

Differences in results and related factors between Hospital-at-Home modalities in Catalonia: a cross sectional study

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Abstract

Background Hospital-at-home (HaH) is a healthcare modality that provides active treatment by healthcare staff in the patient's home for a condition that would otherwise require hospitalization. Previous studies have described two basic types of HaH: hospital admission avoidance and early discharge. The aims of this study were: To describe the characteristics of different types of hospital-at-home (HaH) contacts; to assess readmission, mortality, and mean length of stay for each HaH modality; and to examine which factors could be related to these results. **Methods** A cross-sectional study based on data from all 2014 HaH contacts from Catalonia was designed. The following HaH modalities were considered: admission avoidance (n=7,214; 75.1%) and early discharge (n=2,387; 24.9%). The main outcome indicators were readmission, mortality, and mean length of stay (days). Contact characteristics were compared at bivariable level and indicators were calculated for each HaH modality. Multivariable General linear models were fitted to assess the association between explanatory factors and outcomes. **Results** Differences in contact characteristics between HaH modalities were observed at bivariable level. In the hospital avoidance modality there were 8.3% readmissions, 0.9% mortality, and a mean length of stay (SD) of 9.6 (10.6) days. In the early discharge one, these figures were 7.9%, 0.5%, and 9.8 (11.1), respectively. In both modalities, readmission and mean length of stay were related to comorbidity and type of hospital, and mortality with age. **Conclusions** The results show that the HaH results in Catalonia are acceptable and similar to those observed in other contexts. The factors related to these results could help improve the effectiveness and efficiency of the different HaH modalities.

Background

Hospital-at-home (HaH) is a healthcare modality that, for a limited period of time, provides active treatment by healthcare staff in the patient's home for a condition that would otherwise require hospitalization [1–3]. Previous studies have described two basic types of HaH: hospital admission avoidance and early discharge [4–6]. The admission avoidance model is usually employed with elderly individuals who, instead of being admitted to acute care hospitals, are treated at home [5, 7]. The model mainly focuses on short-term interventions (days) for the acute phase of an illness. With respect to admission to this HaH modality, patients are mostly included after being attended at the emergency services or, less commonly, after being referred by their family doctor. In contrast, the early discharge HaH model is for hospitalized patients who are able to continue their treatment at home, thus reducing the duration of their stay [6].

Within the context of Catalonia, since 1985 the HaH model has been officially recognized as a healthcare activity or service. In spite of this legal framework, the posterior evolution of the healthcare system within the territory has not led to the program's homogenous development [7–11]. This has resulted in the appearance of HaH units without any pre-established or defined resource structures and with varying service portfolios, all of which have hindered a common evaluation. Nevertheless, in spite of the lack of homogeneity, the patients included in HaH programs can be categorized according to two modalities: hospital admission avoidance and early discharge. Although such a classification is very general [4–6], it

does permit an evaluation of results at a population level, and the determination of factors related to them. The delimitation of the factors associated with such results in a particular context allows the definition of the most suitable HaH model for a determined patient population. In addition, the most effective and efficient healthcare circuits could be established, thus helping to improve the modalities results and saving costs for the healthcare systems.

The objectives of this study were: 1) to describe the contact characteristics of both HaH modalities (admission avoidance and early discharge) in Catalonia during 2014; 2) to evaluate the rates of readmission, mortality, and mean length of stay for both modalities; and 3) to examine which factors could be related to the results obtained.

Methods

Study design and population

A cross-sectional study based on the Minimum Basic Data Set from Acute-care Hospitals (MBDSHA) was performed. The MBDSHA included 24 public hospitals in the Catalonian territory and HaH contacts for 2014. A contact was every time a patient received any kind of treatment from commencement to finalization. The same individual could present more than one contact during the study period. Programmed contacts with a specific diagnosis according to the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) were included (n=9,805)[12]. Those who belonged to a diagnostic group with an insufficient number of contacts for robustness (n=95, 1.0%), lacked an identification number (n=49, 0.5%), had no established age (n=2, <0.1%), and whose dates of admission and discharge were wrongly codified (58, 0.6%) were excluded. Finally, a total sample of 9,601 HaH contacts was considered for analysis: 7,214 (75.1%) admission avoidance and 2,387 (24.9%) early hospital discharge.

Main outcomes

Three indicators were established as the main outcomes:

Readmission: consecutive HaH contacts, either HaH or conventional hospitalization (CH), in a period \leq 30 days provided that it was not due to external causes or complications/adverse effects from the initial contact.

Mortality prior to discharge: HaH contacts in which the patient status at discharge was death.

Mean length of stay: for the admission avoidance modality, duration (days) of HaH contact from date of program admission to finalization. For early discharge, duration was a combination of the immediately preceding HC contact and the HaH one, taking it from the CH contact date of admission to HaH finalization.

Contact characteristics

Sex: male and female.

Age (years): considered as a continuous variable.

Diagnosis: categorized according to the ICD-9-CM chapters [12].

Comorbidity according to the Charlson Comorbidity Index (CCI)[13, 14]. The CCI, considered to be an objective measurement of an individual's general state of health, is employed to predict mortality according to the patient's comorbidity. General comorbidity is calculated through the weight assigned to the presence of each of the 19 conditions making up the index. The results are classified as: 0 or 1, 2, and ≥ 3 .

Type of hospital (according to the portfolio of services offered in the hospital itself, irrespective of the patient's territorial assignment): reference hospital, district hospital, high-technology general hospital, and high-resolution hospital.

Number of contacts per patient: 1 or more contact.

Data analysis

A descriptive analysis of the characteristics of the contacts according to HaH modality was performed and results evaluated at bivariable level. To compare possible differences in the explicative variables between the two modalities, chi-square and Fisher's tests were employed for the categorical variables, and the Mann Whitney for age and mean length of stay due to the lack of normality of their distributions. The selected outcomes were then calculated for each modality, and the association between the contacts' characteristics and each of these indicators was assessed with multivariable models. Due to the characteristics of the variables considered as outcomes, logistic regression models were fitted for readmission and mortality, and Poisson models for mean length of stay. From these results, the β coefficients and their respective 95% confidence intervals (95% CI) were obtained, and their exponential was presented to aid interpretation. All the multivariable models were performed individually for the two HaH modalities and adjusted for sex, age, comorbidity (CCI), and type of hospital. All analyses were carried out with STATA v.14® [15] software and statistical significance set at 95% ($\alpha=0.05$).

Results

Table 1 shows the contacts' characteristics according to their HaH modality. The contact frequency for admission avoidance during 2014 in Catalonia (n=7,214) was greater than that of early discharge (n=2,387). Differences were observed between the two HaH modalities for sex, diagnostic group, and type of hospital. The diagnostic groups with the most contacts, was diseases of the respiratory system. With respect to the indicators calculated for each of the HaH modalities (Table 2), while significant differences were found neither for readmissions nor for mean length of stay, differences ($p=0.04$) in mortality before discharge were found.

Table 3 shows that in admission avoidance readmission was related to a CCI ≥ 3 (exp(β): 1.69; CI95%: 1.39-2.07), type of hospital, and age (exp(β): 1.02; CI95%: 1.01-1.02); mortality prior discharge was related to a CCI ≥ 3 (exp(β): 1.89; CI95%: 1.08-3.31), a high-resolution hospital (exp (β): 2.11; CI95%: 1.04-4.27), and age (exp (β): 1.07; CI95%: 1.05-1.10). Mean length of stay was greater in women than in men (exp(β): 0.94; CI95%: 0.92-0.96) and related to the CCI, type of hospital, and age. For the early discharge modality, readmission was related to the CCI and type of hospital; mortality was associated with age (exp (β): 1.11; CI95%: 1.04-1.20); and mean length of stay was related to sex, have a CCI ≥ 3 (exp (β): 1.07; CI95%: 1.03-1.10), to the type of hospital, and to age.

Discussion

Our findings show that in 2014, in Catalonia, the results for readmission, mortality, and mean length of stay for the two HaH modalities, in spite of their heterogeneous development, are similar to those observed in previous studies throughout the world [4–6, 16]. In addition, irrespective of the modality, it was observed that comorbidity and type of hospital are closely related to readmission and mean length of stay whilst the patient's age is strongly linked to mortality. Such information could help define more precisely the most suitable healthcare circuits, and the type of patient who could most benefit from the different HaH modalities.

Previous studies comparing HaH and CH [4, 11, 17–19] have reported that home care can have similar results to conventional hospitalization and would save both human and economic resources [20–23]. In this sense, both the results obtained and the available evidence suggest that, provided the patient's indication permit it, HaH treatment could be a suitable, effective, and possibly efficient alternative to CH [8, 16, 21].

With respect to the volume of HaH activity in Catalonia [24], in spite of a progressively increasing trend of HaH utilization, its implementation rate is low as it represents approximately only 1.5% of total hospital activity [24]. In this regard, encouraging the use of HaH could decrease the medical burden within hospitals and reduce the consumption of resources linked to patient care, thus providing benefits to all levels in the healthcare system [25].

Regarding the HaH modalities, it was observed that whilst admission avoidance was more frequent in less complex hospitals, early discharge was more common in more complex ones. More complex or more serious cases could be addressed to a greater extent in high-technology and high-resolution hospitals. In addition, these hospitals generally have a wide range of technology and services which results in a greater demand for healthcare. Thus, adopting an early discharge program in hospitals of greater complexity, providing the patient's indication allows it, could result in the optimization of services that are only available in these institutions. Further studies centered on the early discharge modality in high-technology and high-resolution hospitals could help assess the optimization of such specialized services.

With respect to the factors related to the considered outcomes, in both modalities it was observed that whilst readmission and median length of stay were linked to the CCI and type of hospital, mortality was

related to the patient's age. In addition, in the admission avoidance modality, mortality was only related to comorbidity in those patients with the highest CCI scores. Nevertheless, in spite of being non-significant, the direction of the relationship in patients with a lower CCI was expected. In this manner, as reported by previous studies [5, 26], our findings suggest that comorbidity could be a particularly relevant factor when choosing this modality. Further longitudinal studies with a greater sample size could be valuable to confirm this hypothesis and thus aid better indication and improve results.

As limitations of the study, it is worth highlighting the reductionism in which the classification of HaH modalities falls. Nevertheless, this classification has been previously employed on numerous occasions when evaluating HaH [5, 6, 18, 19]. In addition, given the heterogeneity observed amongst the HaH units in Catalonia, it permits a general evaluation of the results at a populational level. Another limitation is related to the cross-sectional design of the study. It does not allow the direction of the relationship amongst the variables to be established. Nevertheless, as the analyzed indicators are results from the healthcare utilization, it would be reasonable to argue that the described direction of the relationship between variables is accurate. Finally, it should be mentioned the limitation regarding the variables included. The inclusion of others not considered related to the patient or hospital, as social support or specific treatments, could help to define more accurately what factors are associated with the indicators that we analyzed. However, we consider that the included variables allow for the adjustment of more parsimonious and easily interpretable models. In addition, these variables cover to a large extent basic aspects of both the patients and the care process, being also the analysis of these factors a basic previous step for the conducting studies in greater depth.

Conclusions

In spite of the heterogeneity of HaH development in Catalonia, our findings in terms of readmission, mortality, and mean length of stay are in line with previous studies in other settings [4–6, 8], and provide further evidence of its satisfactory results. Taking into account the related factors, and other more specific HaH indicators such as cost-saving with respect to the CH or freeing-up of beds, could help define more precisely the type of patient and care circuit, thus increasing the effectivity and efficiency of the distinct modalities.

List Of Abbreviations

Hospital-at-home (HaH)

Conventional Hospitalization (CH)

Minimum Basic Data Set from Acute-care Hospitals (MBDSHA)

International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM)

Charlson Comorbidity Index (CCI)

Declarations

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The Agency for Health Quality and Assessment of Catalonia (AQuAS) as a public evaluation agency belonging to the health administration is in charge of the comparative examination of the quality of healthcare. Due to this, it has access and permission from the health authorities to make use of the data of the Minimum Basic Data Set at Hospitals Discharge (MBDS-HD) and other administrative clinical databases for their studies and analysis. Due to the anonymized nature of such data, this research does not require approval by an ethics committee or consent from users of the Health Services.

CONSENT FOR PUBLICATION

Not applicable

AVAILABILITY OF DATA AND MATERIAL

Data is available under reasonable request to jariasdelatorre@gencat.cat

COMPETING INTERESTS

The authors declare that they have no competing interests

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AUTHOR CONTRIBUTIONS

All authors conceived the study design, participated in writing the manuscript, and have critically reviewed and agreed on the final version of this article.

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Tables

Due to technical limitations, tables 1 - 3 are only available as a download in the supplemental files section.

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