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A Multilevel Analysis of the determinants of emergency care visits by the elderly in France

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ABSTRACT

Background: Rising numbers of visits to emergency departments (EDs), especially amongst the elderly, is a source of pressure on hospitals and on the healthcare system. This study aims to establish the determinants of ED visits in France at a territorial level with a focus on the impact of ambulatory care organisation on ED visits by older adults aged 65 years and over.

Methods: We use multilevel regressions to analyse how the organisation of healthcare provision at municipal and wider 'department' levels impacts ED utilisation by the elderly while controlling for the local demographic, socioeconomic and health context of the area in which patients live.

Results: ED visits vary significantly by health context and economic level of municipalities. Controlling for demand-side factors, ED rates by the elderly are lower in areas where accessibility to primary care is high, measured as availability of primary care professionals, out-of-hours care and home visits in an area. Proximity (distance) and size of ED are drivers of ED use.

Conclusion: High rates of ED visits are partly linked to inadequate accessibility of health services provided in ambulatory settings. Redesigning ambulatory care at local level, in particular by improving accessibility and continuity of primary and social care services for older adults could reduce ED visits and, therefore, improve the efficient use of available healthcare resources.

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1. Introduction

Emergency departments are essential for providing a rapid and initial treatment for a large number of health problems and injuries, some of which may be life-threatening and require immediate attention. Nevertheless, they are also used as the entry point by those who do not have any other means to obtain timely and adequate health care services. The steady increase in ED visits in recent years is a source of pressure on hospitals and on the healthcare system in many countries, and raises questions on its appropriate use. In France, the number of ED visits increased by 50% between 2000 and 2015 [1], and according to surveys, two thirds of the patients chose the ED because of the geographical proximity (easy access), availability of technical equipment, opening hours, gratuity and the difficulty of finding a solution in ambulatory setting [2].

A high rate of ED visits without hospitalisation is a sign of inefficiency in the health system to provide timely and appropriate primary care services that are accessible to all [3]. In many coun-

tries, reducing ED visits has become a policy priority for improving the overall efficiency of the healthcare system [4]. Two types of admissions are targeted: visits identified as "non-urgent", substitutable by outpatient or primary care, and visits potentially preventable by adequate and regular upstream management of risk factors and chronic health problems. A number of studies have emphasised the importance of demand-side factors, such as individual health status, socioeconomic and demographic factors. People with chronic illnesses, cognitive disorders and those suffering from multiple diseases have a greater likelihood of visiting EDs [5–7]. The youngest and the oldest population groups have higher ED utilisation rates [2]. The elderly population is often characterised by a proliferation of health problems that may be aggravated by psychological and/or social issues. Inadequate healthcare and social support for older people with complex health needs can lead to visits to emergency departments which are not necessarily the best settings for ensuring optimal provision of coordinated care [2,5].

At the same time, the link between the individual demand variables and the need for ED utilisation is determined by the way the health system is configured [3,4]. The financial and physical accessibility of healthcare for different populations is critical. In France, the introduction of universal health insurance (*Couverture Maladie Universelle*; CMU) for low-income and state medical aid for illegal

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residents which removed financial barriers to regular care, appear to have reduced significantly ED visits of the populations concerned [2,8]. In England, Cecil et al. [9] showed that children aged less than 15 years old with good access to primary care (measured by waiting time for appointments), have a lower probability of visiting the ED [9]. Based on an international survey of 34 countries, excluding France, Van den Berg et al. (2015) suggest that accessibility of primary care, measured by opening hours of general practitioners (GP) and distances to a GP, is an important determinant of the ED visits [10]. In France, where the geographical distribution of the health workforce is very unequal, a wide range of policies have been put in place to strengthen primary care provision with the idea that better accessibility of primary care, especially for the high-need/high-cost elderly population could be a lever for reducing hospital use and ultimately improving system efficiency. Despite an increasing attention to ED utilisation and to primary care interventions for improving care pathways, a few studies looked at the relationship between the healthcare contexts in which patients live and ED utilisation.

This study aims to establish the determinants of ED visits in France at a territorial level with a focus on the impact of ambulatory care organisation (both primary and specialist care) for the population aged 65 years and over. Using multilevel regression models, we analyse the role of healthcare delivery at the municipal and wider *department* level in determining emergency care use, while simultaneously controlling for demographic, socioeconomic and health context of the municipalities in which patients live. We restrict the analysis on ED visits to those without hospitalisation in order to homogenise the patient population (cases relatively less serious or not vital) with the hypothesis that these visits could be substituted and/or avoided by appropriate/timely primary care interventions.

2. Methods and data

2.1. Empirical approach

We examine the rate of ED visits at the municipality area (*commune*) level as the smallest territorial unit which has a meaning for healthcare organisation. This is the territorial division used for monitoring primary healthcare supply in France. ED visit rates are calculated according to patients' place of residence (rather than treatment/hospital location). The socio-economic context and average health status of the area in which patients live will have an impact on their health/emergency care utilisation. From the perspective of territorial organisation of healthcare provision, municipalities are grouped in departments. Departments are responsible for providing specific services and can intervene notably in health and social care at home for the older and/or dependent populations. Department is also the administrative level chosen by most Regional Health Authorities (ARS) for planning the organisation of healthcare resources. Municipalities within a department can share some common resources and services.

We use a multilevel random effects regression model which takes into account that municipalities are clustered within departments. In multilevel models the random variability in the variables observed is decomposed between the basic smallest unit of analysis, conventionally known as level 1, and the higher level grouping, level 2. The possibility of explicitly modelling variances associated with the errors at each level of the hierarchy allows for more interesting questions to be asked of the data. For analytical purposes ED rates can be viewed in a hierarchical framework with municipal level observations (level-1) nested in higher geographical (level-2) groups (departments). In present analysis, we suggest that the socio-economic, demographic and healthcare context, with primary care services available in municipalities have an impact on

ED visits rates and that ED visits in a municipality is correlated with those observed in neighbouring municipalities in the same department (autocorrelation of residues). We further assume that the configuration of healthcare supply at the departmental level will have an impact on ED utilisation at municipal level, accounting for unobserved heterogeneity across departments, assumed to be normally distributed with mean zero. In this way we estimated the determinants of ED visit rates at municipal level by controlling simultaneously the characteristics of the municipalities and the departments they belong to. We also tested the robustness of the results using a two-stage fixed effects model [38,39] (Appendix A in Supplementary material).

2.2. Explanatory variables

Our dependent variable is the rate of ED visits per municipality: the number of persons aged 65 years and over who visited an ED without hospitalisation at least once in the year per 1000 persons aged 65 and over residing in the municipality.

With multilevel models we distinguished two sources of random variation: between departments and within departments (across municipalities). At municipal level, we control both for factors that can impact demand for emergency care (demand-side factors), namely population's health and socioeconomic status, and supply-side factors that can determine ED visits namely, proximity and accessibility of primary care services. At departmental level, we focus on availability/supply of health care resources that are organised at the departmental level.

2.2.1. Health and socio-economic context at municipal level

Health status of the population at the municipal level was proxied by three variables: total mortality rates (all causes) of the resident population, average age of the population over 65, and the percentage of elderly people with a chronic illness (morbidity). The socioeconomic level was controlled by the average income per consumption unit, and covered the entire population of the municipality, not only those aged 65 years and over.

2.2.2. Accessibility of primary care at municipal level

To describe the accessibility of primary care at the municipal level, one of the main objectives of this study, first, we measured the availability of out-of-hours care by municipality, as the proportion of out-of-hours consultations in all GP consultations by the elderly residents. In France, out-of-hours outpatient care is provided by on-call GPs belonging to private associations, such as *SOS Médecins*, at patients' home or by medical practitioners on call-duty within the system of "continuity of care" organized by the regional health authorities (ARS). We expect that these services could be substitute to emergency department visits for non-vital problems and municipalities with highly developed on-call activity may have a lower rate of ED visits.

Second, we calculated the proportion of GP consultations conducted at patient's home (in regular hours). This practice may be important for assuring continuity of care for the elderly who often have difficulty to travel by their own means to the physician's practice.

Third, we used the indicators of Potential Local Accessibility (PLA) of ambulatory care professionals. The PLA are indicators measuring geographic accessibility of healthcare providers at the local level [11]. Calculated at the municipal level, as the weighted density of full time equivalent professionals (FTEs) per 100,000 inhabitants, they take into account the geographic distribution of professionals in a given municipality as well as in neighbouring areas, and the age structure of the population served [12]. For example, the indicator weights the number of FTE generalists per capita in each municipality as a function of the distance travelled by the population

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