatric emergency care aligns with the triple aim of optimizing health system performance. This includes better health, better (experienced) care and lower costs.[32]

Risk-stratification of older patients with emergency care needs

Chapter 3 described a list of arguments why available geriatric screening tools and diagnostic accuracy studies with delayed verification have important limitations. These arguments should trigger researchers to explore innovative approaches for improving risk-stratification among the population of interest. A first recommendation in this respect is performing risk-stratification studies that focus on the main goal of ED caregivers, which is detecting or excluding presence of a serious condition. Nemec and colleagues have defined a generic definition for this outcome a decade ago, while studying non-specific complaints.[33] Of course, this can also be operationalised by one specific pathology (e.g. sepsis), as well. A second recommendation focuses on aligning risk-stratification variables in research with the clinical decision-making process. In clinical care, a lot of variables are weighed against each other. These include among other self-reported patient data (e.g. pain, functionality), clinical observations (e.g. respiration, balance, nutritional status), differences between premorbid and current status, comorbidities, medication use, laboratory values, data from patient reassessment et cetera. This non-exhaustive list makes clear why risk-stratifying older patients in clinical care is complex. Advances in statistical modelling techniques (i.e. artificial intelligence and machine learning) will enable future studies to consider unexplored variables (e.g. dynamic predicators) and conceptualise geriatric risk-stratification in such a way that research data better reflect the everyday clinical decision-making process.[34] As large databases will be necessary for such an endeavour, it seems recommended to establish a consensus on what data should be minimally available before applying advanced modelling techniques.[35] In addition, future research can also explore the added value of biomarkers in this field. As data collections in observational EDs can be much more comprehensive than in conventional EDs, it is obvious that observational EDs will play an important role in the development of these innovative risk-stratification methods.

Nursing home residents

The URGENT study only included community-dwelling patients, as these persons were supposed to benefit most from the intervention. The reasoning behind this choice was that professional patient support is usual less intense at home compared to in a care facility.[8] Therefore, specific studies should be conducted to explore ED use by nursing home residents. While this has never been studied in Belgium or Flanders, international studies describe that ED visits of nursing home residents are often suboptimal and even potentially avoidable.[36-38] A large cohort study is recommend to explore ED use by nursing home residents as a basis for innovative care models aiming to optimize transitions of care (e.g. ED physician, geriatrician or nurse-led outreach initiatives to nursing homes[39,40]). The observational ED type can be a valuable setting for nursing home residents if ED transfers are necessary.

Out-of-hospital post-ED trajectories

The URGENT study described that discharged intervention patients had low acceptance of case manager follow-up and low adherence to advices that had to be completed in community care. Further research is necessary to optimise adherence to post-discharge recommendations. This should start from an exploration why a recommendation was not followed and what could help persons to do so. In addition, models of care should be set up to prevent unnecessary hospital admissions as much as possible (e.g. hospital at home[41]).

Geriatric emergency care within evolving health systems

The Delphi study reported minimal operational standards for geriatric emergency care in both a conventional ED and an observational ED. As Belgian hospitals are required to collaborate within locoregional clinical networks (law of 28 February 2019), one can consider setting up a locoregional geriatric emergency care network including at least one observational ED and one or more conventional EDs. To guarantee appropriate patient transfers in such a network, selection criteria should be developed to guide paramedics in determining the optimal level of care.[42] This implies that geriatric risk-stratification should be (partly) transferred to the pre-hospital setting.

Advanced nursing roles in geriatric emergency care

The URGENT care model was a nurse-led intervention delivered by master-level and non-master-level trained nurses. These nurses had in-depth clinical knowledge and took up leadership roles by advising and coaching ED staff in addition to their clinical responsibilities. Two persons of this team had more extended roles, as they also monitored the delivery of the intervention,

chaired multidisciplinary meetings, and organised training sessions to propagate evidence-based practices. As the ED is a pivotal point between several care settings (e.g. community care, nursing homes, inhospital care) and older adults are a specific patient group, the role of an advanced practice nurse for geriatric emergency care should be worth considering to help integrate geriatric trajectories in ED care and develop clinical networks preventing unnecessary ED transfers and hospital admissions.

OVERALL STRENGTHS AND LIMITATIONS

The overall strength of this manuscript is that it nourishes the rationale, content and proof of concept for geriatric emergency care in both the Belgian and the international setting. It includes the first intervention study on geriatric emergency care in Belgium (i.e. chapter 2); and to our knowledge one of the first nurse-led geriatric emergency care models in Europe. Although this was a monocentric intervention study in an academic setting, efforts were done to broaden the research scope towards non-academic EDs in the entire Flemish region (i.e. chapters 5 and 6). An important limitation is the lack of data on geriatric emergency care in the two other regions within Belgium (i.e. Brussels Capital Region and Wallonia). In addition, the work described in chapters 2, 3 and 4 has initiated international discussions (e.g. within the European Taskforce on Geriatric Emergency Medicine) on how to move the field of geriatric emergency care forward. The work described in chapters 5, 6 and 7 has high potential to stimulate important initiatives aiming to improve care for the acutely ill older patient, both nationally and internationally.

OVERALL CONCLUSIONS

Although further research is necessary to strengthen the evidence base of geriatric emergency care, Belgian EDs have already started integrating geriatric-focused initiatives in clinical practice. As these have introduced important disparities in care within and between EDs, efforts are necessary at national level to harmonise and optimise geriatric emergency care. Starting from the effectiveness and improvement opportunities of a monocentric intervention study delivering proof of concept, an interdisciplinary consensus

was established on minimum operational standards for geriatric care in Belgian EDs. This document describes operational standards for two ED types, the 'conventional ED' and the 'ED with geriatric-focused observation beds'. While stakeholders should consider this proposal and elaborate it into a formal framework, collaborations between EDs and professional organisations should be set up to organise bottom-up initiatives, which preferably deliver data for monitoring and benchmarking purposes. Future initiatives and research should aim to optimise risk-stratification in the population of interest and demonstrate how geriatric emergency care contributes to the performance of healthcare systems.

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CHAPTER 9

Lay summary

SUMMARY PHD

Emergency departments (EDs) are traditionally conceived on a fast-paced, complaint-oriented approach. While this has proven effective for managing the general population, it has shown to deliver suboptimal care and outcomes to the growing group of older adults. Creating a patient-oriented approach by integrating the concept of comprehensive geriatric assessment (CGA) in emergency medicine is considered the best available strategy to optimise care and outcomes of older ED patients. However, the effects of ED-based CGA remain inconclusive. The starting point of this dissertation was a newly developed CGA-based care model for older patients in the ED of University Hospitals Leuven in Belgium (i.e. URGENT). To explore the scaling possibilities of the URGENT care model, this doctoral dissertation described its effectiveness and potential improvement opportunities. These goals were accomplished with five studies. First, a single-centre, quasi-experimental study (sequential design with two cohorts) was conducted to evaluate the effectiveness of the URGENT care model. It showed that a geriatric emergency nurse can improve in-hospital patient management, but failed to introduce substantial out-hospital case-management. The URGENT care model shortened ED length of stay and increased the hospitalization rate. No effect was found on the unplanned ED readmission rate. Second, the diagnostic accuracies of three geriatric screening tools were described and compared regarding their ability to predict four outcomes (i.e. prolonged ED length of stay, hospitalization (following index ED stay) and unplanned ED readmission at 30 and 90 days). All instruments had similar areas under the receiver operating characteristics curve (range between 0.49-0.62), indicating that none of the tools should be used as a stand-alone index. Third, sixteen studies were included in a scoping review to explore the structure and processes of emergency observation units with a geriatric focus. These units were located in the ED, immediately next to the ED or remote from the ED (i.e. hospital-based). All studies reported that staffing consisted of at least three healthcare professions. Observation duration varied between 4 and 72 hours. Four studies reported to assess a patients' medical, functional, cognitive and social capabilities. If deemed necessary, post-discharge follow-up (e.g. community/primary care services and/or outpatient clinics) was provided in eleven studies. Fourth, a multicentre survey reported that Flemish ED head nurses and ED chief physicians agree that older patients need a different approach and that initiatives are necessary to improve both geriatric care in

EDs and continuity of care after ED discharge. In addition, this study also reported that most Flemish EDs have already taken initiatives in this matter (e.g. improved accessibility of geriatric practitioners, integration of geriatric-friendly protocols and equipment). Although these initiatives are valuable, it has introduced important disparities in care between EDs. Fifth, Delphi study methodology was used to develop a consensus on minimal operational standards for geriatric care in Belgian EDs. A broad, interdisciplinary consensus was established focusing on the target population, specific goals, availability of geriatric practitioners and quality assurance. In addition, these statements also determined which protocols, materials and accommodation criteria should be available in two different ED types: the conventional ED and the observational ED. Overall, although the evidence base of geriatric emergency care still needs strengthening, Belgian EDs have already started integrating geriatric-focused initiatives in clinical practice. As these have introduced important disparities in care within and between EDs, efforts are necessary to harmonise and optimise geriatric emergency care. While the established consensus may serve as starting point for formulating a formal framework for geriatric emergency care in Belgium, collaborations between governments, EDs and professional organisations should be set up to organise bottom-up initiatives. Future research should explore how to optimise risk-stratification in the population of interest and demonstrate how geriatric emergency care contributes to the performance of healthcare systems.

CHAPTER 10

Acknowledgements, personal contribution and conflict of interest

SCIENTIFIC ACKNOWLEDGEMENTS

This dissertation comprises research articles published in international, peer-reviewed journals and pre-published manuscripts. In this section, all persons who contributed to the different manuscripts receive credit for their work.

Chapter 2: Unplanned readmission prevention by a geriatric emergency network for transitional care (URGENT): a prospective before-after study
Authors: Pieter Heeren* (PH), Els Devriendt* (ED), Steffen Fieuws (SF), Nathalie IH Wellens (NW), Mieke Deschodt (MD), Johan Flamaing (JF), Marc Sabbe (MS), Koen Milisen (KM) *[joined first authorship]
Concept or design: all authors
Acquisition, analysis or interpretation of data: all authors
Drafting the manuscript and coordinating feedback of co-authors: PH
Critical revision of the manuscript: all authors
Statistical analysis: SF
Obtaining funding: ED, MD, JF, MS and KM
Supervision of the study: JF, MS and KM
Other contributions: NW has contributed as expert on the instruments of the interRAI Suite and has coordinated in collaboration with the first authors the translation of the interRAI Emergency Department Screener and interRAI Contact Assessment instrument. SF developed the statistical analysis plan and conducted statistical analyses. ED and PH were project coordinators. The authors would like to thank Nadja Himschoot, Maren Jonckers, Ellen Ooms and André Collignon for their contribution to data collection.

Chapter 3: Old and new geriatric screening tools in a Belgian emergency department: a diagnostic accuracy study
Authors: Pieter Heeren (PH), Els Devriendt (ED), Nathalie IH Wellens (NW), Mieke Deschodt (MD), Johan Flamaing (JF), Marc Sabbe (MS), Koen Milisen (KM)
Concept or design: all authors
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Drafting the manuscript and coordinating feedback of co-authors: PH
Critical revision of the manuscript: all authors
Statistical analysis: PH
Supervision of the study: JF, MS and KM

Chapter 10: Acknowledgements

Other contributions: The authors would like to thank Nadja Himschoot and André Collignon for their contribution to data collection.

Chapter 4: Structure and processes of emergency observation units with a geriatric focus: a scoping review

Authors: Pieter Heeren (PH), Annabelle Hendrikx (AH), Janne Ceyssens (JC), Els Devriendt (ED), Mieke Deschodt (MD), Didier Desruelles (DD), Johan Flamaing (JF), Marc Sabbe (MS), Koen Milisen (KM)
Concept or design: PH, AH, JC, ED, MD, JF, MS and KM
Acquisition, analysis or interpretation of data: all authors
Drafting the manuscript and coordinating feedback of co-authors: PH
Critical revision of the manuscript: all authors
Statistical analysis: PH, AH, JC
Supervision of the study: JF, MS and KM
Other contributions: The authors would like to thank Magdalena Jans for her contribution to development of the search strings.

Chapter 5 and 6: A multicentre survey on geriatric care in emergency departments anno 2020: Part 1 & 2

Authors: Pieter Heeren (PH), Lotte Lombaert (LL), Petra Janssens (PJ), Johan Flamaing (JF), Marc Sabbe (MS), Koen Milisen (KM)
Concept or design: all authors
Acquisition, analysis or interpretation of data: all authors
Drafting the manuscript and coordinating feedback of co-authors: PH
Critical revision of the manuscript: all authors
Statistical analysis: PH, LL and PJ
Supervision of the study: JF, MS and KM
Other contributions: The authors would like to thank the board of the Flemish Emergency Nurses Association (Vlaamse Vereniging Verpleegkundigen Spoedgevallenzorg; VVVS) and in particular Door Lauwaert and An Bueken, for their contribution in recruitment of study participants.

Chapter 7: A consensus statement on minimum operational standards for geriatric emergency care in Belgium: a modified Delphi study

Authors: Pieter Heeren (PH), Farah Islam (FI), Didier Desruelles (DD), Johan Flamaing (JF), Marc Sabbe (MS), Koen Milisen (KM) on behalf of the Belgian URGENT Delphi Group
Concept or design: all authors
Acquisition, analysis or interpretation of data: all authors
Drafting the manuscript and coordinating feedback of co-authors: PH

Critical revision of the manuscript: all authors
Statistical analysis: PH
Supervision of the study: JF, MS and KM
Other contributions: The authors wish to acknowledge the valuable contribution of all Delphi panel members: Philippe Heerinckx, Ives Hubloue, Tuan Long Tran, Stefan Wynants, Veronique Ghekière, Isabelle De Brauwer, Laetitia Beernaert, Sophie Cristelbach, Sven Guldemont, Dieter Lumen, Sebastien Sohet, Emilie Bogaerts, Nadja Himschoot, Nicole Michaux, Mayelise Dath, Robin Biets, Cecile Piron, Koen van den Heede, Carine van de Voorde, Celine Ricour.

PERSONAL CONTRIBUTION

This section summarizes the contribution of Pieter Heeren to this dissertation.

Chapter 2: Unplanned readmission prevention by a geriatric emergency network for transitional care (URGENT): a prospective before-after study
Pieter Heeren was involved in the design of the study, drafted the protocol for the Ethics Committee and was responsible for daily project management. In addition, he contributed substantially to recruitment of study participants, data acquisition and interpretation of study results. He drafted and revised the manuscript.

Chapter 3: Old and new geriatric screening tools in a Belgian emergency department: a diagnostic accuracy study
Pieter Heeren contributed substantially to conception and design of this study. He was responsible for data acquisition, statistical analysis and interpretation of the results. He drafted and revised the manuscript.

Chapter 4: Structure and processes of emergency observation units with a geriatric focus: a scoping review
Pieter Heeren contributed substantially to conception and design of this study, carried out the data collection, performed the methodological quality assessment and was responsible for data interpretation. He drafted and revised the manuscript.

Chapter 10: Acknowledgements

Chapter 5 and 6: A multicentre survey on geriatric care in emergency departments anno 2020: Part 1 & 2
Pieter Heeren contributed substantially to conception and design of this study, carried out the data collection, performed statistical analysis and interpreted study results. He drafted and revised the manuscript.

Chapter 7: A consensus statement on minimum operational standards for geriatric emergency care in Belgium: a modified Delphi study
Pieter Heeren contributed substantially to conception and design of this study, carried out the data collection, performed statistical analysis and interpreted study results. He drafted and revised the manuscript.

CONFLICT OF INTEREST

This section reports (potential) conflicts of interest for each study in this dissertation.

Chapter 2: Unplanned readmission prevention by a geriatric emergency network for transitional care (URGENT): a prospective before-after study
The URGENT project was possible thanks to a grant of the Flemish government agency for Innovation by Science and Technology (file number: 135182) and a collaboration between Christelijke Mutualiteit Leuven, Wit-Gele Kruis Vlaams-Brabant, Pyxima NV and University Hospitals Leuven. The funder had no role in in the study design, methods, recruitment, data collection, analysis, or preparation of the manuscript.
KM is a member of the editorial board of BMC Geriatrics (section editor). He was not involved in the editorial process of this manuscript. The authors reported no other conflicts of interests.

Chapter 3: Old and new geriatric screening tools in a Belgian emergency department: a diagnostic accuracy study
The Flemish government agency for Innovation by Science and Technology funded this study (file number: 135182). The sponsor had no role in in the study design, methods, recruitment, data collection, analysis, or preparation of the manuscript. All authors declared that they have no conflicts of interests.

Chapter 4: Structure and processes of emergency observation units with a geriatric focus: a scoping review
The authors did not receive grants, institutional or corporate support to conduct this study. KM is a member of the editorial board of BMC Geriatrics (section editor). He was not involved in the editorial process of this manuscript. The authors reported no other conflicts of interests.

Chapter 5 and 6: A multicentre survey on geriatric care in emergency departments anno 2020: Part 1 & 2
The authors did not receive grants, institutional or corporate support to conduct this study. The authors stated to have no conflicts of interest.

Chapter 7: A consensus statement on minimum operational standards for geriatric emergency care in Belgium: a modified Delphi study
FI holds a PhD/Early Stage Researcher fellowship funded by European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement (EU 2020 MSCA, No. 81265). The authors did not receive grants, institutional or corporate support to conduct this study. The authors stated to have no conflicts of interest.

CHAPTER 11

Professional career and publications

PROFESSIONAL CAREER

Pieter Heeren was born in Leuven (Belgium) on August 23, 1988. He obtained a Bachelor in Nursing at Leuven University College in 2010 (magna cum laude) and graduated at KU Leuven as a Master of Science in Health Care Management and Policy in 2012 (cum laude).

After his graduation, Pieter started working as a nurse on a cardiology ward in the University Hospitals Leuven. In January 2013, he took the opportunity to combine his clinical work with a halftime position as a research assistant at the Academic Centre for Nursing and Midwifery at KU Leuven. First, he was part of the Geriatric Oncology Project (GOP) research group that established the International Society of Geriatric Oncology consensus on geriatric assessment in older patients with cancer (January 2013 – September 2014). Next, he coordinated the URGENT project (Unplanned Readmission prevention by Geriatric Emergency Network for Transitional care; September 2014 – September 2016). The URGENT project was a collaboration between the University Hospitals Leuven, Wit-Gele Kruis Vlaams-Brabant, Christelijke Mutualiteit Leuven, Pyxima NV and the Academic Centre for Nursing and Midwifery at KU Leuven. This project was co-funded by the Flemish Agency for Innovation by Science and Technology (IWT; 135182). To gain more clinical insights in geriatric care, Pieter left the cardiology ward and joined the geriatric consultation team of the University Hospitals Leuven in December 2014.

In September 2015, Pieter started the doctoral training as a halftime PhD student at the doctoral school of Patient Related and Public Health Research at the Faculty of Medicine of KU Leuven. During that year, he also enrolled the three-year summer school of the European Academy for Nursing Sciences (EANS), which he completed in 2018. After finalizing the URGENT project, Pieter was able to continue his doctoral studies with financial support from the Geriatric Department of the University Hospitals Leuven. In 2017, Research Foundation – Flanders (FWO) granted him a four-year PhD fellowship (1133320N).

For several years (2016-present), Pieter has been a guest lecturer at University Colleges Leuven-Limburg (UCLL), introducing nursing students to principles of geriatric emergency care. He became a member of the European Taskforce on

Geriatric Emergency Medicine in 2019 and accepted to become co-chair of the Geriatric Section in the European Society for Emergency Medicine (EUSEM) one year later. In 2021, Pieter obtained a one-year postdoctoral position of KU Leuven Internal Funds to continue his work.

PUBLICATIONS

Publications in peer reviewed journals (* = equal contribution)

Islam F, Sabbe M, **Heeren P**, Milisen K. BMC Medical Informatics and Decision Making. Consistency of decision support software–integrated telephone triage and associated factors: a systematic review. BMC Medical Informatics and Decision Making. 2021;21(1):107. doi: 10.1186/s12911-021-01472-3.

Heeren P, Hendrikx A, Ceyssens J, Devriendt E, Deschodt M, Desruelles D, Flamaing J, Sabbe M, Milisen K. Structure and processes of emergency observation units with a geriatric focus: a scoping review. BMC Geriatrics. 2021;21(1):95. doi: 10.1186/s12877-021-02029-9

Mooijaart SP, Nickel CH, Conroy SP, Lucke JA, van Tol LS, Olthof M, Blomaard LC, Buurman BM, Dundar ZD, de Groot B, Gasperini B, **Heeren P**, Karamercan MA, McNamara R, Mitchell A, van Oppen JD, Sanchez FJM, Schoon Y, Singler K, Spode R, Skúldóttir S, Thorrsteindottir T, van der Velde M, Wallace J. A European Research Agenda for Geriatric Emergency Medicine: a modified Delphi study. European Geriatric Medicine. 2021;12(2):413-422. doi: 10.1007/s41999-020-00426-8

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