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Technical Report

CLASSIFICATION OF EMERGENCY DEPARTMENTS IN QUEBEC AS A FUNCTION OF SERVICES OFFERED TO SENIORS DISCHARGED HOME

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Fonds de la recherche en santé Québec

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CLASSIFICATION OF EMERGENCY DEPARTMENTS IN QUEBEC AS A FUNCTION OF STAFFING AND SERVICES OFFERED TO SENIORS DISCHARGED TO THE COMMUNITY

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SUMMARY

Objective: Our goal was to develop a classification of emergency departments (EDs) based on services available to seniors discharged back to the community.

Methods: Data were obtained by a survey of the key informants (chief physicians and head nurses) in all EDs in Quebec as part of a study of the safety of seniors discharged to the community after visiting an ED.[1] Variables were classified *a priori* in the following three categories: 1) availability of human resources; 2) care processes and 3) links to community services. We used a multifactorial analysis (MFA) to analyze the variables by group and globally, thus bringing to light not only the relationships between variables within each group, but also the relationships between different groups. We then proceeded to classify them using Ward's method (hierarchical ascendant classification) applied to reduced data dimensions.

Results: The sample comprised 103 EDs. Analyses were carried out on data from the 68 (66%) of these departments that supplied complete data. These 68 departments did not differ in terms of services offered or patient characteristics from the 35 other departments that supplied incomplete data. We identified three groups of emergency departments: most specialized and less community oriented (n=12), moderately specialized and less community oriented (n=28), and least specialized and more community oriented (n=28).

Conclusion: The three groups of emergency departments identified in this study represent three types of organizations with differing assets and limitations. None of the groups offered at the same time both the recommended care and services available in the community.[2, 3] The most specialized and less community-oriented departments were those in which internal care processes are best developed, but in which links to community services are mediocre. The EDs that were least specialized and more community oriented seem to be those that had the best links with community services but the least-developed care processes. These two groups were the best defined and the most homogeneous. The moderately specialized and less community oriented EDs tended to show limits in terms of availability of human resources and their links with community services were very underdeveloped. This group was the least clearly defined and also the most heterogeneous. Nevertheless, the methodology used in this study allows EDs to be classified in a way that is meaningful and helpful to those planning services and to decision makers. The classification scheme highlighted the fact that EDs are more or less adapted for offering optimal care to seniors. Future research based on this classification will examine the characteristics and clinical outcomes of patients who visit each type of ED.

TECHNICAL REPORT

INTRODUCTION

Emergency departments (EDs) play an important role in the health system by furnishing emergency medical care. They provide access to the hospital for patients who need to be hospitalized. They also serve as a substitute source of primary care for patients who consider that primary care services are not easily accessible, or who need resources (such as diagnostic radiology or tests) that are not available in most primary care settings.[4-7] Seniors (defined here as those aged 65 or more) constitute an increasingly important clientele for emergency departments. The care they need calls for a substantial share of these departments' resources, and they have worse outcomes than younger adults.[8] Moreover, the services offered to seniors who are discharged to the community and their clinical outcomes could be improved by systematic approaches, including carrying out evaluations within EDs and directing patients to appropriate community services (such as home nursing care and support services).[2, 3]

Research on the performance of EDs and the clinical outcomes of patients rarely takes into account the heterogeneity of these departments in terms of size, availability of human resources, and other organizational characteristics.[7, 9-11] An organizational classification of EDs that does take these characteristics into account could help studies on the performance and outcomes of EDs.

OBJECTIVES

To develop an organizational classification scheme of EDs in terms of the care given to seniors who are discharged to the community. This organizational scheme should take into account factors such as ways in which internal personnel are allocated, care processes, and access to community services.

METHODS

The choice of dimensions and of variables used was based in part of the works of Georgopoulos (1986)[12] who conceives of EDs as open systems whose operations depend both on hospital and environmental resources. The choice of attributes describing EDs was also based on a systematic review of the efficacy of interventions with seniors treated in EDs and discharged to their home by Hastings and Heflin (2005).[3] Together, these studies suggest taking into account three principal dimensions: (1) the resources available in the ED and in the hospital for providing treatment and services to seniors in the ED; (2) the presence of care processes for detecting seniors at risk, evaluating the needs of seniors, and discharge planning from the ED; (3) established links with community resources.

Data Sources

The data used for the classification come from a study on the safety of discharge of seniors from EDs in Quebec to the community.[1] This study, carried out during the summer of 2006, used questionnaires addressed to the chief physician and nurse of the 103 EDs registered in Quebec. Where needed, the person charged with coordinating emergency care for seniors helped the head nurse reply to the more detailed questions on care processes. Response rates were 71% for the doctors and 90% for the nurses.

The questionnaires used in this study included questions on the organizational characteristics of EDs in terms of care provided to seniors discharged home after a visit to the ED. Respondents

supplied data on 7 measures of availability of human resources, 6 measures of care processes, and 5 measures of community services (see Table 1).

Availability of human resources: the ratio of the reported number of nursing and medical staff to the official number of beds[*] in an ED, classed as low (the lowest quartile), medium (the 2 intermediary quartiles), and high (the highest quartile); the percentage of doctors assigned to the ED working full time; the availability of a pharmacist (none, on call only, in the ED); the level of multidisciplinarity (low = a maximum of 2 different professionals attached to ED or on call, high = 3 or more, taking into account the following professionals: liaison nurse, clinical nurse specialized in geriatrics, social worker, occupational or physio-therapist, and pharmacist); the existence of a consultant in geriatrics or in psychogeriatrics (none, rarely available, usually available); and the presence of residents in emergency medicine.

Care processes: screening of patients (none or not systematic, systematic); the use of standardized evaluation tools (yes, no); a protocol for discharge planning (yes, no); different types of written information provided to patients at discharge (none, 1 to 4 types, 5 types or more); frequency of follow-up of patients after discharge (never/rarely, sometimes/often); and the frequency of transmission of information to the primary physician (never/rarely, sometimes/often).

Community services: measures taken for sharing information and (or) personnel with local homecare services (none, sharing of information only, sharing of personnel); availability of homecare services; availability of community services for seniors (outpatient geriatric clinics, day hospitals); alternatives to hospitalization such as homecare, rehabilitation, day hospitals, day medical centers, pre-operation evaluation units, outpatient geriatric assessment clinics (0-2, 3-4, 5 or more alternative services offered); and the frequency with which information is transmitted to the primary physician (never/rarely, sometimes/often). All these variables were based on the nurse and physician questionnaires.

Supplementary variables. Several variables appropriate to emergency services were chosen that were not used in developing the classification but were used as supplementary descriptors: size of the ED (the official number of ED beds) and geographic localization using MIZ (Metropolitain Influence Zone)[13]: metropolitan (MIZ=1), urban (MIZ= 2 to 4) and rural (MIZ 5 to7).

Statistical Analysis

We used a multifactorial analysis (MFA).[14, 15] The interest of a MFA was that it allows simultaneous use of both qualitative and quantitative variables. The MFA also allows analysis of group variables (availability of resources, processes, and community services). It is carried out in two stages. First, a factorial analysis (a principal component analysis, if the group variables are quantitative, a multiple correspondence analysis if they are categorical) is made of each of the groups of variables. A number of factorial axes are extracted for each group, which the MFA then analyzes for a global principal component. MFA thus allowed us to highlight not only the relationships between variables within each group, but also those between groups of variables. We then proceeded to classify EDs using an ascendant hierarchical classification technique[16] based on Ward's criteria applied to reduced dimensions. All calculations were carried out with the help of the SPAD 7.0 program.

[*] In this report, the term "bed" is used to denote "stretcher"

RESULTS

In view of the response rates of the nurses and doctors, the analyses presented here represent the 68 EDs (66%) that supplied complete data. These departments did not significantly differ in terms of size, number of visits, or geographical location (data not presented) from the 35 EDs excluded from the analyzed sample. In the first stage of the analysis we carried out a multiple correspondence analysis for each group of variables: that is, availability of human resources, care processes, and community service. After observing values and modalities appropriate to the axes, we chose to keep two axes for each of the groups, which correspond to rates of accumulated inertia of 31.58%, 43.09%, and 43.60% respectively. We then carried out a principal component analysis (PCA) based on 6 factorial axes; we retained the first two axes for the grouped analysis, which corresponded to 19.99% of the explained variance. The correlations between the first axis and the three groups of variables (availability of human resources, care processes, community services) are the following: 0.7259, 0.8346, and 0.6428. The correlations between the second axis and the three groups of variables: are the following 0.6659, 0.5226 and 0.8572. The classification presented here was selected as a function of both statistical performance (ratio inter inertia / total inertia) and interpretability. The three categories of EDs were designated as follows: most specialized and less community oriented (n=12), moderately specialized and less community oriented (n=28), and less specialized and more community oriented (n=28) (see Table 1).

The 12 EDs classified as the most specialized and less community oriented (17.6%) were more likely to have the following characteristics: a high nurse-to-bed ratio, a moderate doctor-to-bed ratio, the availability of a pharmacist in the ED, a greater range of health professionals, and the presence in the ED of geriatric consultation and residents. As to processes, these EDs were also more likely to carry out a systematic screening of patients and to use standardized evaluation tools for seniors, to have a protocol for discharge planning, and to carry out a post-discharge follow-up. As to community services, these EDs were more likely to send (and receive) information to the primary physician and to have the highest availability of home care and other community services for seniors.

For their part, most of the 28 EDs classified as moderately specialized and less community oriented (41.2%) had the following characteristics: a medium nurse-to-bed ratio and a low doctor-to-bed ratio, with most of the doctors being full-time; no pharmacist within the ED; a relatively wide range of healthcare professionals, but no geriatric consultation offered. Most of these departments did not systematically use screening for seniors, and did not have tools for standardized evaluation of seniors. Most did not have protocols for discharge planning, and did not carry out any post-discharge follow-up. As well, most provided no information to patients at the moment of discharge. Most of these EDs had no links to community health centers and lack of available home care or other community services for seniors. This group, it is worth noting, was the most heterogeneous of the three.

The 28 EDs classified as least specialized and more community oriented (41.2%) had the following characteristics: most had a low or medium nurse-to-bed ratio, a medium or high doctor-to-bed ratio; a restricted range of professionals attached to the ED; the lowest ratio of full-time doctors, pharmacists, and geriatric consultants. The rates at which they used systematic screening, standardized evaluation tools for seniors, or protocols for discharge planning and post-discharge follow up, were low, but not the rate at which they distributed information to patients at the moment of discharge. These EDs were more likely to exchange information with primary or treating

physicians in the community and to have the highest availability of homecare and other community services for seniors.

As to the two complementary characteristics (geographical location and size), specialized EDs were generally larger and located in a metropolitan region, while more community-oriented departments were mostly of smaller size and located in non-metropolitan regions. Moderately specialized EDs were situated between these two groups.

DISCUSSION

The goal of the study was to develop a classification of EDs in terms of services offered to seniors discharged to the community. We have characterized three different types of EDs, distinguished from each other by availability of human resources, care process, and community services.
The method used in this study involved exploratory multidimensional statistics. It was carried out in two stages. First, we employed a MFA. This kind of factorial analysis was particularly appropriate for analyzing variables grouped by dimension, and when dealing with both quantitative and qualitative variables. The MFA also highlighted the most significant data structures (factorial axes or factors), which agree with the initial concepts. As well as statistical indicators associated with inertial values of various factors and the dispersion of individuals and variables, a large part of the decision made as to the number of factors to keep was subject to the interpretation of factors, as recommended by Lebart, Morineau and Piron (2000)[17], who assign high importance to understanding the object being studied.

The technique of ascendant hierarchical classification has been shown to be effective in partitioning groups for which the internal variance of each class is minimal and the variance between classes is maximal (proceeding by loss of inertia in aggregating two elements: Ward's generalized criterion). The number of partitions used for the final classification came from combined consideration of both the statistical analyses (interclass distances; inertia quotient) and the theoretical plausibility of groupings.

Finally, one cannot make conclusions about the reproducibility of the solution obtained, that is, about the ability to obtain a similar number of groups with a similar composition using the usual replication methods. These methods consist, notably, of applying the same analytical method to another sample, or comparing the results obtained from an initial sample divided into two equal parts18. The relatively small size of our sample (n=68) and the limited means at our disposal are such that reproducing our results in such way is not possible.

The classification that we have developed was an attempt to take into account the complexity of EDs, considering not only internal resources and care processes, but also relationships between the departments and external healthcare providers in the community. Given this complexity, it is difficult to create homogeneous groupings of EDs. This classification had several limitations. First, it is a secondary analysis of data gathered with another primary goal. If the investigation was to be carried out again with the primary goal of classifying EDs, the nature of links to community resources and the availability of and access to these resources would need to be documented with greater precision. Some questions might be worth formulating differently, so as to delimit more precisely some factors, notably the availability of pharmacists and of geriatric specialists in EDs and access to resources in the community. Second, though those invited to respond to the survey were

those most capable of providing reliable organizational information, we were not able to validate these data from other sources.

CONCLUSION

The groups of EDs identified in this study represented three organizational types with different assets and limitations. None of the groups offered the recommended care processes in EDs and a strong orientation towards services available in the community.[2, 3] The EDs that were most specialized and less community oriented were those with the best internal care processes, but the community services and the link between EDs and these services need to be strengthened. The EDs that were least specialized and more community oriented were those that offer the best community services and maintain links with these services, but which had the least developed internal care processes. These two groups were the most clearly defined and the most homogeneous. EDs that were moderately specialized and less community oriented tended to be limited both in terms of availability of human resources and of care processes, and to have underdeveloped links with community services. This was the least clearly defined and most heterogeneous group. It may contain several sub-types.

Implications for Decision-makers

The study shows that the geriatric services offered in EDs are comprised of elements that are coherently linked to each other. It highlights the fact that conventional indicators of ED performance focus on internal processes and lead to understanding and solving their problems as if these departments were closed systems. It is well known, however, that EDs are complex, open systems, whose function depends not only on internal structures and processes but also on upstream and downstream factors. The method used here leads to a more nuanced and complete view of geriatric services offered in EDs. It is well adapted to the systematic analysis of health services. Using it, we have obtained an interpretable classification of geriatric services offered in EDs, one which could be useful in planning services and to decision makers. This classification also allows a portrait to be drawn of the different types of ED according to geographical location (metropolitan, urban, and rural) of socio-sanitary regions. Other research based on this classification will compare the characteristics and clinical outcomes of patients seen in each of these kinds of EDs.

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Table 1: Characteristics of three types of emergency department (ED)

Variables	Total (n-68) n	Total (n-68) %	Most specialized and less community-oriented EDs %	Moderately specialized and less community-oriented EDs (n=28) %	Least specialized and more community-oriented EDs %	Chi-square** p-value
Availability of human resources						
Nurse-to-bed ratio						0.145
Low	17	25	8	21	36	
Medium	34	50	42	61	43	
High	17	25	50	18	21	
Doctor-to-bed ratio						0.041
Low	16	23	8	39	14	
Medium	34	50	58	50	46	
High	18	27	33	11	39	
Full-time doctors	39	57	100	64	32	<0.001
Pharmacist						<0.001
None	10	15	8	18	14	
On call	37	54	8	57	71	
In the ED	21	31	83	25	14	
Multidisciplinarity						0.002
Low	29	43	17	29	68	
High	39	57	83	71	32	
Availability of a geriatrician or a psychogeriatrician						0.069
None	36	53	17	57	64	
Rarely available	9	13	25	11	11	
Usually available	23	34	58	32	25	
Presence of residents	40	59	75	68	43	0.075
Care processes						
Systematic screening of seniors	22	32	67	29	21	0.017
Standardized tool for evaluating seniors	12	18	50	7	14	0.007
Protocol for discharge planning	10	15	42	4	14	0.011
Information documents given to patient on discharge						<0.001
None	35	51	25	79	36	
1 to 4	21	31	58	18	32	
5 to 7	12	18	17	4	32	
Post-discharge follow-up						0.03
Never or rarely	49	72	42	75	82	
Sometimes or often	19	28	58	25	18	
Information sent to the primary physician						<0.001
Never or rarely	17	25	67	21	11	
Sometimes or often	51	75	33	79	89	

(Continued)

Table 1 (continued)

Variables	Total (n=68)		Most specialized and less community-oriented EDs (n=12)	Moderately specialized and less community-oriented EDs (n=28)	Least specialized and more community-oriented EDs (n=28)	p-value
	n	%	%	%	%	
Community services						
Arrangements with homecare services						<0.001
None	25	37	17	68	14	
Information sharing only	39	57	83	29	75	
More extensive	4	6	0	4	11	
Availability of homecare services	39	57	58	29	86	<0.001
Availability of community services for seniors	20	29	50	0	50	<0.001
Availability of alternatives to hospitalization						0.074
Low	22	32	33	39	25	
Medium	31	46	25	36	64	
High	15	22	42	25	11	
Information received from the primary physician						0.006
Never or rarely	17	25	58	25	11	
Sometimes or often	51	75	42	75	89	
Supplementary variables						
Geographic location (MIZ)						0.004
Metropolitan	29	43	67	54	21	
Urban	21	31	25	36	29	
Rural	18	26	8	11	50	
Number of ED beds						0.006
1-6	15	22	0	14	39	
7-22	38	56	50	61	54	
23+	15	22	50	25	7	

ED: emergency department

* These variables were not used in constructing the classification

** Fisher's exact test was used when the estimated number in a cell is less than 5