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## Original Study

# A New Hospital-At-Home Model for Integrated Geriatric Care: Data From a Preliminary Italian Experience

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## A B S T R A C T

## Keywords:

Older adults  
frailty  
mortality  
emergency department  
disability

**Objective:** Hospital-at-home (HaH) has emerged as an alternative to conventional in-hospital care in older adults, possibly reducing hospital admissions and related complications. This study aimed to describe the characteristics and outcomes of patients referred to "Gruppo di Intervento Rapido Ospedale-Territorio" (GIROT), a HaH service based on comprehensive geriatric assessment, developed in Florence, Italy, during the postpandemic period.

**Design:** Retrospective longitudinal study.

**Setting and Participants:** GIROT provided home-based care to patients with acute or exacerbated chronic diseases and a high risk of hospital-related complications (ie, patients with moderate-to-severe disability and/or dementia), referred from primary care, emergency departments, or in-hospital units.

**Methods:** All-cause mortality and hospitalization rates were assessed at 1, 3, and 6 months, and predictors of 6-month mortality were investigated.

**Results:** Among 391 patients (mean age, 88.4 years; 62.4% female) referred from emergency departments (58.6%), primary care (27.9%), and acute medical units (13.6%), the main diagnoses were respiratory failure (28.4%), acute heart failure (25.3%), and delirium (13.6%). Patients referred from primary care were older and showed a higher prevalence of severe disability and hypomobility. After 1, 3, and 6 months, mortality rates were 34.5%, 45.6%, and 53.8%, and hospitalization rates 7.2%, 21.5%, and 37.9%, respectively. Predictors of 6-month mortality included age (odds ratio [OR], 1.039), severe disability (OR, 3.446), impossible/assisted walking (OR, 4.450) and referral from primary care (OR, 2.066). High global satisfaction with the service was reported.

**Conclusions and Implications:** The GIROT model may help expanding acute health care capacity for older adults at high risk of hospital-related complications. Customized care plans are needed in patients with severe disability/hypomobility, considering also simultaneous palliative care.

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This study was supported by Azienda USL Toscana Centro and Azienda Ospedaliero-Universitaria Careggi. We acknowledge cofunding from Next Generation EU, in the context of the National Recovery and Resilience Plan, Investment PE8 – Project Age-It: "Ageing Well in an Ageing Society." Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the

European Commission can be held responsible for them. The study's sponsors did not influence study design, conduct, or reporting.

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<https://doi.org/10.1016/j.jamda.2024.105295>

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Over the last decades, the phenomenon of population ageing has led to an exponential growth of the number and proportion of adults at very old ages. This demographic shift has been accompanied by an increase in the prevalence of frailty and multimorbidity, posing a major challenge to the hospital-based model of acute diseases. Indeed, frail older individuals with multiple coexisting chronic diseases frequently experience recurrent hospital admissions, often related to decompensated chronic conditions, resulting in an increased risk of hospital-related complications (eg, delirium, infections, deconditioning, functional decline, disability, nursing home admission).<sup>1,2</sup> A posthospital syndrome may also develop due to deconditioning, poor nutrition, sleep deprivation, and impaired mental status, leading to an increased risk of readmission in the short term.<sup>3</sup> Moreover, this scenario often results in keeping older patients with poor prognosis away from their home, with consequent increase of health care costs and hospital-associated psychological distress. This suggests the need to transform existing health care models, providing integrated care with a comprehensive and person-centered approach. Care coordination between acute and community-based services might help to reduce unnecessary hospital admissions and health care systems burden, while improving older adults' care, particularly in individuals with high frailty and/or disability.

Hospital-at-home (HaH) provides hospital-level care to selected people in their homes or in nursing homes, as a substitute for traditional inpatient hospital care.<sup>4</sup> Over the last decades, HaH has emerged as a promising health care strategy, allowing to provide acute-level care in the familiar atmosphere of the home environment while reducing hospital admissions, length of stay, and related health risks.<sup>5-8</sup> Possible benefits on quality of life, psychological distress, delirium occurrence, and institutionalization have also been reported.<sup>7,9-11</sup> However, until a few years ago, the development of HaH programs was limited in most countries, including Italy.

More recently, the COVID-19 pandemic has emphasized the need of geriatric care pathways, especially for frail older patients in hospital and care homes.<sup>12</sup> Moreover, the pandemic has challenged the capacity of health care facilities, prompting a remarkable expansion of HaH models.<sup>13</sup> Different HaH models have been created, with heterogeneous characteristics and setup according to the organization of local acute and community-based services. Although differences exist in organizational arrangements, these models share common purposes, mainly aimed at avoiding hospital admission (admission avoidance) and/or reducing length of stay (early discharge) of frail older patients.<sup>14</sup> Preliminary data have been provided, showing encouraging results.<sup>11,15</sup> However, criteria for patients' selection are highly variable, and evidence on outcomes remains limited.

In Florence, Italy, HaH was first created during the COVID-19 pandemic, in April 2020. After the dramatic outbreak of SARS-CoV-2 infection in the nursing home setting and the subsequent increase in hospitalization rates, the local health care authorities mandated that hospitals setup intermediate care units on-site at the nursing homes.<sup>16,17</sup> Specialized mobile multidisciplinary teams were thus created, providing bedside acute care to SARS-CoV-2–positive residents based on the comprehensive geriatric assessment. This hospital-at-nursing home service—"Gruppo Intervento Rapido Ospedale-Territorio" (GIROT) (ie, Hospital-Community Rapid Intervention Group)—introduced an innovative organizational model for outbreak management with an integrated care approach.<sup>18</sup> Together with the COVID-19 vaccination program, the onset of GIROT activity was associated with a decrease of hospitalization and lethality among SARS-CoV-2–positive residents.<sup>19,20</sup>

During the postpandemic period, the GIROT model evolved from a hospital-at-nursing home service to a full HaH service, offering home-based care to frail older patients with acute and/or exacerbated chronic conditions referred from different clinical settings including primary care, emergency departments (EDs), and acute medical units.

This study describes the characteristics of the GIROT model as an HaH service developed during the postpandemic period. Moreover, we explored the characteristics and outcomes of GIROT users, performing a comparison across referral settings (ie, primary care, ED, acute medical units).

## Methods

A retrospective longitudinal study was conducted in Florence, Italy, involving patients referred to the GIROT service from primary care, ED, or acute medical units of the Florence Health District between October 2022 and March 2023 (Figure 1).

Patients were deemed eligible for inclusion in the GIROT service if all the following criteria were present: presence of acute or exacerbated chronic diseases as per Supplementary Appendix 1, indication for medical therapies that can be provided in a home setting, high risk of hospital-related complications due to moderate-to-severe disability, motor disability (ie, need of walking assistance, in wheelchair/bedridden) and/or dementia, and patients' and caregivers' consent to home-based care.

Patients referred from the ED included older adults awaiting an inpatient bed, who had been evaluated by a geriatric specialist from the GIROT team to assess appropriateness for GIROT care, according to the model of acute frailty units.<sup>21,22</sup> Patients from acute medical units and primary care were referred from ward physicians or general practitioners based on the aforementioned inclusion criteria, after preliminary shared decision-making with the GIROT team. Patients with acute surgical conditions, acute stroke, acute coronary syndromes, indications for admission to critical care services (including the need of noninvasive ventilation or high-flow oxygen therapy), or inadequate social support were considered as not eligible for GIROT care. In the case of inadequate social support, hospital-based care was preferred for the treatment of acute conditions, and caregivers and/or families were referred to social services to discuss possible strategies to improve assistance and address specific patient's needs in daily care after the resolution of the acute condition.

## Intervention

Members of the GIROT team included geriatricians and internal medicine specialists providing home-based care in a comanagement arrangement with general practitioners and in collaboration with nurses and physiotherapists from the health care district. Admission to the GIROT service was discussed and agreed with general

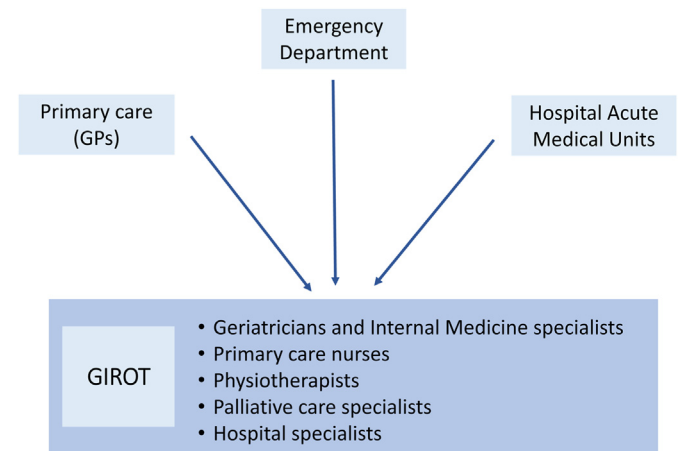


Fig. 1. Organizational structure of the GIROT HaH model. GPs, general practitioners.

practitioners. The timing of first medical assessment was established with the referring physician based on clinical status severity using the following color code: red (within 24–48 hours), yellow (within 48–72 hours), and green (within 7 days).

Home-based care consisted of a comprehensive geriatric assessment including delirium screening using the 4-AT test and medical therapy optimization. Moreover, a first-line diagnostic workup was conducted, including electrocardiogram, point-of-care hemogasanalysis, on-site standard blood tests, and bedside ultrasound. On-site medical management including intravenous drug administration and hydration, and low-flow supplemental oxygen was available (Supplementary Appendix 2). Medical management also focused on prevention and treatment of geriatric syndromes (eg, pressure sores, urinary incontinence, delirium, swallowing disorders [presbyphagia], malnutrition, functional decline). In-home nursing care was provided for the management of pressure sores, urinary incontinence, and constipation. Remote consultations were conducted beyond in-person assessments, if deemed necessary to monitor patient's symptoms and parameters (ie, blood pressure, heart rate, oxygen saturation, body weight, fever, urine output in patients with a catheter) following medical therapy optimization, such as dose adjustments (eg, reduction or up-titration of diuretics, psychoactive therapies), introduction of specific treatments (eg, antibiotic therapy), and/or deprescribing. In the case of clinical instability and/or in need of advanced medical care, direct hospital admission was discussed based on a goal-of-care conversation with patients, their families, and general practitioners. Simultaneous palliative care was offered to patients approaching end of life, in collaboration with palliative care specialists.

The GIROT activity was provided 6 d/wk, from 8 AM to 8 PM. General practitioners received regular clinical updates from the GIROT team and participated in the discussion of diagnostic and therapeutic strategies and timing of GIROT discharge. After GIROT discharge, a new intervention could be requested by general practitioners in the case of disease exacerbation.

### Outcomes

Outcomes included mortality and hospitalization for any cause, assessed at 1, 3, and 6 months after admission to the GIROT service. Information concerning vital status and hospital admissions was obtained from electronic hospital records and phone interviews. Moreover, satisfaction with the GIROT service was assessed by phone interviews with patients and/or their caregivers using the following question: please rate your overall satisfaction with the GIROT service (answer options included very unsatisfied, unsatisfied, satisfied, and very satisfied).

### Ethics

The observational study was approved by the local research ethics committee (Comitato Etico Regione Toscana - Area Vasta Centro, protocol reference No. 26560\_oss). Each participant or his/her legal representative gave written informed consent to study participation.

### Statistical Analysis

Data were summarized as means with SDs for normally distributed continuous variables, medians and interquartile ranges (25th–75th percentiles) for nonnormally distributed variables, and absolute frequencies with percentages for categorical variables.

Bivariate analyses were performed to compare the characteristics and outcomes of patients from different settings. Differences in

categorical variables were tested using the  $\chi^2$  test. The analysis of variance test or the Kruskal Wallis test were used as appropriate for comparisons of continuous variables.

Disability was defined based on the Barthel Index (BI)<sup>23</sup> and classified as mild (BI 80–100), moderate (BI 40–80), or severe (BI <40). The comorbidity burden was defined as the count of comorbidities (hypertension, diabetes, heart failure, chronic obstructive pulmonary disease, chronic kidney disease, atrial fibrillation, stroke history, active cancer, dementia, and Parkinson disease).

Kaplan–Meier curves for overall survival and hospitalization were created, and log-rank tests were performed to test differences between patients from different settings. Follow-up data were censored at the time of follow-up (May 2024) or at 30, 90, or 180 days for participants who were known to have died (overall survival) or to have been admitted to hospital (hospitalization) at 1, 3, and 6 months, respectively.

Multivariable binary logistic regression models were created to identify predictors of 6-month mortality, adjusting for demographics and main clinical variables, showing an association with the outcome in bivariate analysis. To avoid multicollinearity, the intercorrelations among predictors were checked using a correlation matrix of 2-sided Spearman  $\rho$  correlation coefficients. Correlations of  $\geq 0.50$  were considered large. Results of logistic regression were expressed as odds ratios (ORs) and 95% CIs. Statistical significance was set at  $P < .05$ . All statistical analyses were performed using SPSS software version 26 (SPSS Inc).

### Results

The study sample included 391 patients (mean age, 88.4 years; SD, 6.0; 62.4% female), referred from the ED ( $n = 229$ , 58.6%), primary care ( $n = 109$ , 27.9%), and acute medical units ( $n = 53$ , 13.6%). The main reasons for referral were respiratory failure (28.4%), acute heart failure (25.3%), and delirium (13.6%). The sociodemographic and clinical characteristics of the overall study sample and of each single subgroup are shown in Table 1.

Patients referred from the primary care setting were older and showed a higher prevalence of severe disability, hypomobility, and presbyphagia. No significant differences were observed in single comorbidities and disease burden; however, patients from the primary care setting were receiving a slightly lower number of daily medications. Prevalence of delirium was 6.4% in the overall sample, with similar rates between different settings (Table 1).

The GIROT activity is detailed in Table 2. The median duration of the intervention was 6 (interquartile range, 2–11) days. Patients referred from the ED more commonly received intravenous medical treatments and oxygen therapy compared with patients from primary care. The remaining services and treatment provided were similar across patient subgroups.

### Outcome Analysis

Follow-up data were available in 377 patients. All-cause mortality rates at 1, 3, and 6 months were 34.5%, 45.6%, and 53.8%, respectively (Supplementary Appendix 3). Mortality risk was significantly higher among patients referred from the primary care setting (Figure 2, left panel).

Of the overall sample, 7.2% were admitted to hospital within 1 month of admission to GIROT. The rate of hospitalization increased to 21.5% and 37.9% at 3 and 6 months, respectively (Supplementary Appendix 3), with no significant differences between different referral settings (Figure 2, right panel).

Satisfaction with the GIROT service is illustrated in Figure 3, showing a positive experience in about 9 of 10 patients and caregivers.



**Table 1**  
Baseline Sociodemographic and Clinical Features of GIROT Patients, by Referral Setting

	Overall Sample (N = 391)	ED (n = 229)	Primary Care (n = 109)	Acute Units (n = 53)	P
Age, y, mean (SD)	88.4 (6.0)	88.4 (5.8)*	89.7 (6.0)*	85.8 (6.3) <sup>†</sup>	<.001
Female	147 (37.6)	139 (60.7)* <sup>†</sup>	79 (72.5) <sup>†</sup>	26 (49.1)*	.011
Disability					
Mild	48 (12.3)	35 (15.3)*	6 (5.5) <sup>†</sup>	7 (13.2)* <sup>†</sup>	.007
Moderate	86 (22.0)	49 (21.4)*	19 (17.4)*	18 (34.0)*	
Severe	257 (65.7)	145 (63.3)*	84 (77.1) <sup>†</sup>	28 (52.8)*	
Impossible/assisted walking	266 (68.0)	152 (66.4)	83 (76.1)	31 (58.5)	.055
Presence of formal caregiver					
Round-the-clock	159 (40.7)	95 (41.5)	43 (39.4)	21 (39.6)	.39
Some hours per day	43 (11.0)	25 (10.9)	11 (10.1)	7 (13.2)	
Nursing home resident	41 (10.5)	22 (9.6)	17 (15.6)	2 (3.8)	
Disease count, median (interquartile range)	2 (2-3)	3 (2-4)	2 (1-3)	3 (2-3)	.06
Number of daily medications, mean (SD)	6.5 (3.0)	6.8 (2.9)*	5.6 (2.9) <sup>†</sup>	6.8 (3.3)*	.003
Dementia	182 (46.5)	113 (49.3)	51 (46.8)	18 (34.0)	.13
With behavioral disorders	77 (19.7)	54 (23.6)	18 (16.5)	5 (9.4)	.10
Parkinson disease	24 (6.1)	13 (5.7)	8 (7.3)	3 (5.7)	.83
Hypertension	228 (58.3)	140 (61.1)	56 (51.4)	32 (60.4)	.22
Diabetes	86 (22.0)	54 (23.6)	20 (18.3)	12 (22.6)	.55
Heart failure	148 (37.9)	95 (41.5)	33 (30.3)	20 (37.7)	.14
Atrial fibrillation	114 (29.2)	68 (29.7)	26 (23.9)	20 (37.7)	.18
Previous stroke	40 (10.2)	22 (9.6)	11 (10.1)	7 (13.2)	.74
COPD	87 (22.3)	51 (22.3)	19 (17.4)	17 (32.1)	.11
Chronic kidney disease	66 (16.9)	42 (18.3)	13 (11.9)	11 (20.8)	.24
Active cancer	25 (6.4)	11 (4.8)	12 (11.0)	2 (3.8)	.07
Oxygen therapy at GIROT admission	52 (13.3)	28 (12.2)*	9 (8.3)*	15 (28.3) <sup>†</sup>	.002
Hip fracture in the past 12 months	11 (2.8)	5 (2.2)	3 (2.8)	3 (5.7)	.39
Hypomobility syndrome	48 (12.3)	14 (6.1)*	29 (26.6) <sup>†</sup>	5 (9.4)*	<.001
Presbyphagia	27 (6.9)	9 (3.9)*	14 (12.8) <sup>†</sup>	4 (7.5)* <sup>†</sup>	.010
Delirium	25 (6.4)	14 (6.1)	8 (7.3)	3 (5.7)	.89

Values are n (%) or as otherwise indicated.

\*Subgroup with significantly different values ( $P < 0.05$ ).<sup>†</sup>Subgroup with significantly different values ( $P < 0.05$ ).

### Predictors of All-Cause Mortality

At bivariate analysis (Supplementary Appendix 4), 6-month mortality was associated with older age, severe disability (BI < 40/100), impaired motor performance (impossible/assisted walking), and geriatric syndromes (eg, hypomobility, presbyphagia). Among comorbidities, mortality was associated with dementia and cancer. Patients who died within 6 months of GIROT admission had more frequently received intravenous hydration, whereas no significant differences were observed in other services and treatments provided during home-based care (Supplementary Appendix 4).

At multivariable analysis (Supplementary Appendix 5), advanced age (OR, 1.039; 95% CI, 1.001-1.079), severe disability (OR, 3.446; 95% CI, 1.622-7.322), and impossible/assisted walking (OR, 4.450; 95% CI, 2.670-7.416) were identified as independent predictors of 6-month mortality. Moreover, referral from primary care was independently associated with increased mortality (OR, 2.066; 95% CI, 1.229-3.472).

**Table 2**  
GIROT Activity: Diagnostic and Therapeutic Interventions

	Overall Sample (N = 391)	Emergency Department (n = 229)	Primary Care (n = 109)	Acute Units (n = 53)	P
Intravenous hydration	69 (17.6)	46 (20.1)	18 (16.5)	5 (9.4)	.17
Intravenous medical therapies	100 (25.6)	83 (36.2)*	12 (11.0) <sup>†</sup>	5 (9.4) <sup>†</sup>	<.001
Oxygen therapy	84 (21.5)	62 (27.1)*	11 (10.1) <sup>†</sup>	11 (20.8)* <sup>†</sup>	.002
Blood transfusion	2 (0.5)	2 (0.9)	0 (0)	0 (0)	.49
Social support	12 (3.1)	8 (3.5)	2 (1.8)	2 (3.8)	.68
Physiotherapy	7 (1.8)	3 (1.3)	3 (2.8)	1 (1.9)	.65
Second-line diagnostic tests	8 (2.0)	7 (3.1)	1 (0.9)	0 (0)	.23
Day hospital services for specialist assessment	8 (2.0)	5 (2.2)	2 (1.8)	1 (1.9)	.97

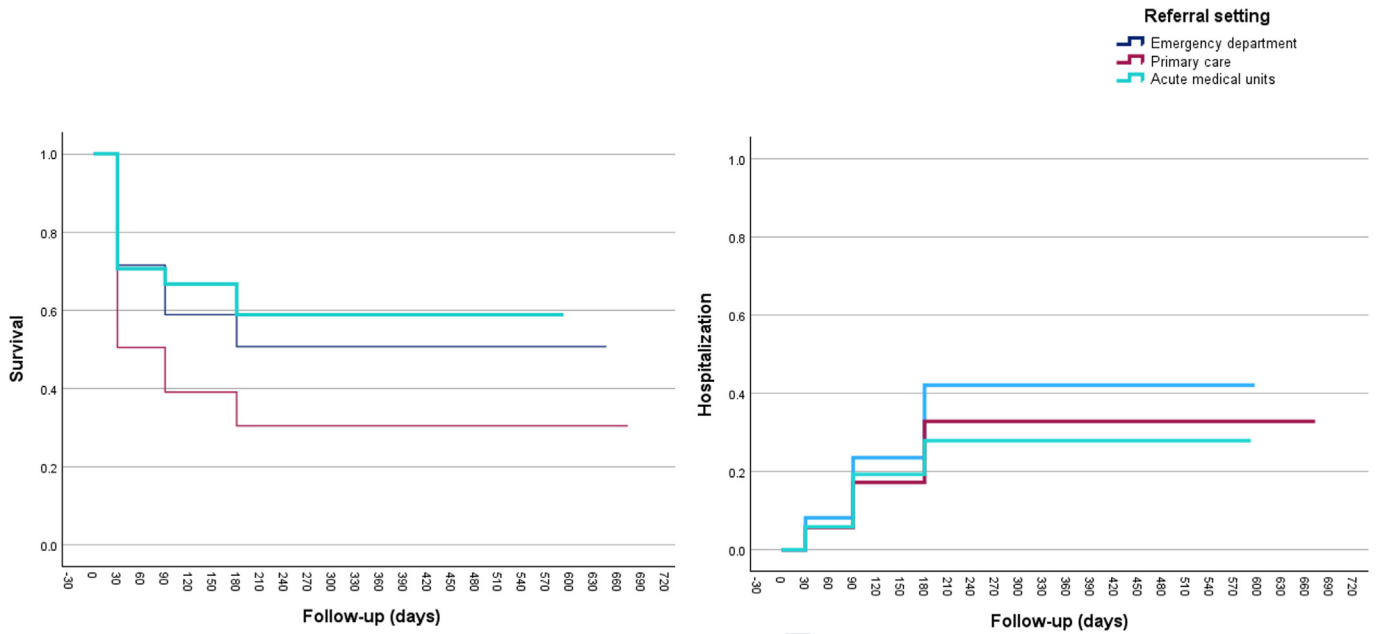
Values are n (%) or as otherwise indicated. These interventions were conducted in addition to essential GIROT services, which included comprehensive geriatric assessment, first-line diagnostic tests, management of geriatric syndromes including in-home nursing care when appropriate (pressure sores, urinary incontinence, constipation), and simultaneous palliative care.

\*Subgroup with significantly different values ( $P < 0.05$ ).<sup>†</sup>Subgroup with significantly different values ( $P < 0.05$ ).

### Discussion

This study describes the GIROT model, an HaH service developed in Florence, Italy, to provide home-based care to frail older patients at high risk of hospital-related complications. The characteristics of GIROT patients and rates of mortality and hospitalization have been estimated, comparing referral settings (ie, primary care, ED, acute medical units).

According to the inclusion criteria, the sociodemographic and clinical features of GIROT patients described in this study draw up the picture of a complex and highly vulnerable population, with high prevalence of dementia, severe disability, and motor impairment. These patients, despite a high risk of hospital admission, usually derive low benefits from in-hospital care, due to concomitant conditions determining a poor prognosis and a high risk of hospital-related complications. In particular, patients from primary care showed higher disability levels. We may thus suppose that the GIROT activity



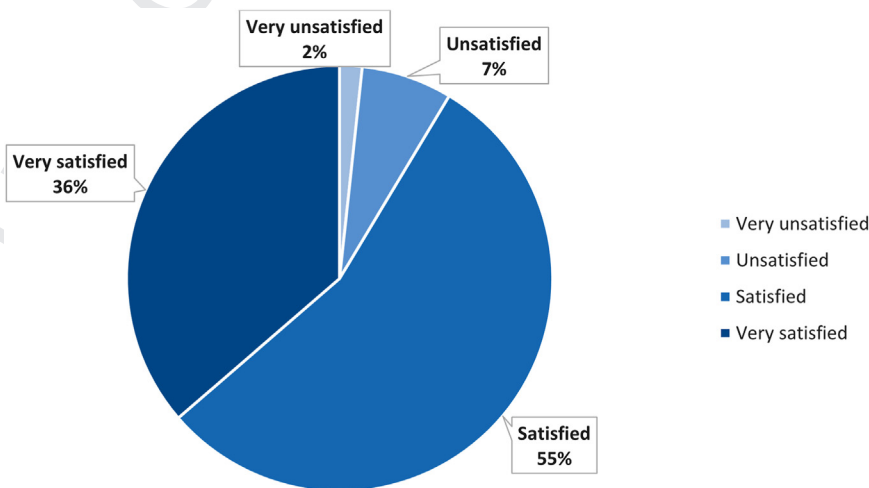
**Fig. 2.** Kaplan-Meier curves for overall survival (left panel) and hospitalization (right panel), stratified by referral setting. Overall survival:  $P < 0.001$  for primary care vs ED/acute medical units;  $P = 0.341$  for ED vs acute medical units. Hospitalization:  $P = 0.200$  for primary care vs ED;  $P = 0.152$  for ED vs acute medical units;  $P = 0.741$  for primary care vs acute medical units. Follow-up data were censored at the time of follow-up (May 2024) or at 30, 90, or 180 days for participants who were known to have died (left panel) or to have been admitted (right panel) at 1, 3, and 6 months, respectively.

has supported general practitioners in the management of older patients with greater functional impairment, in whom avoidance of hospital admission may be preferable, when possible.

To date, available data on HaH are limited to a small number of randomized trials and observational studies and describe a highly heterogeneous scenario, including models with very different organizational structure and patients with varying clinical and functional profile.<sup>7,11,15</sup> A direct comparison of different experiences might thus be difficult to perform. Data from this study demonstrate that the GIROT service shares similarities with existing HaH models regarding referral settings and indications, mainly including acute diseases or exacerbated chronic conditions in very old, frail patients from primary care, ED, or hospital units.<sup>6,8,10,24-27</sup> Diagnostic assessments, treatments, and services provided by the GIROT are also similar to those offered by other HaH services.<sup>6</sup> However, although geriatric

syndromes are poorly documented in most studies and functional level is variably described, available data suggest that the GIROT activity involves older patients (mean age, 88 vs 79-83 years) with lower functional level and a greater proportion of patients showing severe disability (65.7% with BI < 40/100 vs 62.9% with BI  $\geq$  15/100) compared with other existing HaH models.<sup>5,8,10,13,15,25,28</sup>

Current evidence indicates that HaH programs result in either comparable or lower mortality and readmission rates than conventional inpatient care, particularly when admission avoidance is pursued.<sup>7,8,11</sup> The outcome analysis of our study revealed relevant mortality rates among GIROT patients, particularly during the first month of the observation period. The observed percentages were higher than described in previous HaH studies, which reported 6-month mortality rates of approximately 15% to 20%.<sup>6,8,10,28</sup> This discrepancy is likely related to older age, lower functional level, and



**Fig. 3.** Patient and caregiver satisfaction rates with GIROT service (n = 347).

higher prevalence of dementia in patients referred to the GIROT. Indeed, severe disability and physical impairment, which were inclusion criteria for the GIROT service, emerged as predictors of 6-month mortality in the present study. Our results are consistent with a large body of literature identifying disability as a strong independent predictor of mortality in older adults.<sup>29-31</sup> In particular, several studies have reported higher short- and long-term mortality rates among older patients with severe disability as expressed by lower BI scores, both in acute care settings and in chronic conditions.<sup>32-37</sup> In patients with high levels of disability and multimorbidity, short-term death risk seems to be strictly related to acute deterioration of preexisting conditions,<sup>29</sup> which may provide an explanation for the relevant mortality rates observed in this study.

This scenario highlights the necessity of planning palliative care in this highly vulnerable population. Indeed, the percentage of death reported in this sample suggest that a significant proportion of GIROT patients were approaching end of life and might have benefited from specialist palliative care. However, it should be considered that end-of-life stages might be difficult to identify in this population. In many cases, a low-intensity care approach may be appropriate in accordance with the transitional care model. Indeed, many older patients with multiple chronic conditions and very low functional level may experience a relatively long phase of stability in which some end-of-life signs might be present (eg, weight/appetite loss, delirium, physical and/or cognitive deterioration, advanced organ failure), although in the absence of approaching death. In some patients, a simultaneous care approach may also be useful, with palliative care implemented within the framework of a home-based service (eg, GIROT).<sup>38</sup> The latter might indeed help the stabilization of chronic conditions and management of geriatric syndromes, reserving second-level specialist palliative care to patients in need of treatment of refractory symptoms. However, taking into consideration the relevant proportion of patients with severe disability, adequate home social support is a necessary prerequisite for the provision of home-based acute care within the GIROT model.

GIROT patients referred from primary care showed an increased risk of death, with no greater disease burden compared with the other study subgroups. However, most of these patients showed severe functional (77.1%) and motor impairment (76.1%), with 1 in 4 presenting a hypomobility syndrome. Similar results have recently been reported in a home-based care service created to manage geriatric urgencies, where loss of mobility was identified as a mortality predictor.<sup>39</sup> GIROT users from primary care thus emerge as a highly vulnerable subgroup with poor short-term prognosis, that is expected to derive very low benefit from hospitalization. We might suppose that the GIROT activity may have helped general practitioners to prevent ED and hospital admission for these patients, in whom early implementation of simultaneous palliative care may be considered instead.

In this sample, rates of hospital admission ranged from 7.2% at 1 month to 37.9% at 6 months, in agreement with a recent review of randomized clinical trials comparing HaH and usual in-hospital care.<sup>11</sup> We cannot exclude that the absence of overnight care contributed to the observed hospitalization rates. However, higher 6-month readmission rates (42%-54.5%) have been reported in some HaH samples with higher functional autonomy.<sup>6,8</sup> The GIROT service may have allowed to prioritize home-based care in individuals with preexisting severe disability who were expected to derive poor benefit and high psychological distress from in-hospital care. The GIROT model may thus have contributed to admission avoidance, being aligned with the purposes of other HaH models described in the literature.

The previous hypothesis is supported by patients' and caregivers' experience, reporting high global satisfaction with home-based care, in agreement with previous HaH studies.<sup>6-8,25</sup> Indeed, home-based care probably aligns with older individuals' preference to receive

health care in their home, surrounded by their families. Moreover, HaH was found to reduce patients' and caregivers' stress and burden of care, thus positively impacting their quality of life.<sup>40</sup>

### Limitations

Some limitations of this study should be mentioned. First, the lack of a control group did not allow to compare home-based and conventional in-hospital care and their impact on patients' outcomes. Second, the causes and place of death were not recorded, and information on death dates was not available, thus preventing a detailed time survival analysis. Because time-to-event data were not available, overall survival and hospitalization were censored at 30, 90, or 180 days based on mortality/hospitalization at 1, 3, and 6 months, respectively. Some deceased patients may thus have been considered among those at risk of hospital admission and included in the calculation of hospitalization rates, which may have been underestimated. Third, this study did not systematically investigate outcomes of geriatric interest, including quality of life and hospital-related complications, that should be assessed in future studies to expand current knowledge on the model. Finally, we are unable to describe in detail the implementation of palliative services in the GIROT model because palliative care was mainly provided with a simultaneous approach in a collaboration with palliative care specialists. Taking into consideration mortality rates observed in this sample, we acknowledge that the boundaries of this care model are not strictly defined. However, due to the low prognostic accuracy observed for multimorbid older patients in palliative care,<sup>41</sup> this kind of flexible approach may be considered as a strength of the GIROT model, allowing a continuum of care from acute hospital until palliative care. In fact, the model allows to develop customized care programs, tailored to each single patient's functional level and clinical needs. Additional strengths are the large sample size and the inclusion of older adults with severe disability, that are usually excluded from clinical studies. Our research thus offers useful insights into the characteristics and prognosis of a real-world, highly vulnerable subgroup of older individuals, similar to those frequently accessing health care services in routine care.

### Conclusions and Implications

The GIROT HaH model may help expand acute health care capacity for frail older adults at high risk of hospital-related complications. Customized care plans including simultaneous palliative care should be developed in patients with severe physical and functional impairment, showing an extremely high risk of negative health outcomes.

### Disclosures

The authors declare no conflicts of interest.

### References

- Brennan TA, Leape LL, Laird NM, et al. Incidence of adverse events and negligence in hospitalized patients. *N Engl J Med.* 1991;324:370-376.
- 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.
- Krumholz HM. Post-hospital syndrome — an acquired, transient condition of generalized risk. *N Engl J Med.* 2013;368:100-102.
- Leff B, DeCherrie LV, Montalto M, Levine DM. A research agenda for hospital at home. *J Am Geriatr Soc.* 2022;70:1060-1069.
- Mas M, Inzitari M, Sabaté S, et al. Hospital-at-home integrated care programme for the management of disabling health crises in older patients: comparison with bed-based intermediate care. *Age Ageing.* 2017;46:925-931.
- Aimonino Ricauda N, Tibaldi V, Leff B, et al. Substitutive "hospital at home" versus inpatient care for elderly patients with exacerbations of chronic obstructive pulmonary disease: a prospective randomized, controlled trial. *J Am Geriatr Soc.* 2008;56:493-500.

- 761 7. Leong MQ, Lim CW, Lai YF. Comparison of hospital-at-home models: a systematic review of reviews. *BMJ Open*. 2021;29:e043285.
- 762 8. Shepperd S, Butler C, Craddock-Bamford A, et al. Is comprehensive geriatric assessment admission avoidance hospital at home an alternative to hospital admission for older persons? *Ann Intern Med*. 2021;174:889–898.
- 763 9. Isaia G, Astengo MA, Tibaldi V, et al. Delirium in elderly home-treated patients: a prospective study with 6-month follow-up. *Age*. 2009;31:109–117.
- 764 10. Tibaldi V, Isaia G, Scarafioti C, et al. Health care reform hospital at home for elderly patients with acute decompensation of chronic heart failure: a prospective randomized controlled trial. *Arch Intern Med*. 2009;169:1569–1575.
- 765 11. Arsenault-Lapierre G, Henein M, Gaid D, et al. Hospital-At-home interventions vs in-hospital stay for patients with chronic disease who present to the emergency department. *JAMA Netw Open*. 2021;4:E2111568.
- 766 12. O'Hanlon S, Dhesi J, Aronson L, Inouye SK. Covid-19: a call for mobilizing geriatric expertise. *Eur Geriatr Med*. 2021;12:597–600.
- 767 13. Inzitari M, Arnal C, Ribera A, et al. Comprehensive geriatric hospital at home: adaptation to referral and case-mix changes during the COVID-19 pandemic. *J Am Med Dir Assoc*. 2023;24:3–9.e1.
- 768 14. Edgar K, Illiffe S, Doll HA, et al. Admission avoidance hospital at home. *Cochrane Database Syst Rev*. 2024;3:CD007491.
- 769 15. Shepperd S, Illiffe S, Doll HA, et al. Admission avoidance hospital at home. *Cochrane Database Syst Rev*. 2016;9:CD007491.
- 770 16. Stall NM, Farquharson C, Fan-Lun C, et al. A hospital partnership with a nursing home experiencing a COVID-19 outbreak: description of a multiphase emergency response in Toronto, Canada. *J Am Geriatr Soc*. 2020;68:1376–1381.
- 771 17. Nouvenne A, Caminiti C, Dlodati F, et al. Implementation of a strategy involving a multidisciplinary mobile unit team to prevent hospital admission in nursing home residents: protocol of a quasi-experimental study (MMU-1 study). *BMJ Open*. 2020;10.
- 772 18. Benvenuti E, Rivasi G, Bulgaresi M, et al. Caring for nursing home residents with COVID-19: a "hospital-at-nursing home" intermediate care intervention. *Aging Clin Exp Res*. 2021;33:2917–2924.
- 773 19. Rivasi G, Bulgaresi M, Mossello E, et al. Course and lethality of sars-cov-2 epidemic in nursing homes after vaccination in Florence, Italy. *Vaccines*. 2021;9:1174.
- 774 20. Bulgaresi M, Rivasi G, Tarantini F, et al. Impact of SARS-CoV2 infection on mortality and hospitalization in nursing home residents during the "Omicron era." *Aging Clin Exp Res*. 2023;35:1393–1399.
- 775 21. Lucke JA, Mooijaart SP, Heeren P, et al. Providing care for older adults in the emergency department: expert clinical recommendations from the European task force on Geriatric Emergency Medicine. *Eur Geriatr Med*. 2022;13:309–317.
- 776 22. Conroy SP, Ansari K, Williams M, et al. A controlled evaluation of comprehensive geriatric assessment in the emergency department: the 'emergency frailty unit'. *Age Ageing*. 2014;43:109–114.
- 777 23. Mahoney FI, Barthel DW. Functional evaluation: the barthel index. *Md State Med J*. 1965;14:61–65.
- 778 24. Tibaldi V, Aimonino N, Ponzetto M, et al. A randomized controlled trial of a home hospital intervention for frail elderly demented patients: behavioral disturbances and caregiver's stress. *Arch Gerontol Geriatr Suppl*. 2004;431–436.
- 779 25. Levine DM, Ouchi K, Blanchfield B, et al. Hospital-level care at home for acutely ill adults a randomized controlled trial. *Ann Intern Med*. 2020;172:77–85.
- 780 26. Mas M, Santaugènia SJ, Tarazona-Santabalbina FJ, et al. Effectiveness of a hospital-at-home integrated care program as alternative resource for medical crises care in older adults with complex chronic conditions. *J Am Med Dir Assoc*. 2018;19:860–863.
- 781 27. Singh S, Gray A, Shepperd S, et al. Is comprehensive geriatric assessment hospital at home a cost-effective alternative to hospital admission for older people? *Age Ageing*. 2022;51:afab220.
- 782 28. Tsiachristas A, Ellis G, Buchanan S, et al. Should I stay or should I go? A retrospective propensity score-matched analysis using administrative data of hospital-at-home for older people in Scotland. *BMJ Open*. 2019;9:e023350.
- 783 29. Braggioni M, Pellizzari M, Basso C, et al. Overall mortality and causes of death in newly admitted nursing home residents. *Aging Clin Exp Res*. 2020;32:275–280.
- 784 30. Yang Y, Du Z, Liu Y, et al. Disability and the risk of subsequent mortality in elderly: a 12-year longitudinal population-based study. *BMC Geriatr*. 2021;21:662.
- 785 31. Wu LW, Chen WL, Peng TC, et al. All-cause mortality risk in elderly individuals with disabilities: a retrospective observational study. *BMJ Open*. 2016;6:e011164.
- 786 32. Reilev M, Lundby C, Jensen J, et al. Morbidity and mortality among older people admitted to nursing home. *Age Ageing*. 2019;49:67–73.
- 787 33. Espauella J, Arnau A, Cubí D, et al. Time-dependent prognostic factors of 6-month mortality in frail elderly patients admitted to post-acute care. *Age Ageing*. 2007;36:407–413.
- 788 34. Wang E, Liu A, Wang Z, et al. The prognostic value of the Barthel Index for mortality in patients with COVID-19: a cross-sectional study. *Front Public Health*. 2023;10:978237.
- 789 35. Li F, Li D, Yu J, et al. Barthel index as a predictor of mortality in patients with acute coronary syndrome: better activities of daily living, better prognosis. *Clin Interv Aging*. 2020;15:1951–1961.
- 790 36. Ryg J, Engberg H, Mariadas P, et al. Barthel index at hospital admission is associated with mortality in geriatric patients: a Danish nationwide population-based cohort study. *Clin Epidemiol*. 2018;10:1789–1800.
- 791 37. Rossello X, Miró O, Llorens P, et al. Effect of Barthel index on the risk of thirty-day mortality in patients with acute heart failure attending the emergency department: a cohort study of nine thousand ninety-eight patients from the epidemiology of acute heart failure in emergency departments registry. *Ann Emerg Med*. 2019;73:589–598.
- 792 38. Estrada LV, Gelfman L, Zhang M, et al. Challenges and solutions of conducting dementia clinical trials: a palliative care at home pilot for persons with dementia. *J Am Geriatr Soc*. 2024;72:2544–2551.
- 793 39. Nouvenne A, Ticinesi A, Siniscalchi C, et al. The multidisciplinary mobile unit (mmu) program bringing hospital specialist geriatric competencies at home: a feasible alternative to admission in older patients with urgent complaints. *J Clin Med*. 2024;13:2720.
- 794 40. Ko SQ, Chua CMS, Koh SH, et al. Experiences of patients and their caregivers admitted to a hospital-at-home program in Singapore: a descriptive qualitative study. *J Gen Intern Med*. 2023;38:691–698.
- 795 41. White N, Reid F, Harris A, Harries P, Stone P. A systematic review of predictions of survival in palliative care: how accurate are clinicians and who are the experts? *PLoS One*. 2016;11:e0161407.