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Comparison of a geriatric unit with a general ward in Mexican elders

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ABSTRACT

There is evidence that geriatric services may be more effective in handling problems of the elderly in acute care. We therefore studied a cohort of matched triplets (age, gender and admission diagnosis), to assess the effect of a geriatric service on elderly problems (falls, pressure ulcers, delirium and functional decline). This is a follow up study; comparing a geriatric unit with an internal medicine unit at two hospitals of the Mexican Institute of Social Security (IMSS) in Mexico City. Socio-demographic characteristics, functionality, emotional state, cognitive status, delirium, co-morbidities, diagnosis, number of medications, presence of pressure ulcers and falls, were assessed. We developed a composite variable as a global end-point, including: delirium, falls, mortality, pressure sores and functional decline. 70 patients were included in the geriatric services and 140 in the internal medicine unit. Mean age =72.5±7 years (±S.D.), and 52.9% were women. At baseline, only illiteracy, quality of life and the number of medications were statistically different between each group. Fully adjusted multiple logistic conditional regression model found an odds ratio of 0.27 (95% CI 0.1–0.7) for the presence of the composite variable, favoring the geriatric unit. Geriatric units in acute care may be beneficial in different frequent end points in elderly.

1. Introduction

Aging is a process that implies an accumulation of allostatic load associated with physical and cognitive decline (Kirkwood, 1998). At the beginning of the last century human lifespan was approximately 30 years. Over the past five decades human lifespan has more than doubled in many societies as a result of declining mortality rates (Kirkwood, 1998; Hayflick, 2007). This phenomenon is part of the demographic transition, characterized also by declining fertility rates and producing a growing proportion of older, even in developing countries. Another phenomenon, known as epidemiological transition, is also occurring in many countries, resulting in an elevated prevalence of chronic conditions in the elderly, due to advances in prevention and treatment of communicable diseases (Omran, 1971; Kinsella and Velkoff, 2002).

Elders have biopsychosocial characteristics which distinguish them from younger adults. Particularly the so-called geriatric syndromes are almost unique of this age group and have been characterized as a set of causes that lead to single events such as falls, delirium, and depression (Walston and Fried, 1999; Inouye et al., 2007). In addition, older adults have the life-time impact of diseases, both chronic and acute, and their respective treatments. This can result in the failure of an important proportion of elderly persons to carry out activities of daily living (functional decline); which leads them to the need for assistance by someone else (dependency). Therefore, older adults require specialized health care personnel and specific health services, needs that may become especially burdensome in developing countries (Gutiérrez-Robledo, 2002).

There is evidence that the comprehensive geriatric assessment (CGA) can reduce the incidence of delirium, pressure ulcers, and functional decline during hospitalization (Moore et al., 2001; Inouye, 2004). CGA, usually provided at a geriatric evaluation and management unit (GEM), includes a thorough biopsychosocial evaluation of the elder and his family, performed by a geriatric

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team and deriving in targeted interventions (Stuck et al., 1993). The first study to assess the impact of a GEM in the acute hospital care of older adults was the so-called Sepulveda study, a randomized controlled clinical trial in which 63 subjects were allocated to a GEM and 60 to a usual care unit. A statistically significant reduction in one-year mortality was found in this study (24% one-year mortality in GEM patients and 48% in the usual care group) (Rubenstein et al., 1984a). There are also two meta-analyses that analyze this issue, in which a beneficial effect of a GEM has been established, especially with regard to functional decline. These two reports also address quality characteristics of studies on the impact of admission to a GEM (Stuck et al., 1993; Van Craen et al., 2010). In Latin America there is only one report of a study, done in Peru, which found a lower prevalence of functional decline during hospitalization in GEM patients than in patients admitted to an internal medicine ward (IMW) (Zelada et al., 2009). However, this study had no adjustment for potential confounders such as disease severity, gender or age of the subjects. Control for these confounders is part of the study's quality criteria underlined by *Stück* and *van Craen* in their respective meta-analyses (Stuck et al., 1993; Van Craen et al., 2010).

The aim of our study was to determine the effectiveness of a GEM in the prevention or treatment of functional decline, delirium, falls, pressure ulcers and in-hospital mortality, when compared to the usual care provided at the IMSS in Mexico City in an IMW. In contrast to others, this study is observational and therefore it explores the real life operation of both types of health care services.

2. Methods

2.1. Study groups

We prospectively followed up two groups of hospitalized elderly patients at two hospitals from the IMSS in Mexico City, from their admission to their discharge. IMSS is the major public health care provider in Mexico.

One group was selected from whom were admitted to the 20 bed GEM. This service is the only one that IMSS has implemented in the in the country. The GEM was composed of geriatric medicine specialists, two geriatric nurses, rehabilitation technicians, a nutritionist and a psychologist. They assessed the elderly, established their diagnosis and designed a tailored intervention for the patient and his/her family. This intervention was supervised by all members of the team, to supervise the correct implementation of the recommendations. In addition, the geriatrician could decide consulting other specialists on a need-basis. The other group was admitted to the 50-bed IMW of both the same hospital where the GEM is located and another general hospital with similar specialties available and services provided, and a comparable number of physicians, nurses, and training residents. In this case, physicians in charge were internal medicine specialists and there was one nurse for every 5 patients. Regarding residents, the IMW had residents only of internal medicine and in the GEM only residents of geriatrics.

Over a 2 year period (2007–2009) patients aged 60 and older were recruited from among those admitted to either the GEM or the two IMW and having at least one frequent geriatric problem (falls, slow walking speed, tiredness, sorrow, depression, memory deficit, difficulty with IADL's, and bathing), as assessed at the first visit after admission by a study geriatrician. In addition, elderly patients with any of the following conditions at admission were excluded: altered consciousness or not able to communicate, admission from the ICU, and under mechanical ventilation or parenteral nutrition.

Among those fulfilling the above criteria in the IMW group, patients were selected to match, by age (±8 years), gender and main diagnosis group, those enrolled in the GEM group. For each patient entered in the GEM group two matched patients were entered into the IMW group. With this group ratio and taking into account the latest work of *van Craen*, with a 13% expected difference between groups in functional decline (favoring GEM) (Van Craen et al., 2010) we determined that a minimum of 70 study subjects in the GEM group and 140 subjects in the IMW group would provide adequate power (over 80%) at conventional alpha error values (0.05).

2.2. Measurements

After obtaining informed consent, an initial interview, performed shortly after admission by four previously trained and standardized nurses, gathered information on the patient's functional, mood and quality of life status, as well as on his/her socio-demographic characteristics. The presence of pressure ulcers was also assessed during this interview.

Functional status was assessed using both the Barthel Index and the Lawton ADL Scale. A validated Spanish version of the Barthel Index was used, with the same scoring as in the original scale (range 0–100), the highest score corresponding to the best possible functional subject in activities of daily living (Kirkwood, 1998). We also used a validated Spanish version of the Lawton and Brody IADL scale, which, as in the original version, is composed of eight items, with the worse possible score of 0, and the best score of 8 (Olazaran et al., 2005).

Mood was assessed with a Spanish version of the 30-item Yesavage's Geriatric Depression Scale (GDS), with a possible score ranging from 0 to 30, being 30 the most depressed subject (Javier, 1997). A Spanish version of the Minimental State Examination (MMSE) was used to assess cognitive status, scored as in the original version (Martinez de la Iglesia Ma and Dueñas Herrero, 2002). Delirium was assessed with a Spanish version of the Confusion Assessment Method for the ICU tool (CAM-ICU), with delirium being indicated by the presence of both acute onset of mental status changes (and a fluctuating course) and inattention plus either disorganized thinking or an altered level of consciousness (Quiroga et al., 2004).

Quality of life was measured with the visual analogue scale of the EuroQoL (EQ VAS), in which the subject rates his/her quality of life in a 0–100 point scale, with the highest score indicating the best possible quality of life (Toro et al., 2010).

During hospitalization the study nurses made daily visits to the included patients to assess the presence of falls and delirium. Daily reports were given to a supervisor and all data were entered on a weekly basis.

The study nurses also administered a final interview on the patients, 48 h prior to their discharge. During this interview the following measurements were included: Barthel Index, CAM-ICU, EQ VAS, falls and presence of pressure ulcers.

If the patient died during hospitalization, the date and cause of death were recorded.

In addition, several clinical data were abstracted from the medical record by a study geriatrician, including the main hospitalization diagnosis, the APACHE II score, a list of prescribed medications and the presence of comorbidities. APACHE II is a reliable tool to assess the severity of an acute condition, and integrates a series of laboratory data (i.e. sodium), vital signs (i.e. heart rate) and clinical items (neurological status), with a maximum score of 76 points, corresponding to a 99.9% hospital mortality rate (Knaus et al., 1985; Charlson et al., 1987). Comorbidity information was summarized using the Charlson with a score ranging from 0 to 34 (Charlson et al., 1987).

Medical records were also reviewed at patient's discharge or death to obtain the number of hospitalization days.

2.3. Outcome variable

The primary outcome variable to be analyzed was a dichotomous composite variable considered present if any of the following conditions occurred during hospitalization: functional decline, incident pressure ulcers, persistent pressure ulcers which did not ameliorate during hospital stay, incident delirium or persistent delirium, not ameliorating during hospitalization and the occurrence of falls during hospitalization. As in previous studies, functional decline was defined as a reduction of more than 30 points in the Barthel Index, from admission to discharge (Javier, 1997; Sleiman et al., 2009). Pressure ulcers were also assessed by the study nurses in the initial and discharge interviews with a thorough skin examination, and were considered present if any ulcer was present, irrespective of their severity. The presence of delirium was monitored daily using the CAM-ICU tool, as was also the case for falls. Each clinical outcome composing the primary outcome was also analyzed as a secondary outcome.

2.4. Statistical analysis

Most clinical scales and indexes were treated as continuous variables and were summarized through means and standard deviations. Categorical variables were summarized using proportions and included gender, education, delirium and pressure ulcers presence, functional decline and main diagnosis, among others.

Since the compared groups of patients were individually matched, conditional logistic regression models of the following form were fitted to assess the effect of GEM admission compared to IMW admission on the primary and secondary outcomes:

$$\varphi = \beta_0 + \beta_1 O + \sum \beta_j x_j$$

where φ is the logit of being admitted to the GEM, β_0 is an intercept, β_1 is the change in φ associated to the primary or secondary outcome O, and $\sum \beta_j x_j$ is a vector of coefficients (β_j) associated to additional admission predictors (x_j), such as socio-demographic or clinical characteristics of patients at admission. Age was always included in all fitted models, in spite of the fact that it was a matching variable, because matched subjects could have up to 8 years of difference in age and residual confounding by this variable was a possibility.

These models were fitted using the STATA statistical software, version 10 [StataCorp., 2007. Stata Statistical Software: Release 10, College Station, TX: StataCorp LP.]. Rather than defining the logit of presenting a primary or secondary outcome as the dependent variable we had to define the logit of being admitted to the GEM as the dependent variable in the fitted models because, in each triplet, patients in both groups could present the outcome of interest and because β_1 in the models formulated this way can also be interpreted as the change in the logit of presenting the outcome of interest associated to being hospitalized in the GEM.

Similar conditional logistic regression models were used to assess the statistical significance of differences in the distribution of socio-demographic and basal clinical characteristics and scales between patients admitted to the GEM or the IMW.

3. Results

Over the study period, 138 consecutive patients admitted to the GEM were screened to be included in the study (Fig. 1). Of them, 70 (51%) patients were included and 68 were not included in the study, 3 (2%) of them because they refused to participate in the study, 42 (30%) because they did not meet the inclusion criteria and 23 (17%) because they had exclusion criteria. In the IMW group, 452 hospitalized patients were screened. Of them, 12 (3%) declined to participate in the study, 203 (45%) either did not meet any of the inclusion criteria or did not have an age, gender and main diagnosis match on the GEM group and 97 (21%) had exclusion criteria. Age and gender of the subjects who did not participate in the study were not significantly different from those included in this study. Therefore, we analyzed 70 GEM and 140 IMW matched patients (70 triplets).

Table 1 compares the distribution of baseline characteristics observed in each group. Patients in both groups had a similar age distribution, with a combined average age of 72.5 years and 52.9% being female in each group. Patients admitted to the GEM had a lower proportion of illiterates (7.1%) than those admitted to the IMW (17.1%).

General quality of life at admission, as assessed by the EuroQol VAS, was significantly better in patients admitted to the GEM (74.0) than in those admitted to the IMW (64.4). GEM patients also showed higher Barthel average scores at admission than IMW patients. In contrast, average Lawton IADL scores were similar in both groups.

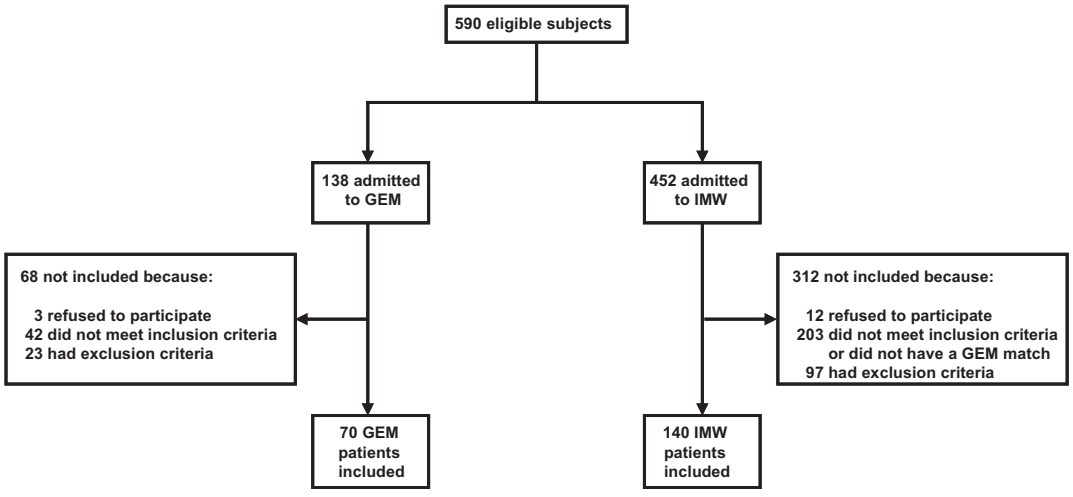

Fig. 1. Study subjects flow chart.

Table 1
Patient characteristics at admission.

	IMW ($n = 140$)	GEM ($n = 70$)
Mean age (SD)	72.6 (7.7)	72.3 (7.2)
Gender		
% women	52.9	52.9
Education		
None	17.1	7.1
Elementary school	55.7	62.9
High school or higher	27.1	30.0
Mean EuroQol VAS (SD)[‡]	64.4 (22.8)	74.0 (23.6)
Mean Barthel Index (SD)	85.3 (23.3)	89.3 (19.7)
Mean Lawton IADL Scale (SD)	5.4 (2.4)	5.3 (2.8)
Mean MMSE score (SD)	19.7 (6.4)	21.0 (6.4)
Mean 30-item GDS (SD)	10.7 (5.8)	9.6 (5.7)
Delirium (%)[†]	12.9	12.9
Mean APACHE II score (SD)	11.4 (5.1)	10.6 (4.6)
End-stage renal disease (%)	37.9	27.1
Hemiplegia (%)	11.4	15.7
Mean Charlson comorbidity Index (SD)	8.5 (3.2)	8.2 (2.8)
Polypharmacy before hospitalization(%)	25.0	30.0
Pressure ulcers (%)	3.6	7.1

[†] Assessed by the CAM-ICU tool.
[‡] $p < 0.05$.

Mean MMSE scores were 1.3 units higher in the GEM group (21.0). Conversely, mean GDS scores were 0.9 higher in the IMW group (10.7). Delirium was present at baseline in 12.9% of patients in both groups.

The mean APACHE II score, indicating the severity of the acute illness, was lower in the GEM group (10.6) than in the IMW group (11.4), yet this difference was not statistically significant. The most common hospitalization main diagnoses were: ischemic stroke, renal failure, community acquired pneumonia, acute coronary syndrome, diabetes and chronic obstructive pulmonary disease. Main diagnoses frequency did not show any statistically significant difference between the compared groups. However, end stage renal disease had a frequency of 37.9% in the IMW group, whereas in the GEM group it had a frequency of 27.1%. In contrast, hemiplegia was more prevalent in the GEM group (15.7%) than in the IMW group (11.4%).

Patients studied had, at baseline, an overall mean Charlson comorbidity index of 8.4, which was also slightly lower in patients admitted to the GEM unit (8.2). The most common comorbid conditions were: high blood pressure, diabetes mellitus, peptic ulcer disease, chronic obstructive pulmonary disease, vascular peripheral disease, chronic renal failure, heart failure and coronary heart disease. All these comorbid conditions were similarly distributed in both study groups.

Non-statistically significant differences between the compared groups were observed for polypharmacy before hospitalization (consumption of at least 5 drugs) and the presence of pressure ulcers at admission, but they both had a higher prevalence in the GEM group.

Patients in the GEM group stayed in the hospital for an average of 9.9 days (SD = 10), a length of stay slightly higher than that observed in the IMW group (mean = 9.3 days, SD = 6.1). However, this difference was not statistically significant. The mean number of different drugs administered during hospitalization was significantly lower ($p < 0.05$) in patients seen at the GEM (10.2 drugs, SD = 5.0) that in patients seen at the IMW (12.7 drugs, SD = 5.3).

No falls were recorded in any of the study participants and therefore the impact of type of service on falls could not be evaluated.

During hospitalization, GEM patients showed a statistically significant lower combined frequency of functional decline, delirium, pressure ulcers and death than that observed in IMW patients. This primary outcome was seen in 40.0% of patients admitted to the IMW and in 24.3% of patients admitted to the GEM (Table 2). The matched odds ratio, adjusted for age and gender and main diagnosis group at admission, comparing the presence of any of these outcomes (primary outcome) in the GEM group versus the IMW group was 0.47 (95% confidence interval = 0.25–0.91). Table 2 presents the matched odds ratio for presenting the primary outcome in the compared groups, adjusted for additional clinical variables at admission, including educational level, comorbidities, functionality and quality of life and the severity of acute illness. After adjusting for these variables, the relative odds of presenting the primary outcome in the GEM group was 0.27 of those observed in the IMW group (95% confidence interval = 0.10–0.70). This implies a 73% reduction in the odds of presenting functional decline, delirium, pressure ulcers or death during hospitalization if a patient was admitted to the GEM rather than to the IMW.

Functional decline during hospitalization was the most frequent secondary outcome seen in this study, occurring in 32.1% of patients in the IMW group and in 17.1% of patients in the GEM group (Table 2). Incident or persistent delirium during hospitalization was second in frequency as a secondary outcome and was also more frequent in the IMW group (15.7%) than in the GEM group (7.1%). In addition, incident or persistent pressure ulcers also occurred with greater frequency in IMW patients (8.6%) than in patients hospitalized at the GEM (5.7%). These three secondary outcomes had a similar a matched odds ratio, adjusted for baseline characteristics, when comparing their frequency in GEM patients versus that observed in IMW patients, ranging between 0.22 and 0.37. However, only the odds ratio corresponding to the effect of hospitalization service on functional decline reached statistical significance.

Finally, the last secondary outcome evaluated was in-hospital death and occurred also with higher frequency in the IMW group (7.1%) than in the GEM group (5.7%). However, after adjustment for base-line characteristics, the matched odds ratio indicated that the odds of dying were 1.5 times higher in the GEM group; nevertheless this result was not statistically significant.

4. Discussion

We present here the results of an observational study that finds beneficial effects in several outcomes of hospitalizing a group of

Table 2
Assessed clinical outcomes at discharge.

	IMW ($n = 140$), %	GEM ($n = 70$), %	Adjusted OR	95% confidence interval
Primary outcome				
Any of the secondary outcomes	40.0	24.3	0.27	0.10–0.70
Secondary outcomes				
Functional decline	32.1	17.1	0.23	0.08–0.65
Delirium (incident or persistent)	15.7	7.1	0.37	0.11–1.27
Pressure ulcers (incident or persistent)	8.6	5.7	0.22	0.02–2.16
Died during hospitalization	7.1	5.7	1.50	0.31–7.18

Obtained through conditional logistic regression and adjusted for age, educational level, the presence at admission of pressure ulcers, end-stage renal disease and hemiplegia and the baseline scores of EuroQol VAS, Barthel Index, Lawton IADL, MMSE, Charlson and APACHEII scales.

elderly patients in a GEM as opposed to an IMW in a developing country. Characteristics of care provided at the institution where the study took place precluded us to conduct a randomized clinical trial. On the other hand, an observational design may be more appropriate to evaluate the expected impact of a GEM that has had enough time consolidate a heath care group and is working under real-life conditions (Stuck et al., 1993).

We attempted to increase comparability between the compared groups in patients' baseline characteristics by individually matching them by gender, broad age group (±8 years) and main diagnosis at admission. In addition, we measured at baseline the educational level and several clinical scales (ADL, IADL, EuroQol VAS, MMSE, GDS, CAM-ICU, Charlson and APACHE II) and conditions, including co-morbidities, polypharmacy and the presence at admission of pressure ulcers and obtained, through multiple conditional regression models, an estimate, adjusted for these co-variables, of the effect on several relevant clinical outcomes, of GEM care compared to IMW care, regardless of whether or not the distribution of these potential confounders was found to be significantly different between the compared groups. These baseline characteristics have been found to have some effect in other studies of elderly patients, with similar outcomes to the ones we evaluated (Badia et al., 1999; Zelada et al., 2009). In our study we found that GEM admitted patients had a higher educational level than patients admitted to the IMW and also a better general quality of life as assessed by the EuroQol VAS. In addition, GEM patients had slightly better Barthel, MMSE, APACHE II and Charlson baseline scores than their IMW counterparts and also lower GDS scores and a lower prevalence of end stage renal disease. On the other hand, GEM patients had a higher prevalence at admission of hemiplegia, polypharmacy and pressure ulcers.We selected five clinically relevant outcomes in hospitalized elderly patients: Functional decline, delirium, pressure ulcers, in-hospital death and falls during hospitalization. We attempted to minimize measurement bias of the first three outcomes by training and constant supervision of the study nurses. Additionally, no falls were recorded in any study subject. A study of more than twenty thousand participants found an incidence of approximately 3% of nosocomial falls (Toyabe, 2010). Therefore, our sample was not big enough to detect this outcome (Reuben et al., 1995). Thus, we ended up evaluating the effect of hospitalization in a GEM rather than in an IMW with a primary outcome variable combining the presence of functional decline, delirium, pressure ulcers and death during hospitalization.

We found a 53% reduction in odds of presenting the primary outcome, adjusted for age, gender and main diagnosis, for patients hospitalized at the GEM compared to patients admitted to the IMW and an even higher reduction (73%) after adjustment for additional sociodemographic and clinical characteristics. In addition, we found similar reductions in the odds of presenting functional decline and incident or persistent delirium and pressure ulcers in patients admitted to the GEM, albeit only the reductions observed for functional decline were statistically significant. On the other hand, in-hospital mortality was similar or possibly somewhat higher in GEM patients.

In general our results are consistent with findings from other studies, especially with regard to the lower functional decline of patients hospitalized in a GEM (Rubenstein et al., 1984a; Stuck et al., 1993; Rubenstein et al., 1995; Zelada et al., 2009; Van Craen et al., 2010). This is the second study in Latin America to find similar results. A paper by Zelada et al. conducted in Peru, found that patients seen at an IMW had 4.2 times the odds of presenting functional decline, compared to patients seen at a GEM (Zelada et al., 2009), with no adjustment for age, gender or comorbidity. In addition, other studies have also found a lower frequency of delirium and pressure ulcers in GEM patients (Landefeld et al., 1995; Inouye, 2004).

We were not able to find a report in the literature where multiple outcomes assessed with a composite variable as we did in our study. Evaluation of different geriatric adverse outcomes, allows having a global view of the multidimensional components of a GEM, which at any given time must respond to the needs of elderly patients and prevent or improve all their potential complications. The diverse activities a GEM performs to elder care, from the CGA to the targeted interventions (rehabilitation, nutrition, reduction in polypharmacy, etc.), maybe the cause of this study results, as has been stated by other authors (Rubenstein et al., 1995; Zelada et al., 2009).

Other possible explanations or mediators of the beneficial effect of a GEM that we found are intervention complexity and health group expertise. It has been reported that complex interventions, understood as multifactor or multidimensional, have proven to be useful in the treatment of elderly patients. For instance, a recent study by (Beswick et al., 2008) found that a multidimensional intervention could delay institutionalization, decrease the number of hospitalizations and maintain the independence of community dwelling elder. On the other hand, a phenomenon described in *Stuck* meta-analysis was that of the beneficial effect of the expertise of a consolidated health group, in contrast to interventions specifically designed for a clinical trial that showed no positive effect of care at a GEM (Stuck et al., 1993).

A change in the acute care of elderly could result in better functionality and less frequency of pressure ulcers and delirium. In a healthcare system that is overwhelmed by the elder, new strategies to deal with their specific health care needs could result in a better satisfaction of consumers and their families. Furthermore, follow up studies have found that patients who continue to be managed by an ambulatory geriatric service persist with a positive effect on functionality; and in some cases in cognitive and affective status (Rubenstein et al., 1995; Beswick et al., 2008).

We are aware of the fact that our results could only be generalized to the fraction of hospitalized elderly patients more likely to be benefited by the care provided in a GEM, i.e., those with at least one geriatric problem and without unconsciousness or serious conditions requiring intubation or parenteral nutrition, for instance (Stuck et al., 1993; Rubenstein et al., 1995). Our study also had a limited time frame and studies are needed to evaluate relevant geriatric outcomes after hospitalization.

Finally, costs comparisons of care at a GEM versus an IMW are another important outcome to measure in future studies. There are a few studies in the literature that have assessed costs, some have found similar costs in both types of services whereas others have found that geriatric services may be more expensive compared with usual care (Rubenstein et al., 1984b; Rubenstein et al., 1995).

Conflict of interest statement

None.

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