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## Original Study

# Two European Examples of Acute Geriatric Units Located Outside of a General Hospital for Older Adults With Exacerbated Chronic Conditions



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## A B S T R A C T

## Keywords:

Geriatrics  
model of care  
acute care  
post-acute care

**Objective:** Throughout Europe, the number of older adults requiring acute hospitalization is increasing. Admission to an acute geriatric unit outside of a general hospital could be an alternative. In this model of acute medical care, comprehensive geriatric assessment and rehabilitation are provided to selected older patients. This study aims to compare patients' diagnoses, characteristics, and outcomes of 2 European sites where this care occurs.

**Design:** Exploratory cohort study.

**Setting and participants:** Subacute Care Unit (SCU), introduced in 2012 in Barcelona, Spain, and the Acute Geriatric Community Hospital (AGCH), introduced in 2018 in Amsterdam, the Netherlands. The main admission criteria for older patients were acute events or exacerbations of chronic conditions, hemodynamic stability on admission, and no requirement for complex diagnostics.

**Measures:** We compared setting, characteristics, and outcomes between patients admitted to the 2 units. **Results:** Data from 909 patients admitted to SCU and 174 to AGCH were available. Patients were admitted from the emergency department or from home. The mean age was 85.8 years [standard deviation (SD) = 6.7] at SCU and 81.9 years (SD = 8.5) ( $P < .001$ ) at AGCH. At SCU, patients were more often delirious (38.7% vs 22.4%,  $P < .001$ ) on admission. At both units, infection was the main admission diagnosis. Other diagnoses included heart failure or chronic obstructive pulmonary disease. Five percent or less of patients were readmitted to general hospitals. Average length of stay was 8.8 (SD = 4.4) days (SCU) and 9.9 (SD = 7.5) days (AGCH).

**Conclusions and Implications:** These acute geriatric units are quite similar and both provide an alternative to admission to a general hospital. We encourage the comparison of these units to other examples in Europe and suggest multicentric studies comparing their performance to usual hospital care.

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Throughout Europe, health care systems are confronted with an increase of older adults requiring acute care services.<sup>1</sup> Older adults frequently suffer from multiple chronic conditions and frailty compared to younger adults (aged <70 years).<sup>2,3</sup> Consequently, we observe an increase of patients with multiple chronic conditions and frailty who require hospitalization.<sup>2–4</sup> Older hospitalized adults with multiple chronic conditions and/or frailty are predisposed to poorer outcomes compared to patients who do not have these conditions,<sup>5,6</sup> including early unplanned hospital readmissions, functional decline, and potential overtreatment in the final months of life.<sup>7–9</sup> With increased demand for care, increasing costs, and poor outcomes after hospital admission, several models of care that aim to avoid admission to a general acute hospital have been developed.<sup>10</sup> Examples of such models are intensive outpatient follow-up and hospital at home (HaH).<sup>11,12</sup> However, these models may assume that patients have an informal caregiver and cannot always provide acute or unplanned care.

Another model of care is admission to an acute geriatric unit in intermediate care as alternative to admission to a general hospital. Intermediate care was recently defined in an international Delphi study as care that represents a broad range of time-limited services that aim to ensure continuity and quality of care; promote recovery; restore independence and confidence; or prevent a decline in the functional ability at the interface between hospital, home, long-term care (nursing homes), primary care, and community services.<sup>13</sup>

In our model of acute geriatric units in intermediate care, acute medical care and early rehabilitation are provided for patients with exacerbations of chronic conditions or “minor” acute events, for example, an infection in patients with complex social or functional problems. The care is delivered at a unit within an intermediate care facility and is led by a geriatrician.<sup>14</sup> We present this model of care in context with other models of care for geriatric patients in Figure 1, which shows how acute geriatric units may fill a gap in care for adults

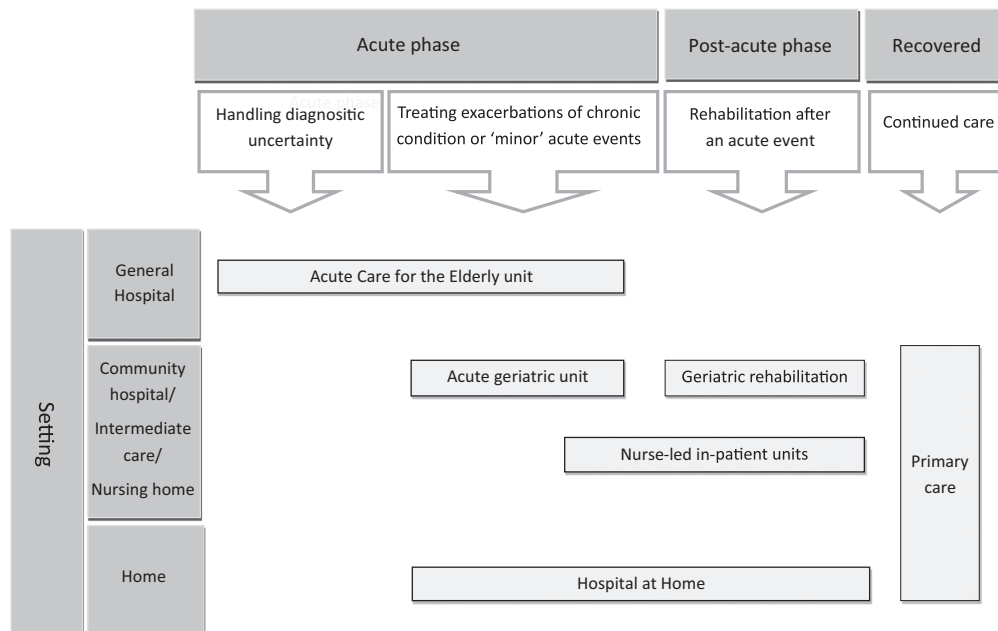
with multiple chronic conditions<sup>19</sup> and frailty<sup>20,21</sup> who need acute care.

The specific example of acute geriatric units that we will discuss in this article was pioneered in 2012 at an intermediate care facility, Parc Sanitari Pere Virgili in Barcelona, Spain.<sup>22</sup> Here, a specific ward, the Subacute Care Unit (SCU), provides acute and subacute care to older adults. Previous studies of this unit have shown its potential as an alternative to conventional hospitalization in selected older patients.<sup>14,22</sup> Recently, this model of care was successfully scaled up to provide acute care to older adults affected by COVID-19 and thereby reduce the caseload of general hospitals.<sup>23</sup>

In the Netherlands, a similar unit, the Acute Geriatric Community Hospital (AGCH), opened in 2018.<sup>24</sup> These 2 units, the SCU and the AGCH, both offer an age-friendly environment, where a comprehensive geriatric assessment (CGA) is used to direct care and provide early rehabilitation.<sup>24–26</sup> Both units provide care to patients directly admitted from emergency departments (EDs) or from home through specific primary care pathways (only SCU).

Acute care for older adults in bed-based units led by a geriatrician and implemented outside a general hospital is not common and has not yet been compared between European countries. We think the model that was implemented since 2012 (SCU) is like the model that was newly introduced (AGCH). By comparing and sharing these existing practices, this approach could be implemented in other European countries. Therefore, we will describe and compare these 2 existing models of care that have been implemented in Spain (SCU) and in the Netherlands (AGCH).

We will answer 2 questions: (1) What patients are amendable to transfer to these 2 units? (We will do this by evaluating the baseline characteristics of patients who have been transferred to these units.) and (2) What are the outcomes at discharge, regarding return to a general acute hospital, length of stay (LOS), mortality during admission, and return to original living situation?



**Fig. 1.** Patient trajectory and care settings during an acute medical crisis. Figure depicts the patient trajectory during an acute medical crisis, the settings in which care can be provided, and the specialized units for (older) adults in acute and post-acute care. ACE units are situated in a general hospital and provide care during the acute phase, when there is diagnostic uncertainty or patients may require admission to an intensive care unit.<sup>15</sup> NLU can be situated both inside and outside of a general hospital and provide care in the late acute, that is, subacute, and post-acute phases.<sup>16</sup> The acute geriatric units that we describe in intermediate care can provide acute care when there is no diagnostic uncertainty in patients who have exacerbations of chronic conditions or “minor” acute events. HaH care can be provided during both acute and post-acute phases.<sup>12</sup> After hospitalization in either a general hospital or at an acute geriatric unit, patients can receive care in a geriatric rehabilitation unit, which is similar to post-acute care in a community hospital in the United Kingdom.<sup>17,18</sup> After patients have recovered, they transition back to primary care.

## Methods

### Design, Setting, and Staffing

In both settings, we gathered data from existing prospective cohort studies.<sup>24,27</sup> Please see [Table 1](#) for an overview of staffing, setting, and resources of both units.

The SCU is a 40-bed unit, which serves the northern part of Barcelona (reference population 900,000). It is located within a 350-bed intermediate care facility, Parc Sanitari Pere Virgili, including wards for geriatric rehabilitation, palliative care, and long-term nursing beds as well as outpatient and home care resources. Patients are mainly admitted from the nearby university hospitals Vall d'Hebron and Hospital Clinic de Barcelona (1.5 and 4.5 km from the SCU, respectively) or directly from primary care. Staff at the referring hospitals and primary care centers are trained to select patients for admission to the SCU. [Table 1](#) lists all daytime staff that work exclusively at the SCU located within the intermediate care facility. During evening, nighttime, and weekends, the intermediate care facility has a geriatrician on duty who attends to medical emergencies and provides clinical support to the SCU. The geriatrician may attend the SCU in person 1 to 5 times per evening and night.

The AGCH is a 23-bed unit, which serves an urban area in Amsterdam with approximately 150,000 inhabitants.<sup>28</sup> It is located in a 123-bed skilled nursing facility, Eben Haëzer from care organization Cordaan providing geriatric rehabilitation, palliative care, and long-term care. Patients are directly and primarily admitted from the EDs of 2 nearby locations of the Amsterdam University Medical Centers. At the first location, the Academic Medical Center, specialized nurse practitioners and/or the attending geriatrician select(s) patients at the ED for admission to the AGCH. At the second location, the Vrije Universiteit Medical Center, staff from the department of internal medicine was trained to select patients for transfer and request transfer through the attending geriatrician at the AGCH. Staff from the AGCH operate from the skilled nursing facility. The geriatricians work both at the AGCH as in the university hospital Academic Medical Center location. During the evening, nighttime, and weekends, a geriatrician is on duty and will be present at the university hospital or on call at home. On average, the attending geriatrician may receive 3 to 5 phone calls per evening and night and may need to come to the AGCH once per week to perform acute medical interventions.

Moreover, both units may adapt beds and/or staffing when the demand from ED of general acute hospitals increases during the winter vs in summer when bed occupation is usually lower.

**Table 1**  
Overview of Acute Geriatric Units, Staffing, Setting, and Resources

Subacute Care Unit (SCU) Barcelona, Spain			Acute Geriatric Community Hospital (AGCH) Amsterdam, The Netherlands			
<b>Setting</b>			<b>Setting</b>			
350-bed (total) intermediate care hospital			123-bed (total) skilled nursing facility			
230 beds for geriatric rehabilitation			24-bed geriatric rehabilitation unit			
40-bed subacute care unit			23-bed acute geriatric care unit			
23-bed palliative care unit			No separate palliative care unit			
Double rooms			Single rooms			
<b>Inclusion and admission criteria</b>			<b>Inclusion and admission criteria</b>			
Exacerbations of chronic conditions or “minor” acute events requiring			Exacerbations of chronic conditions or “minor” acute events requiring			
Hemodynamic stability			hospitalization			
No need for complex diagnostic testing			Hemodynamic stability			
Expecting to return to previous living situation within 10 days			No need for complex diagnostic testing			
—			Expecting to return to previous living situation within 14 days			
			Presence of geriatric conditions (eg, falls, delirium, dementia, functional impairments)			
<b>Daytime staff*</b>			<b>Daytime staff*</b>			
Geriatrician	—	1 per 12–14 beds	3 in total	Geriatrician or internist	1 per 23 beds	1 in total
Registered nurses	1 per 12–14 beds	3 in total	Registered nurses	1 per 8–10 beds	2 in total	
Nurse assistants	1 per 10 beds	4 in total	Registered nurses	1 per 4–6 beds	4 in total	
Physiotherapist	1 per 40 beds	1 in total	Nurse assistant	1 per 23 beds	1 in total	
Social worker	1 per 40 beds	1 in total	Physiotherapists	1 per 10–12 beds	2 in total	
<b>Evening/night time staff</b>			<b>Evening/night time staff</b>			
On-call geriatrician at intermediate care hospital (same facility) attending SCU			On-call geriatrician/internist at acute hospital (separate facility) attending AGCH			
Registered nurses	1 per 20 beds	2 in total	Registered nurses	1 per 10–12 beds	2 in total	
2 nurse assistants	1 per 20 beds	2 in total	1 nurse assistant	1 per 23 beds	1 in total	
<b>Consultant services</b>			<b>Consultant services</b>			
Clinical pharmacist			Clinical pharmacist			
Occupational therapist			Occupational therapist			
Clinical psychologist						
<b>Medical resources</b>			<b>Medical resources</b>			
Oxygen			Oxygen			
Intravenous medication			Intravenous medication			
Electrocardiogram			Electrocardiogram			
Urgent blood testing, blood gas analysis			Urgent blood testing, blood gas analysis			
Daily simple radiography			Weekly simple radiography			
<b>Health care setting</b>			<b>Health care setting</b>			
Opened February 2012			Opened July 2018			
Admission through EDs of acute hospitals and primary care			Admission through EDs of acute hospitals			
Serving area with 700,000 inhabitants			Serving area with 150,000 inhabitants			
Structurally funded within Catalan public health care system			Funded as care innovation by health care organizations and insurance until May 2021			
Reimbursed per admission			Reimbursed per day			

\*Residents, nurse practitioners in training, or nursing students not included.

### Admission Criteria

Admission criteria for transfer to both units were:

1. acute medical problems in older patients that require hospitalization (eg, acute events such as a pneumonia, exacerbation of chronic conditions such as heart failure, or minor acute events in very frail patients);
2. hemodynamic stability (on assessment at the ED);
3. no need for complex diagnostic testing (such as CT or MRI scans during admission);
4. expecting to return to previous living situation in 10–14 days; and
5. only for AGCH: geriatric conditions (see Table 1; eg, delirium, cognitive impairment, falls, functional impairment).

### Care Provided and Preferable Outcomes

At both units, a full CGA<sup>26</sup> is performed on admission as a basis for an individualized interdisciplinary care plan. For the AGCH, the CGA is partially conducted at the ED by a nurse practitioner and is completed by a nurse practitioner at the AGCH. The care plan includes the prevention or management of complications of hospitalization in older adults such as immobilization, delirium, or falls.<sup>14</sup> Moreover, Advance Care Planning<sup>29</sup> is established, including both short-term goals during admission (maximum desirable intensity of care, transfer to acute care, resuscitation) and conversations related to long-term goals. Another focus of both units is discharge planning.<sup>30</sup> A transitional care program is available for selected patients at the SCU. In this program, an advance practice nurse will prepare the discharge by connecting to local home care agencies and informing the patient and family with regard to medication and primary care services. In addition, the electronic health care record is shared in Catalonia between hospital and primary care, which facilitates the transmission of clinical information.<sup>31</sup> At the AGCH, discharge planning is discussed with the patient and family members within 48–72 hours after admission.<sup>32</sup> At both units, personal handovers by telephone or email are used to inform primary care providers that the patient is being discharged and to assist in (re)starting primary care services.<sup>32</sup>

Like traditional hospitals, intravenous (IV) medication and fluids can be administered at both units. Daily routine laboratory testing and simple radiography are available (radiography available once a week at the AGCH). The units both aim to admit patients for a limited number of days, a maximum of 10 at the SCU and 14 at the AGCH, to discharge >70% of patients to their original living situation and to discharge less than 15% of patients to another intermediate care unit. We collected these outcomes for both samples.

### Preventative Strategies and Adaptations/Environment at the SCU and the AGCH

Lack of social support, reduced physical activity, and sensory overstimulation can contribute to negative outcomes in older admitted patients.<sup>33,34</sup> The SCU and AGCH have several adaptations to support the recovery of older patients and reduce the risk of negative outcomes such as delirium. First, at the SCU patients may stay in a room alone or with 1 other patient. The AGCH has large single rooms, where there is space for an extra bed so that informal caregivers can stay overnight. Second, from Monday through Friday patients receive daily specialized rehabilitation therapy from a physiotherapist, and the AGCH also has therapy sessions on Saturday. The SCU has physical therapy room on the same floor, which makes it easier for patients to attend physical therapy sessions. Third, at both units family, friends and informal caregivers may visit patient throughout the day. Finally, to improve sleep quality the SCU has quiet hours (12 PM through 6 AM).

Also, staff is asked to take special care to reduce noise levels, and these are monitored with an on-site and visible decibel meter. At the AGCH, each room is equipped with a continuous, noncontact heart rate and respiration monitor (EarlySense), which allows measurement of these vital signs without having to disturb the patient during sleep.<sup>35</sup>

### Data Collection and Baseline Evaluation

We used data from both institutions' routine CGAs. For the SCU, we obtained routine collected data for health care purposes from the electronic health records. In concordance with Spanish law, patients did not sign a specific informed consent other than a general consent, allowing anonymous data use for study purposes. For the AGCH, individual patient or proxy (in case of cognitive impairment) consent was obtained. Each study protocol was approved by local medical Ethics Committees. The data are partly duplicative to earlier publications.<sup>24,25</sup>

Sociodemographic data, clinical characteristics (main admission diagnosis, Charlson comorbidity index,<sup>36</sup> history of dementia), and activities of daily living scores (Barthel index<sup>37</sup> or Katz–ADL index<sup>38</sup>) were collected. At the SCU, history of dementia included patients with suspected dementia. At the AGCH, this only included confirmed (by a medical doctor) cases of dementia. Main admission diagnosis was differently defined in the 2 samples. At the SCU, these were defined as respiratory infections, urinary tract infections, cardiovascular diagnosis, and other diagnosis. At the AGCH, there were additional disease categories: other infection, neurologic diagnosis, and gastrointestinal/dehydration/electrolyte disturbance. On admission, the Identification of Seniors at Risk (ISAR) score at the SCU and the Identification of Seniors at Risk–hospitalized Patients (ISAR-HP) score at the AGCH were filled out by clinicians. ISAR scores range from 0 to 6 and ISAR-HP score range from 0 to 5; both are used to predict adverse outcomes after home discharge, with a higher score indicating a higher risk. We used a cut-off of 2 or more points to indicate an increased risk.<sup>39</sup> Confusion Assessment Method (CAM)<sup>40</sup> at the day of admission was used to assess the presence of delirium. For the SCU, the presence of delirium on admission was assessed at the SCU itself. For the AGCH this was assessed at the ED, prior to transfer to the AGCH.

### Analysis

Outcomes were presented in frequencies and percentages, means, standard deviations (SDs) and 95% confidence intervals (CIs). For comparing proportions, we used the  $\chi^2$  test, and when comparing means we used the independent samples *t* test. To measure Activities of Daily Living, 2 different instruments were used—Barthel vs Katz-ADL index. Therefore, we did not perform comparative statistical analysis for ADL indices. We performed descriptive analysis using SPSS, version 26.00 (IBM SPSS Statistics, IBM Corporation, Armonk, NY).

### Results

The detailed clinical sample from SCU included 909 patients collected in January 2015 to March 2016, including readmitted patients. The bed occupancy rate in this period was 47.6%. The sample from AGCH included data collected between February 1, 2019, and October 19, 2019. In this period, there were 278 admissions including 23 readmissions, and 174 patients provided consent for the use of their data. Bed occupancy rate in this period was 52.5%.

### Baseline Characteristics

Table 2 provides baseline characteristics of patients admitted to the SCU and AGCH. At the SCU, more patients had been previously

**Table 2**  
Baseline Characteristics and Outcomes in Patients From Both Intermediate Care Geriatric Units

	Subacute Care Unit (SCU) (n = 909)	Acute Geriatric Community Hospital (AGCH) (n = 174)	P Value
Age, mean (SD)	85.8 (6.7)	81.9 (8.5)	<.001
Men	363 (40.0)	84 (48.3)	.04
Living independently alone	180 (19.8)	85 (48.9)	<.001
Nursing home resident	220 (24.4)	15 (8.6)	<.001
ISAR score, mean (SD)	3.4 (1.4)	3.1 (1.5)	.02
ISAR score $\geq 2$	822 (90.5)	126 (80.3)	<.001
Activities of daily living (ADL) <sup>a</sup>			
Barthel index at admission	45.4 (30.1)	—	
Katz index at admission	—	3.0 (2.1)	
Number of usual drugs, mean (SD)	8.5 (3.8)	7.2 (4.0)	<.001
Delirium on admission <sup>b</sup>	352 (38.7)	38 (22.4)	<.001
Previous hospitalization <sup>c</sup>	370 (45.8)	51 (31.5)	<.001
Primary admission diagnosis			
Respiratory infections <sup>d</sup>	431 (47.4)	45 (25.9)	<.001
Urinary tract infection	102 (11.2)	29 (16.7)	.04
Other infection or cellulitis	—	18 (10.3)	—
Cardiovascular	208 (22.9)	14 (8.0)	<.001
Neurological	—	14 (8.0)	—
Gastrointestinal, dehydration, or electrolyte disturbance	—	12 (6.9)	—
Other <sup>e</sup>	169 (18.5)	42 (24.1)	.09
Comorbidities			
Dementia <sup>f</sup>	398 (43.8) <sup>g</sup>	34 (19.5) <sup>g</sup>	<.001
Diabetes mellitus	306 (33.7)	45 (25.8)	.043
Heart failure	449 (49.4)	40 (23.0)	<.001
Ischemic cardiomyopathy	195 (21.5)	29 (16.7)	.15
Chronic renal disease	255 (28.1)	54 (31.0)	.42
COPD	338 (37.2)	41 (23.6)	<.001
Cerebrovascular disease	224 (24.6)	58 (33.3)	.02
Charlson comorbidity index, <sup>h</sup> mean (SD)	2.77 (1.7)	2.86 (2.1)	.60
Outcomes at discharge			
Mean length of stay, mean (SD), target <10/14 days <sup>**</sup>	8.8 (4.4)	9.9 (7.5)	.08
Return to usual living situation, target >70%	692 (76.1)	139 (84.2)	.28
Discharge to other intermediate care unit, target <15%	136 (14.9)	18 (10.3)	.11
Admission to acute hospital, target <5%	22 (2.4)	9 (5.2)	.044
Death during admission	60 (6.6)	9 (5.2)	.48

COPD, chronic obstructive pulmonary disease.

Unless otherwise noted, values are n (%).

<sup>a</sup>Barthel Index range 0–100, Katz Index range 0–6.

<sup>b</sup>Positive CAM (Confusion Assessment Method) at the SCU or at the ED prior to transfer to the AGCH.

<sup>c</sup>6 months prior to index admission.

<sup>d</sup>Including exacerbation of chronic obstructive pulmonary disease.

<sup>e</sup>At AGCH recurrent falls, delirium, medication reconciliation. At the SCU, this includes other diagnoses different to respiratory or urinary tract infections, or cardiovascular diseases.

hospitalized (45.8% vs 32.8%,  $P < .001$ ). At the SCU, patients were admitted for respiratory infections (47.4%), urinary tract infections (11.2%), cardiovascular diagnosis (22.9%), and other diagnosis (18.5%). At the AGCH, there were fewer respiratory infections (25.9%), more urinary tract infections (16.7%), and fewer cardiovascular principal diagnoses (8.0%). Respiratory infections also included exacerbations of chronic obstructive pulmonary disease. At both sites, cardiovascular diagnosis concerned mostly exacerbations of heart failure. Charlson comorbidity was similar between the groups, and comorbid dementia was present at 43.8% of patients at the SCU and 19.5% at the AGCH ( $P < .001$ ). Also, at the SCU, relatively more patients (39.7%) were delirious on admission compared to the AGCH (22.4%) ( $P < .001$ ).

### Outcomes at Discharge

Rates of discharge to original living situation ( $n/n_{tot}$ ), SCU 76.1% (692/909) and AGCH 79.9% (139/174), were similar ( $P = .28$ ). At the SCU site, 6.6% (60/909) of patients died during admission; this was 5.2% (9/174) at the AGCH ( $P = .48$ ). A small percentage of patients were readmitted to an acute hospital during admission, 2.4% (22/909) at the SCU and 5.2% (9/173) at the AGCH ( $P = .044$ ) (Table 2).

### Discussion

We found similar models of care between the SCU and the AGCH, with similar admission diagnosis (respiratory and/or urinary infections and heart failure). We also observe relative differences: patients at the SCU were older, with a higher prevalence delirium at admission compared with the AGCH. At the SCU, more patients were living in a nursing home, where geriatric syndromes are more prevalent<sup>41</sup> and fewer were living independently compared with the AGCH. At discharge, we find similar lengths of stay, return to previous living situation, discharge to another intermediate care unit, and mortality. Importantly, return and admission to general hospital is equal to/lower than 5 percent. Meaning that hospital admission is avoided in most patients.

To place this model of acute geriatric units outside of a general hospital within an international context, we will discuss 4 other models of care for older adults: Acute Care for the Elderly (ACE) units,<sup>15</sup> Hospital at Home (HaH),<sup>12</sup> nursing-led inpatient units (NLU),<sup>16</sup> and post-acute geriatric rehabilitation units in community hospitals (Figure 1).<sup>42</sup>

The acute geriatric unit model of care that we describe differs from other geriatric care units like the ACE developed in the United States.<sup>15</sup> An ACE unit is hospital based and provides a full range of hospital diagnostics and services.<sup>15</sup> ACE units improve hospital outcomes such as LOS and readmissions in frail, older patients. However, acute geriatric units that are situated outside of a general hospital may have advantages over ACE units in specific settings. First, an acute geriatric unit can allow for a more comfortable environment, closer to the community, that can help in the management of care transitions. Second, there also may be an advantage in that an intermediate care facility can combine acute, rehabilitation, and palliative care if indicated. Third, compared with a general acute hospital, the SCU and AGCH do not provide the same range of costly diagnostics and services, reducing the cost per admission.

Other models of care for older adults are admission to NLU<sup>16</sup> and post-acute care wards in community hospitals.<sup>42</sup> Compared with

<sup>g</sup>The SCU includes suspected and confirmed cases of dementia. The AGCH only includes confirmed (by a medical doctor) cases of dementia.

<sup>h</sup>Range of 0–31, with a higher score indicating more or more severe comorbidity.

<sup>\*\*</sup>10 days at the SCU, 14 days at the AGCH.

NLUs, we find that NLU LOS ranges from 16 to 60 days which is longer than the LOS at the AGCH an SCU.<sup>16</sup> This prolonged LOS indicates that care provided at NLUs will be within the post-acute phase and not in the acute phase as in our model.

Post-acute care units in community hospitals have been implemented in countries like the United Kingdom.<sup>17</sup> There is evidence they improve functional outcomes and are cost-effective compared with continued hospital stay.<sup>18,43</sup> Compared with our model, these post-acute care units may not fully replace acute hospital admission because they may not always have resources for providing acute hospital treatment (eg, no IV medication or 24/7 acute medical services).<sup>17</sup> However, there are community hospitals in Northern Europe and the United Kingdom that can also provide acute care and administer IV medication.<sup>17</sup> However there is a large variation in practice. Most community hospitals are focused on rehabilitation and may be nurse-led vs led by a physician. They may also have a longer LOS (range 11–58 days) compared with the model of care that we describe.<sup>18</sup> Moreover, in community hospitals in the United Kingdom, most patients are discharged from wards of general acute hospitals and are not referred from the ED, unlike our model of care.<sup>18</sup>

Another *bed-based* model of care is where an HaH team comes in to a nursing home or community hospital to provide, for example, treatment with IV medication.<sup>44</sup>

More commonly in the HaH model, hospital-level care is provided at the home of an older patient. The outcomes (eg, mortality or readmission) of admission to HaHs are similar to an acute general hospital.<sup>12</sup> However, HaHs cannot fully replace acute geriatric units because HaH care is frequently provided when an informal caregiver is present.<sup>12</sup> In contrast, in our sample many older persons were living in a nursing home (SCU) or independently by themselves (AGCH), without a spouse or family member who could act as an informal caregiver. Therefore, the social support of patients attended in SCU or AGCH could be lower, and this can contribute to the clinical and functional complexity. These patients may need more intensive monitoring or treatment than can be provided by an HaH team.

Limitations of this study include data collection in 2 settings and at 2 different time points, which may reduce comparability of data. Therefore, the statistical testing should be interpreted with caution. However, our descriptive patient data demonstrate that these 2 units serve a similar population with similar outcomes.

Speculating on benefits of acute geriatric units, we suggest that they are adapted to the needs of older patients with frailty. At both units, patients receive specialized geriatric rehabilitation that may help to prevent functional decline and sustain functional capacity at an early stage. Furthermore, the environment is adapted to improve night rest, prevent delirium, and boost recovery. These adaptations may not have been feasible in the setting of a general hospital, as the growth of hospital budgets has been restricted in recent years, length of hospital stay is decreasing, and hospitals are primarily focused on providing acute specialist care, which may not be the primary focus of care for frail older adults.<sup>45</sup> In rural areas or island communities, this model could be implemented if there is no general acute hospital within the proximity of the patient's home. Another benefit is that this model of care can be scaled up within a facility; the SCU was scaled up and used to deliver acute care to older adults affected by COVID-19.<sup>23</sup> Telemedicine could also be implemented within this model of care for example by inviting consulting specialists and primary care providers to partake in multidisciplinary consultations.<sup>21,46</sup> Moreover, the EarlySense could also be used to monitor vital signs (ie, respiration and heart rate) from an outside location.<sup>35</sup>

## Conclusions and Implications

Our descriptive data show that, though in 2 different settings, these acute geriatric units are quite similar and can provide an alternative to general hospital. Our results encourage the comparison with other European care models that aim to provide acute care outside of a general hospital. Further research could focus on performing multicenter studies, evaluating cost-effectiveness, and comparison to hospital-based units.

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## References

- European Commission. The 2012 Ageing Report: Economic and budgetary projections for the EU27 Member States (2010–2060). Prepared with the Economic Policy Committee (AWG), European Economy 2; 2012.
- Marshall A, Nazroo J, Tampubolon G, Vanhoutte B. Cohort differences in the levels and trajectories of frailty among older people in England. *J Epidemiol Community Health* 2015;69:316–321.
- Buurman BM, Frenkel WJ, Abu-Hanna A, et al. Acute and chronic diseases as part of multimorbidity in acutely hospitalized older patients. *Eur J Intern Med* 2016;27:68–75.
- Palladino R, Pennino F, Finbarr M, et al. Multimorbidity and health outcomes in older adults in ten European health systems, 2006–15. *Health Aff (Millwood)* 2019;38:613–623.
- Bagshaw SM, Stelfox HT, McDermid RC, et al. Association between frailty and short- and long-term outcomes among critically ill patients: A multicentre prospective cohort study. *Can Med Assoc J* 2014;186:E95–E102.
- König HH, Leicht H, Bickel H, et al. Effects of multiple chronic conditions on health care costs: An analysis based on an advanced tree-based regression model. *BMC Health Serv Res* 2013;13:219.
- Boyd CM, Landefeld CS, Counsell SR, et al. Recovery of activities of daily living in older adults after hospitalization for acute medical illness. *J Am Geriatr Soc* 2008;56:2171–2179.
- Kansagara D, Englander H, Salanitro A, et al. Risk prediction models for hospital readmission: A systematic review. *JAMA* 2011;306:1688–1698.
- Teno JM, Gozalo PL, Bynum JP, et al. Change in end-of-life care for medicare beneficiaries: Site of death, place of care, and health care transitions in 2000, 2005, and 2009. *JAMA* 2013;309:470–477.
- Hoogendijk EO, Afilalo J, Ensrud KE, et al. Frailty: Implications for clinical practice and public health. *Lancet* 2019;394:1365–1375.
- Conley J, O'Brien CW, Leff BA, et al. Alternative strategies to inpatient hospitalization for acute medical conditions: A systematic review. *JAMA Intern Med* 2016;176:1693–1702.
- Shepperd S, Iliffe S, Doll HA, et al. Admission avoidance hospital at home. *Cochrane Database Syst Rev* 2016;9:CD007491.
- Sezgin D, O'Caomh R, O'Donovan MR, et al. Defining the characteristics of intermediate care models including transitional care: An international Delphi study. *Aging Clin Exp Res* 2020;32:2399–2410.
- Inzitari M, Gual N, Roig T, et al. Geriatric screening tools to select older adults susceptible for direct transfer from the emergency department to subacute intermediate-care hospitalization. *J Am Med Dir Assoc* 2015;16:837–841.
- Ahmed N, Taylor K, McDaniel Y, Dyer CB. The role of an acute care for the elderly unit in achieving hospital quality indicators while caring for frail hospitalized elders. *Popul Health Manag* 2012;15:236–240.
- Griffiths PD, Edwards MH, Forbes A, et al. Effectiveness of intermediate care in nursing-led in-patient units. *Cochrane Database Syst Rev* 2007;(2):CD002214.
- Davidson D, Ellis Paine A, Glasby J, et al. Analysis of the Profile, Characteristics, Patient Experience and Community Value of Community Hospitals: A Multi-method Study. Southampton, UK: NIHR Journals Library; 2019.
- Young J, Hulme C, Smith A, et al. Measuring and Optimising the Efficiency of Community Hospital Inpatient Care for Older People: The MoCHA Mixed-Methods Study. Southampton, UK: NIHR Journals Library; 2020.

19. Boyd CM, Darer J, Boult C, et al. Clinical practice guidelines and quality of care for older patients with multiple comorbid diseases: Implications for pay for performance. *JAMA* 2005;294:716–724.
20. Fried LP, Tangen CM, Walston J, et al. Frailty in older adults: Evidence for a phenotype. *J Gerontol A Biol Sci Med Sci* 2001;56:M146–M156.
21. Roller-Wirnsberger R, Lindner S, Liew A, et al. European collaborative and interprofessional capability framework for prevention and management of frailty—A consensus process supported by the Joint Action for Frailty Prevention (ADVANTAGE) and the European Geriatric Medicine Society (EuGMS). *Aging Clin Exp Res* 2020;32:561–570.
22. Colprim D, Martin R, Parer M, et al. Direct admission to intermediate care for older adults with reactivated chronic diseases as an alternative to conventional hospitalization. *J Am Med Dir Assoc* 2013;14:300–302.
23. Inzitari M, Udina C, Len O, et al. How a Barcelona post-acute facility became a referral center for comprehensive management of subacute patients with COVID-19. *J Am Med Dir Assoc* 2020;21:954–957.
24. Ribbink ME, Macneil-Vroomen JL, van Seben R, et al. Investigating the effectiveness of care delivery at an acute geriatric community hospital for older adults in The Netherlands: A protocol for a prospective controlled observational study. *BMJ Open* 2020;10:e033802.
25. Gual N, Morandi A, Perez LM, et al. Risk factors and outcomes of delirium in older patients admitted to postacute care with and without dementia. *Dement Geriatr Cogn Disord* 2018;45:121–129.
26. Ellis G, Whitehead MA, Robinson D, et al. Comprehensive geriatric assessment for older adults admitted to hospital: Meta-analysis of randomised controlled trials. *BMJ* 2011;343:d6553.
27. Gual N, Inzitari M, Carrizo G, et al. Delirium subtypes and associated characteristics in older patients with exacerbation of chronic conditions. *Am J Geriatr Psychiatry* 2018;26:1204–1212.
28. Stadinindex. Stadinindex-Noord-Holland. 2019. Available at: <https://www.stadinindex.nl/noord-holland>. Accessed June 11, 2019.
29. Lum HD, Sudore RL, Bekelman DB. Advance care planning in the elderly. *Med Clin North Am* 2015;99:391–403.
30. Verhaegh KJ, MacNeil-Vroomen JL, Eslami S, et al. Transitional care interventions prevent hospital readmissions for adults with chronic illnesses. *Health Aff (Millwood)* 2014;33:1531–1539.
31. Marimon-Suñol S, Rovira-Barberà M, Acedo-Anta M, et al [Shared electronic health record in Catalonia, Spain]. *Med Clin (Barc)* 2010;134(Suppl 1):45–48 [in Spanish].
32. van Seben R, Geerlings SE, Buurman BM [10 tips for improving patient handovers from hospital to other health care settings]. *Ned Tijdschr Geneesk* 2017; 161:D1031.
33. Brown CJ, Redden DT, Flood KL, Allman RM. The underrecognized epidemic of low mobility during hospitalization of older adults. *J Am Geriatr Soc* 2009;57: 1660–1665.
34. National Clinical Guideline Centre (UK). Delirium: Diagnosis, Prevention and Management. National Institute for Health and Care Excellence: Guidance. London: Royal College of Physicians; 2010.
35. Brown H, Terrence J, Vasquez P, et al. Continuous monitoring in an inpatient medical-surgical unit: A controlled clinical trial. *Am J Med* 2014;127:226–232.
36. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: Development and validation. *J Chronic Dis* 1987;40:373–383.
37. Mahoney FI, Barthel DW. Functional evaluation: The Barthel index. *Md State Med J* 1965;14:61–65.
38. Katz S. Assessing self-maintenance: Activities of daily living, mobility, and instrumental activities of daily living. *J Am Geriatr Soc* 1983;31:721–727.
39. McCusker J, Bellavance F, Cardin S, et al. Detection of older people at increased risk of adverse health outcomes after an emergency visit: The ISAR screening tool. *J Am Geriatr Soc* 1999;47:1229–1237.
40. Inouye SK, van Dyck CH, Alessi CA, et al. Clarifying confusion: The confusion assessment method. A new method for detection of delirium. *Ann Intern Med* 1990;113:941–948.
41. Lee PG, Cigolle C, Blaum C. The co-occurrence of chronic diseases and geriatric syndromes: The health and retirement study. *J Am Geriatr Soc* 2009;57:511–516.
42. Green J, Young J, Forster A, et al. Effects of locality based community hospital care on independence in older people needing rehabilitation: Randomised controlled trial. *BMJ* 2005;331:317–322.
43. Young J, Green J, Forster A, et al. Postacute care for older people in community hospitals: A multicenter randomized, controlled trial. *J Am Geriatr Soc* 2007; 55(12):1995–2002.
44. Montalto M, Chu MY, Ratnam I, et al. The treatment of nursing home-acquired pneumonia using a medically intensive hospital in the home service. *Med J Aust* 2015;203:441–442.
45. Bouwman B. Ligduurmonitor Nederlandse ziekenhuizen 2011. Arnhem: Coppa Consultancy; 2012.
46. Zulfikar AA, Hajjam A, Talha S, et al. Telemedicine and geriatrics in France: Inventory of experiments. *Curr Gerontol Geriatr Res* 2018;2018:9042180.