ORIGINAL ARTICLE

Effectiveness of community hospital post-acute care on mortality, re-admission, institutionalization, and activation of a home care programme in Emilia-Romagna region, Italy

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Abstract

Background In Italy, there is scant evidence on the impact of Community Hospitals (CHs) on clinical outcomes.

Aims To assess the effectiveness of CHs versus long-term care hospital or inpatient rehabilitation facilities on mortality, re-admission, institutionalization, and activation of a home care programme in the Emilia-Romagna Region (ERR-Italy) after acute hospitalisation.

Methods We implemented a cohort study drawing upon the ERR Administrative Healthcare Database System and including hospital episodes of ERR residents subject ≥ 65 years, discharged from a public or private hospital with a medical diagnosis to a CH or to usual care between 2017 and 2019. To control for confounding, we applied a propensity score matching.

Results Patients transferred to CHs had a significantly lower risk of dying but an increased risk of being readmitted to community or acute hospital within 30/90 days from discharge. The hazard of institutionalisation within 30/90 days was significantly lower in the whole population of the CH exposed group but not among patients with cardiac or respiratory chronic diseases or diabetes. The activation of a home care program within 90 days was slightly higher for those who were transferred to a CH.

Discussion The findings of our study show mixed effects on outcomes of patients transferred to CHs compared to those who followed the post-acute usual care and should be taken with cautious as could be affected by the so-called 'confounding by indication'.

Conclusions The study contributes to the intermediate care available evidence from a region with a well-established care provision through CHs.

Keywords Intermediate care · Community Hospitals · Mortality · Rehospitalisation · Institutionalisation · Italy

Introduction

Nowadays, one of the major challenges for European health care and welfare systems is the ageing of the population with the resulting heavier burden of multimorbidity and the urgency to envisage a continuum of care from hospital and home, primary care, and community services [1]. Stemming from this need, the concept of intermediate care (IC) has been developed in Europe since the last couple of decades. IC includes different types of health services such as home care, residential care, or bed-based facilities (e.g. community hospitals, temporary nursing facility/residential care home). The objective of IC services is twofold: avoiding hospital admissions and ensuring coordination and continuity of health and social care after the discharge from acute care hospitals, especially for elderly and frail patients [2]. IC services are usually limited in time [3] and focus on the rehabilitation and the contrast of the functional and cognitive decline of patients, with a particular attention to therapeutic education and self-care (self-management, patient/caregiver education), also through the support of multidisciplinary teams and the involvement of care givers [4].

CH have been introduced in Emilia-Romagna Region (ER) since 2014 and currently there are 26 structures equipped with 15–20 beds on average (298 in total) managed by nurses on a 24-h basis, and in which medical care

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is provided by GPs or other medical staff contracted by the National Health System at need or planned. Physiotherapists, occupational therapists and social-healthcare assistants are the other health professionals that may be involved in the multidisciplinary management. The district holds the organizational and managerial responsibility and also ensures 'the necessary specialist advice'. The core function of the community hospital is to take charge of patients who require health care that cannot be provided in the home environment of the patient, because of structural and/or family reasons or who need continuous nursing supervision. The average stay in the community hospital is expected to be around 15–20 days, and admission can be from the patient's home or a residential care facility upon referral by the patient's GP, the hospital ward or directly from the emergency room. The community hospital can be physically located in converted hospitals or residential care facilities (5).

CHs represent the optimal setting for: (1) elderly patients dischargeable from acute hospitals but still in need of continuous nursing care, (2) frail or chronic patients with an exacerbation of a pre-existing clinical condition that does not require hospitalisation, (3) patients who need nursing assistance in activities of daily living (ADL), drug administration, management of aids and devices that cannot be delivered at home, temporarily continuous or almost continuous monitoring, or an educational support for his/her own or his/her caregiver, (4) patients in need of rehabilitation. The exclusion criteria for access to CH are cardio-vascular or neurological instability; end-of-life stage; need of ongoing medical care or initial diagnostic assessment.

There exists a body of evidence that assesses the effectiveness of IC services, through different study designs. IC including transitional care seems to decrease the utilisation of hospital resources, but findings on their impact on ADL outcomes, institutionalisation, access to Emergency departments and cost-effectiveness are scarce and controversial [6, 7]. Among the intermediate care settings, interventions delivered in CHs has been evaluated using diverse epidemiological approaches, ranging from randomised control trials (RCT) to observational studies. Evidence suggests that transition to CHs can reduce re-admission rates [8], length of hospital stay [9], demand for home care and home health care services [10], and improve patient's function and independence [11]. In Italy, there is scant evidence on the impact of CHs on health outcomes besides a report of risk factors for death or acute hospitalisation among CHs patients [12]. The present study contributes at filling this gap assessing the effectiveness of Community Hospitals versus long-term care hospital or inpatient rehabilitation facilities on mortality, re-admission, institutionalization, and activation of a home care programme in the Emilia-Romagna Region (northern Italy) among patients transferred from public or private acute hospitals.

Materials and methods

Data sources and study design

We implemented a cohort study drawing upon the Emilia-Romagna Administrative Healthcare Database System. The data sources used to retrieve relevant information for the definition of the population and on the comorbidities and the care complexity index were the following databases: (1) the Hospital discharge record, (2) the Community Hospital discharge record, (3) the residential and semi-residential home, (4) the home care record, (5) the Emergency Room, (6) the drug prescription, (7) the outpatient specialty care (8), the population health register, (9) the 2011 Population census.

Study population and variables of interest

We considered the hospital episodes of subject aged $\geq$ 65 years residing in the Emilia-Romagna region, discharged from a public or private hospital with a medical DRG (index hospitalisation) to a CH or to a long-term care hospital or inpatient rehabilitation facility between January 1st 2017 and September 30th 2019, and not hospitalised in the previous 90 days in a hospital or a CH.

We built two different cohorts with the aim of assessing our objective among the general population and among the patients discharged with a diagnosis of heart failure, diabetes, or chronic respiratory affections that represent the major burden of chronic diseases among the elderly and may correspond to a more homogeneous group of patients requiring ongoing monitoring and care (13). Therefore, cohort A included hospital episodes of patients discharged for any medical cause. Cohort B included only hospital episodes of patients discharged with a diagnosis of congestive heart failure (ICD-9 CM 428.x), or diabetes mellitus, type 2 or unspecified with no mention of complications (ICD-9 CM 250.00/250.02), or chronic obstructive bronchitis (ICD-9 CM 491.20/491.21), or respiratory failure (ICD-9 CM 518.81-84) [13].

In both cohorts, the population, upon discharge, was divided into two groups according to the exposure of interest, that is the type of care after discharge from a public or private hospital. Therefore, one group consisted of patients transferred to a CH (hereafter, the exposed) whereas and the other group of patients transferred to a public or private long-term care hospital or an inpatient rehabilitation facility (usual care; hereafter, the non-exposed). Among the latter group, we excluded the hospital episodes of patients who had been hospitalised in a CH for any cause during the enrolment period.

The outcomes considered were: (a) mortality within 30 or 90 days from admission to CH or usual care, (b) re-admission for any cause to CH or acute hospital within 30 or 90 days from discharge, (c) institutionalisation (permanent transfer to a nursing home) within 30 or 90 days from discharge (only among patients not already living in a nursing home before the index hospitalisation), (d) new activation of a home care programme within 30 or 90 days from discharge (only among patients who did not have an active home care programme before the index hospitalisation). A visual summary of the study population, the exposure, and the outcomes is reported in Fig. 1.

Statistical analyses

To take into account possible confounders of the association between the type of care after discharge from an acute hospitalisation and the outcomes of interest, we applied a propensity score matching (PSM) [14]. The list and details of the variables used in the matching process to control for the case-mix of the cohort are reported in Supplemental Table 1. We matched patients 1:5 (1 exposed and 5 unexposed) without replacement and evaluated the match quality by effect size (i.e. calculation of the standardised differences and relative p-values) [15].

To assess the association under study, we applied different models according to the outcome considered. For the outcome mortality within 30 or 90 days, we run stratified Cox semi-parametric models, considering matched groups as strata. For the other outcomes, we used the Fine and Gray competitive risk model to account for those patients who died during the observation period and therefore could not experience the outcome of interest. The models were run in both cohort A and B. For each outcome, survival curves were also plotted to visualise and compare the outcome occurrence's speed in the two cohorts.

Results

Baseline and distribution of outcomes

Cohort A consisted of 28,511 hospital episodes. Before the matching, the exposed and the unexposed significantly differed in terms of index of care complexity (very high among 36% of the CH episodes and 44% among the usual care episodes), altimetric area of residence, district of residence, year of hospitalisation, and Local Health Unit of the index hospitalisation. After the matching, the cohort (7,986 hospital episodes) appeared well balanced (Supplemental Table 2A). Both in the unmatched and the matched sample, the crude risk of mortality within 30 or 90 days was higher in the non-exposed group; differences among the two exposure groups were less marked for the other outcomes (Supplemental Table 3A).

Cohort B consisted of 3,148 hospital episodes. Before the matching, the exposed and the unexposed significantly differed in terms of index of care complexity (very high among 54% of the CH episodes and 59% among the usual care episodes), educational qualification, altimetric area of residence, group of comorbidities (gastrointestinal disorders reported in the 64% of the CH episodes and in the 53% of the usual care path episodes), district of residence, year of hospitalisation, and Local Health Unit of the index hospitalisation. After the matching, the cohort (798 hospital episodes) appeared well balanced (Supplemental Table 2B). Both in the unmatched and the matched sample, the crude risk of mortality within 30 or 90 days was higher in the non-exposed group; instead, the crude risk of re-admission within 30 or 90 days was higher in the exposed group. Differences among the two exposure groups were less marked for institutionalisation and activation of a home care programme (Supplemental Table 3B).
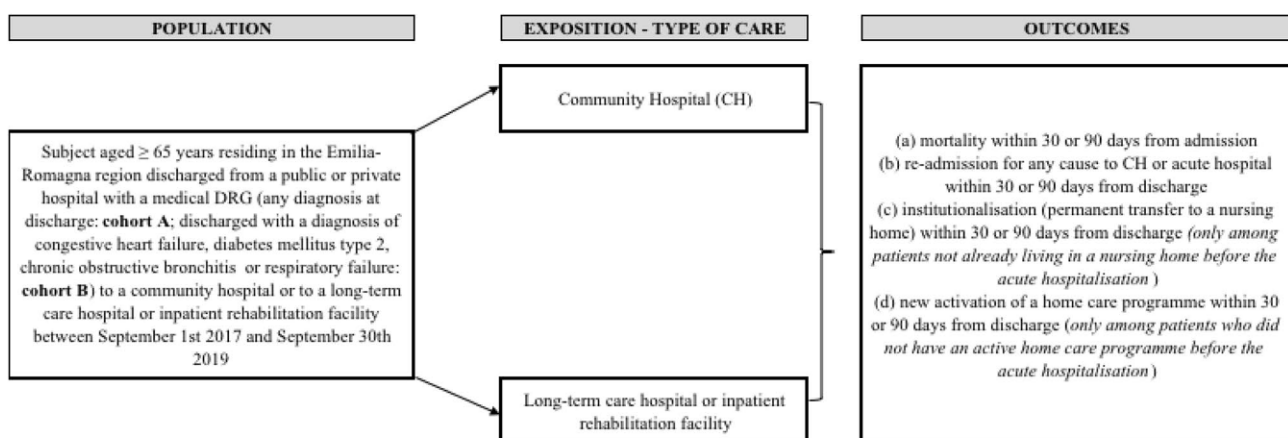

Fig. 1 Study population, exposure, and outcomes

Model results

In cohort A (Table 1), patients admitted to CH were 55% (95% CI 0.38–0.54) and 46% (95% CI 0.48–0.61) less likely to die within 30 or 90 days, respectively, than those who followed the usual care. The non-exposed group start dying earlier and died at a faster pace than the exposed group (Fig. 2A). The hazard of being readmitted within 30 days was 21% higher among the exposed (95% CI 1.01–1.45) that experienced slightly earlier re-admissions than among the non-exposed (Fig. 2A). Readmissions within 90 days did were not different among the two groups as can be appreciated in the overlapping of the survival curves (Fig. 2A). The hazard of institutionalisation within 30 or 90 days among the exposed was 34% (95% CI 0.48–0.90) and 23% (95% CI 0.59–0.90) lower, respectively. Patients admitted to CH seemed to have a 14% higher hazard of having a home care programme activated within 90 days (95% CI 1.00–1.29).

In cohort B (Table 1), patients admitted to CH were 77% (95% CI 0.10–0.49) and 69% (95% CI 0.20–0.49) less likely to die within 30 or 90 days, respectively, than those who followed the usual care. The latter group died at a faster pace than the former (Fig. 2B). The hazard of being readmitted or institutionalised seemed higher among patients admitted to CH as shown also in the survival curve (Fig. 2B), but 95% confidence intervals around the point estimates crossed one, suggesting that the role of chance could not be ruled out. The possibility of the activation of a home care programme did not differ significantly between exposed and unexposed, whose survival curves were almost entirely overlapping throughout the entire observation period (Fig. 2B).

Discussion

Summary of main results

This is the first study carried out in an Italian region aimed at comparing clinical outcomes between patients who, after a discharge from an acute hospitalisation, were transferred to a community hospital and those who followed the usual post-acute path of care. In Italy, only nine out of the 21 regions out have established CHs and the Emilia-Romagna is one of the regions with the highest number of such facilities. Patients transferred to a CH had a significantly lower risk of dying but an increased risk of being readmitted to community or acute hospital within 30 or 90 days from the discharge. The hazard of institutionalisation within 30 or 90 days among those patients who were not in a nursing home before the acute hospitalisation was significantly lower in the whole population under study but showed signals of increase among patients with cardiac or respiratory chronic diseases or diabetes. The activation of a home care program within 90 days from discharge was slightly higher for those who did not have an active home care programme before the acute hospitalisation and were later transferred to a CH.

Interpretation

The findings of our study show mixed effects on the short and mid-term outcomes of patients who, after an acute hospitalisation, were transferred to Community Hospitals compared to those who were discharged to a public or private long-term care hospital or an inpatient rehabilitation, which represents the post-acute usual care. Somehow, they reflect the uncertainty around the impact of IC, and more specifically Community Hospitals, on patients' outcomes, as

Table 1 Hazard ratios of the association between the type of care after discharge from an acute hospitalisation on the outcomes, 2017–19

	Cohort A				Cohort B			
	Hazard ratio	95% CI		p value	Hazard ratio	95% CI		p value
Mortality*								
Within 30 days	0.45	0.38	0.54	<0.0001	0.23	0.10	0.49	<0.0001
Within 90 days	0.54	0.48	0.61	<0.0001	0.31	0.20	0.49	<0.0001
Re-admission for any cause**								
Within 30 days	1.21	1.01	1.45	0.040	1.43	0.91	2.31	0.123
Within 90 days	1.09	0.96	1.25	0.190	1.25	0.89	1.76	0.192
Institutionalisation**								
Within 30 days	0.66	0.48	0.90	0.010	1.35	0.46	3.97	0.588
Within 90 days	0.77	0.59	0.90	0.041	1.65	0.70	3.90	0.255
New activation of a home care programme**								
Within 30 days	1.09	0.94	1.26	0.261	0.92	0.58	1.45	0.714
Within 90 days	1.14	1.00	1.29	0.047	1.00	0.67	1.49	0.999

*Cox models, **Fine and Grey models

concluded by a recent review of the literature on this topic [6]. Indeed, although the number of studies looking at the effects of post-acute care has increased in the last decade, robust and consistent empirical evidence of the impact of different forms of service delivery that can be offered by CHs is still lacking, highlighting the need for a continuous evaluation of new delivery models and their contribution to wider system effectiveness [4, 5]. Our study certainly adds to the available knowledge but our results have to be interpreted with caution given the nature of the study and the limitations that we highlight later in the discussion.

We found a very strong association between type of care after discharge from the acute hospitalisation and short and mid-term mortality with patients transferred to CHs having halved the risk of death compared to the control group. A protective effect, though less pronounced was previously reported only in two Norwegian randomised controlled trials that focussed on the benefits of CHs providing intermediate care closer to home and social and care networks [8, 16]. Most of the previous research did not report any difference in mortality [8–10, 17, 18]. Despite representing a favourable outcome, we believe that our result must be interpreted with caution considering that our cohorts were on average 84 years-old and therefore at increased risk of dying and that 50% of deaths occur in the hospital setting according to previous research [19]. Even if we used all the demographic, clinical, and social variables available in our datasets to adjust for the potential differences in the case mix of the two groups being compared, we could not explore the level of disability or cognitive decline at admission, nor the presence of delirium or social and contextual factors (i.e. social networks). These latter variables are important predictors of the patient's ability to recover and to maintain functional independence [20] and may play a part in determining the type of intermediate care the patient is addressed to, either a CHs or an ordinary long-term or post-acute rehabilitation. This means that our finding may not be completely free from the so-called "confounding by indication", which may occur when the clinical indication for selecting a particular path of care also affects the outcome [21]. At the same time, this result indicates that clinicians correctly direct to CHs those patients who have higher probabilities of regain functional independence and attaining good clinical outcomes or need temporary nursing assistance, contributing to an optimal resource allocation within the health system.

In our population, the risk of re-admission within 30 days from discharge was significantly higher among patients transferred to CHs. In cohort B (patients admitted to hospital with a diagnosis of heart or respiratory failure, or diabetes) differences in re-admissions, both within 30 or 90 days, were not significant although there was an indication of increased hazard among patients discharged to CHs. These results deviate from the available evidence that points towards lower re-admission rates among patients cared for in intermediate service [8, 22] although some studies did not find a clear association, either protective or detrimental [9]. One of the factors affecting the risk of early re-admission seems to be the length of stay (LOS) in the health care facility [18]: we collected the information on the LOS both in the index hospitalisation and in the CH or in long-term care hospital or an inpatient rehabilitation facility but there were not significant differences between the two groups being compared (18,7% and 19,3% on average before PSM and 16,7% and 17,1% on average after PSM in cohort A and cohort B, respectively; Supplemental Table 4). Therefore, LOS appears not to be a crucial factor in explaining these unfavourable differences, which deserve a deeper investigation possibly with alternative study designs apt to unveil the underlying mechanisms.
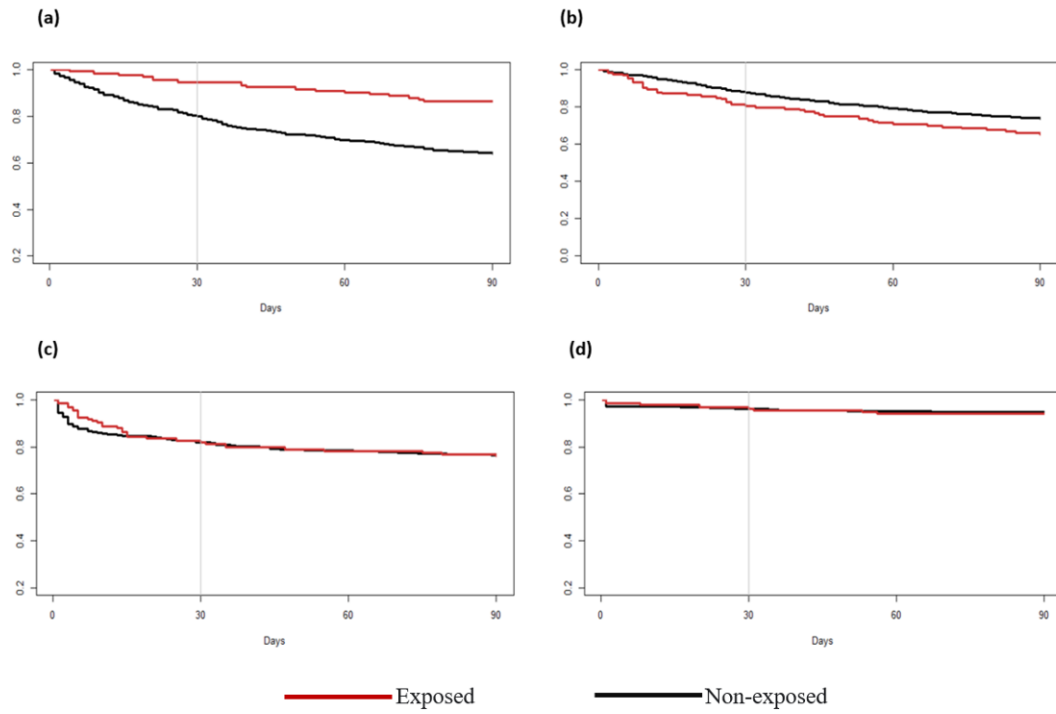
The hazard of institutionalisation within 30 or 90 days was significantly lower among the whole cohort for patients transferred to CHs; differences were not significant, though of the opposite direction, among patients primarily admitted to acute hospital for heart or respiratory failure or diabetes and later discharged to CHs. Our main result is in line with findings of other studies where the lower need of long-term care placement has been associated with higher quality markers of the healthcare services [23] and the multidisciplinary asset of the team [11] and suggest that patients treated in IC services tend to achieve better functional outcomes [10]. The opposite trend, that is a higher hazard of institutionalisation, in cohort B could be justified by the small sample size of the non-exposed in cohort B (confirmed by the larger confidence intervals than those for cohort A) and by the greater care complexity of patients (80% and 68% of patients at high/very care complexity in cohort B and A, respectively) who would need higher intensity medical assistance.

A reduced need of home care services, which has been previously reported [8, 10], is usually regarded as a positive outcome that reflects the favourable effect of IC interventions on functional independence. In our study, the short and mid-term need of home care did not show differences between patients transferred to CHs or following the usual care (transferred to a public or private long-term care hospital or an inpatient rehabilitation facility), except for a slightly higher chance of activation of a new home care programme within 90 days from discharge in the whole cohort of patients. This phenomenon should be interpreted as an attempt to reduce the risk of re-admission or long-term care referral, guaranteeing the supply of care closer to home within the frame of a continuum of care.
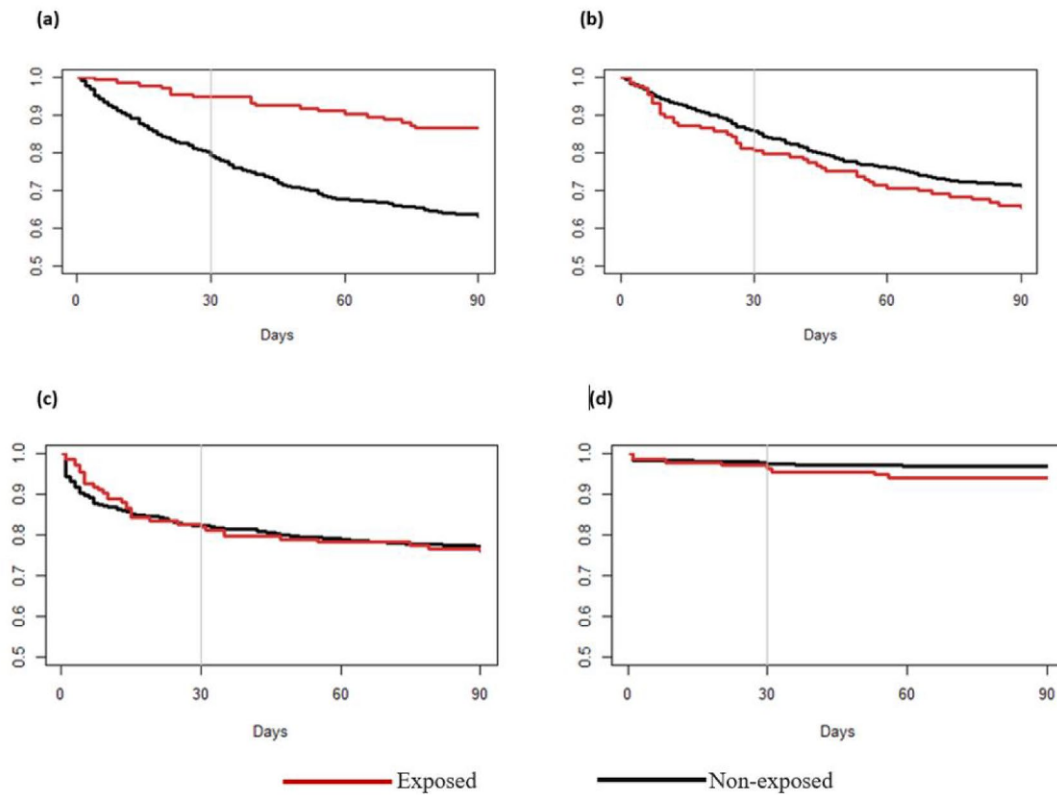
Strengths and limitations

At the best of our knowledge, this is the first study at both national and regional level that evaluates the effect of CHs

A. Cohort A

B. Cohort B

◄**Fig. 2** Survival curves by outcomes within 30 and 90 days, exposure, and cohort. Legend: **a** mortality within 30 or 90 days from admission to Community Hospital or usual care, **b** institutionalisation (permanent transfer to a nursing home) within 30 or 90 days from discharge (only among patients not already living in a nursing home before the index hospitalisation), **c** re-admission for any cause to CH or acute hospital within 30 or 90 days from discharge, **d** new activation of a home care programme within 30 or 90 days from discharge (only among patients who did not have an active home care programme before the index hospitalisation)

on short and mid-term health outcomes. It covers the entire regional population who, within the observation period, was transferred to CHs after an acute hospital episode in both public and private structures. Administrative health databases are deemed to be of high quality in Emilia-Romagna; they were used as the basis for the construction of the cohorts and the retrieval of all variables of interest through an individual-level linkage preventing from the risk of misclassification. Thanks to this wealth of data, we were able to adjust for many measurable differences in the groups using the propensity score matching.

The study is not free from limitations. Admission to CHs is restricted to patients who do not present cardio-vascular or neurological instability or are in their end-of-life stage. The same exclusion criteria did not apply to the group transferred to the usual care path and this differential selection may have played a role in the association with the outcomes of interest. To this extent, mortality could be the outcome most affected by this bias because for the non-exposed group the hospital setting often represent the place of death.

We could not investigate potential improvements of activities of daily living, which should be one of the main outcomes of CHs, because this variable was only recently introduced in the Hospital discharge database and a validation of its quality is not available yet. Similarly, we could not investigate patient related outcomes (PREMS). Although a questionnaire based on an English experience [24] has been recently validated and introduced at regional level, it is currently used only in a few regional CHs [25].

Moreover, we could not investigate and contrast the outcomes of interests among patients coming from home and admitted either to CHs or to acute hospitals because they would likely represent two populations not comparable in terms of stage and severity of disease and therefore intensity of healthcare assistance. An alternative study design able to control for such differences would be better suited to pursuing this objective.

Conclusions and implication for research and policy

This study contributes to the available evidence with results from a region with a well-established provision of care through community hospitals. This is particularly relevant because existing studies are limited in their geographical scope to England, Norway, Australia, Canada, and USA, although rich field experience exists also in other European regions such as Scotland and Catalonia [5, 26]. In drawing conclusions from the available body of knowledge, it vital to recall that although IC services share the common goals of avoiding hospital admissions and ensuring coordination of post-acute care, there exists significant variations in terms of IC definition, scopes, service users, organisational patterns, and professionals involved. As the policy vision for community hospitals continues to develop internationally, further research is needed to underpin service design and to understand what the role of community hospital provision across the full range of services and system contexts is. Acknowledging the challenge of complex interventions evaluation, more evidence from well-conducted randomised controlled trials is required to fully determine their safety, effectiveness, and cost-effectiveness compared to usual care.

Declarations

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