Title: The appropriate use of emergency departments: evidence from a French survey[1]

25 January 2019

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Key words: Emergency departments, appropriate use of medical services, efficiency of the healthcare system

Abstract

This paper analyses the determinants of the appropriateness of emergency room visits for adult patients (18+), distinguishing between individual patient characteristics and primary care supply characteristics. There is evidence that emergency care can substitute to some extent to primary care for reasons that have nothing to do with the urgency of care needs. This can lead to avoidable emergency visits that raises concerns about the efficiency of care provision. We take advantage of a unique French survey called "*Enquête urgence"*, implemented in 2013 by the French Ministry of Health, where the characteristics of all ED visits in French hospitals have been exhaustively recorded during one day (24h). While no administrative data collected at the hospital level or from emergency departments (ED) provide direct observation of avoidable ED visits, this survey collected for each visits three direct assessments of appropriateness completed by a physician, of which one is collected *ex ante* (before the beginning of medical examinations) and two *ex post*. We first compare our direct assessments of visit appropriateness with classical indicators used in studies on administrative data. We find that 52% of emergency room visits are deemed necessary ex post by the physician, 34% are deemed divertible (conditions that would have been treated more efficiently by a primary care physician the same day) and 15% are judged delayable (there was no emergency and thus the ED visit could have been avoided). Then we examine the determinants of avoidable visits by OLS and multinomial logit (MNL) estimates. We show that (i) financial barriers increase the risk of avoidable ED visits; (ii) accessibility of primary care services is positively associated with appropriateness. Finally we are able to assess the ED visits that were exposed to a "type one error" - i.e. visits that are deemed avoidable at entry but which prove to be appropriate after medical examinations. We find that a non-negligible number of patients, namely 1041 patients (4.27% of the sample) were at risk of a type one error and that this risk is not randomly assigned among patients.

[1] Acknowledgments : We thank for useful discussions Matt Sutton, Boriana Miloucheva, Anne-Laure Samson, Patrice Geoffron, Albert Vuagnat and Fabien Toulemonde, participants at the LEDa-LEGOS seminar, as well as participants at the EuHEA PhD Student-Supervisor and Early Career Researcher Conference, Catania, 2018 and participants at the JESF 2018, Paris. We are grateful to the DREES, Ministry of Health and Solidarity for support and helpful discussions. We acknowledge financial support from the Health Chair– Université Paris Dauphine, PSL University, ENSAE and Istya, under the aegis of the Risk Foundation.

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I. Introduction

Since the early 2000s, most OECD countries have faced an increase in the number of visits to emergency departments (ED). Studies conducted among OECD countries found that 12% to 56% of ED visits are likely to be avoidable (Berchet, 2015). A large difference is observed in the proportion of avoidable ED visits across countries that can be due to heterogeneous definitions of appropriateness. Nevertheless, most countries have the same concern regarding the continuous rise in the use of ED, and the likely sizeable share of avoidable visits. In France, the number of visits to ED increased by 30% in ten years, and reached 19 million visits in 2013 for a population of 66 million people. Recently, an administrative report estimated that 20% of ED visits were inappropriate in France, inducing avoidable expenditures of about €500 Million for France (Cour des comptes, 2014).

From the regulator perspective, emergency room visits can been deemed "inappropriate" or "avoidable" if the health problem could be treated the same day or the day after by a general practitioner (GP) or a specialist in an ambulatory care setting. This definition is clearly based on the concern for efficiency in care provision. Of course, such conception can conflict with the preferences of some patients who want access to care on request. At the individual level, decision to visit ED is sequential. For a given health problem, patients first decide or not to use medical services. Second, they seek care from emergency care or primary care (Cunningham, Clancy, Cohen, & Wilets, 1995). The choice to use emergency rather than primary care depends on individual characteristics, on insurance coverage, but also on the availability at the right time of primary care supply.

Assuming that emergency care can substitute to some extent to primary care, most studies investigate (i) the role of payment or coverage conditions that could favor the use of ED care ; (ii) the role of failings in the supply for primary care.

Regarding financial explanations, many studies find a negative association between income and the use of emergency care (Grumbach, Keane, & Bindman, 1993; Rust and al., 2008; Weber, Showstack, Hunt, Colby, & Callaham, 2005). As concerns health insurance, it is generally considered that better coverage leads people to consume more medical care (Newhouse, 1993). Such a mechanism can affect the use of emergency care if insurance coverage modifies the relative price of primary care with respect to emergency care.

Miller (2012) found that a reform that led in 2006 to better health insurance coverage for Massachusetts residents decreased the number of ED visits per capita from 5 to 8 percent. She found a significant impact only for "non-urgent" visits and visits that occurred during opening hours of medical offices. These findings support the argument that better coverage for office visits increases the substitution of primary care services to emergency care by decreasing the relative price of primary care. Such results suggest that visits that shifted from ED to primary care services were avoidable.

Another study was conducted by S. L. Taubman *et al.* to analyze the impact of the 2008 Oregon's health insurance experiment on the use of ED. The experiment consisted of an extension of the Medicaid eligibility

threshold among individuals randomly assigned by a lottery. In contrast with Miller's results, the estimations show that the expansion of Medicaid coverage in Oregon increased the proportion of individuals with at least one visit to the ED by 7 percentage points, and the average number of ED visit per capita by +41% (Taubman, Allen, Wright, & Baicker, 2014). This impact is restricted to outpatient ED visits (that don't lead to a hospital admission), and mostly concerns people who formerly did not, or used little urgent care. In comparison with Miller (2012), this result shows an opposite effect of more coverage on the use of ED visits. However, they do not necessarily question Miller's findings. Indeed, the positive impact in Oregon is restricted to people with null or small previous use of ED. Moreover, the target of the Oregon's health insurance experiment is people with a low income level, close to the Medicaid eligibility threshold. For this specific population, there is empirical evidence of care refusals from physicians in the context of ambulatory care that might explain less substitution with ED (Buchmueller, Orzol, & Shore-Sheppard, 2015).

As concerns the organization of supply for care, easy and continuous access to primary care is important to limit the use of emergency care. Rust *et al* (2008) found that individuals who reported having had at least one barrier in access to primary care in the last 12 months had a higher probability to use emergency care than individuals who did not face any barrier. Similar evidence is obtained from an international survey including 34 European countries (Van den Berg, Van Loenen, & Westert, 2016). Individuals reporting restrictions in access to care outside of office hours have a probability to visit ED which is significantly higher (+17%). In contrast, individuals who have a regular physician who knows their medical record and their living conditions have a significantly lower probability to visit ED (- 10%). A recent analysis of the use of ED by the elderly in France, shows also that limits in access to primary care is associated with a greater use of ED (Or & Penneau, 2018). All these results suggest that a limited access to primary care services leads people to seek care at ED, i.e. a place which is not always appropriate given their needs.

Besides insurance coverage and availability of primary care, other determinants can influence the use of ED for non-urgent reasons. Cunningham *et al*. (1995) show that a good or excellent self-assessed health and higher education are associated with a lower probability to visit ED for non-urgent reasons.

All the papers aforementioned have no direct information regarding the appropriateness of ED visits. They (i) examine the influence on ED visits of insurance coverage and of access to primary care; (ii) Infer the existence of avoidable ED visits from the finding of a significant impact of these determinants (that have nothing to do with the seriousness of care needs), associated or not with an information about the patient's illness. Actually, no administrative data collected at hospital level or from emergency wards provide direct observation of avoidable ED visits. As stated by Parkinson *et al* (2018), administrative data mostly provide observations on characteristics that are correlated with the fact that the visit was not appropriate. These characteristics are related to the entry mode (self-referred patient), to the lack of investigation or treatment during the visit and to a

discharge with no follow-up with primary care. In this context, a unique indicator of the avoidable visit is not available, but a collection of characteristics that, put together, increase the chance that the visit was avoidable.

In this paper we take advantage of a unique survey carried out in 2013, where the characteristics of all ED visits in French hospitals have been exhaustively recorded during one day (24h). On top of information regarding patient and emergency ward characteristics, this survey collected for each visit three direct assessments of the appropriateness of the visit: one *ex ante* score set at entry in the ward by a care provider (generally a registered nurse), which determines the patient ranking in the waiting list on the basis of the severity of his or her clinical condition; two *ex post* assessments (a quantitative score and a qualitative assessment) provided by a physician at the end of the visit.

The sample used for the empirical analysis contains 28,929 visits recorded in 590 emergency departments. We first examine the features of our data, comparing our direct assessments of visit appropriateness with the classical indicators used in studies on administrative data. Then we examine the determinants of avoidable visits, distinguishing between individual patient characteristics and primary care supply characteristics. Finally, the fact that we have at our disposal *ex ante* and *ex post* assessments enables us to analyze the visits that were exposed to a "type 1 error", i.e. patients that were deemed non urgent and avoidable at entry, while they were eventually hospitalized or their venue was coded as relevant at the end.

The paper is organized as follows. In Section 2 we describe the data we use. In Section 3 we present the indicators at our disposal to identify appropriate emergency room visits. Descriptive statistics on the basic features of the data are displayed in Section 4, together with comparisons of the indicators of appropriateness. The econometric analysis of the determinants of appropriate ED visits is given in Section 5. Visits that were exposed to a "type 1 error" are examined in Section 6. We conclude in section 7.

II. The data

Our database comes from a French survey called "*Enquête urgence*" implemented in 2013 by the French Ministry of Health. All patients that visited one of the 736 ED in France on the 11 June in 2013 were surveyed over a 24-hour period, from 11 June 2013 at 8am to 12 June 2013 at 8am. The date has been carefully chosen to be representative of a "normal day", without any pick of demand because of winter flue, vacations or week-end. The data comprise two complementary datasets collected at the same time. First, information at the ED level describes its organization and the inputs available. Second, data at the patient-visit level contains information on the patient's socio-demographic characteristics and detailed key variables to understand the circumstances of the ED visit. This information includes the reasons declared by the patient for deciding to seek care from the emergency room, the patient's health problem, the medical procedures performed during the visit and the type of discharge. In addition, our survey provides us valuable information on the appropriateness of

the visit: one *ex ante* score set at entry by a care provider on the basis of an assessment of the patient's clinical needs, and two *ex post* quantitative and qualitative assessments provided by a physician at the end of the visit.

Other sources are used to add information on the characteristics of the patient's location (zip-code). First data provided by INSEE (Institut National de la Statistique et des Etudes Economiques) give information at the zip-code level on median household income, unemployment rate, poverty rate and share of individuals aged 65 and more. Second an original dataset built with the services of the French Ministry of Health provides information on the availability of primary care in the deep night, more exactly between midnight and 8am. This data makes it possible to know if GP consultations are available, and if GPs have set up an organized supply of primary care for the deep night near the patient's home.

Consistent data is available for 731 emergency departments out of the 736 surveyed. The initial dataset contains information on 52,018 emergency room visits. The number of visits recorded in the survey is consistent with the number calculated with exhaustive administrative data, the *Statistique Annuelle des Etablissements de santé.* To perform an analysis of patient's behavior, we restricted our analysis to adults, deleting 20,192 observations corresponding to patients under 18 and 109 ED specialized in pediatrics. Indeed, children being brought to ED by their parents, this entails a somewhat different analysis of motivation and behavior. For the same reason, because we wanted to analyze the individual decision to use ED, we excluded patients admitted through a transfer from a medical or social institution, such as nursing homes, institutions for disabled children, etc. Moreover, we deleted observations with inconsistencies, such as patients supposed to be coming from home, while the physician of the ED considered they could have been treated in their medical institution. These choices led us to exclude 1522 visits and 2 EDs. Then we had to delete 1370 visits and 34 EDs, because of missing information on the *ex ante* and *ex post* assessments, or on patient motivations for coming, and medical decisions during the visit. Five other visits have been removed, because they concerned patients who died at their arrival (we kept patients who died during the visit). After this process of selection and cleaning, the sample used in our empirical analysis contains 28,929 observations (visits) recorded in 590 emergency departments that belong to 586 distinct hospitals.

III. The identification of appropriate ED visits

As stated above, administrative data do not provide direct appraisal of the ability of an ED visit to be avoided, but information on characteristics that are correlated with the fact that the visit was not appropriate. These characteristics are related to the entry mode (self-referred patient), to the lack of investigation or treatment during the visit and to a discharge with no follow-up with primary care. Thanks to our survey, we have also at our disposal three direct assessments of the visit appropriateness. They are given by care providers at entry or discharge of the visit in the emergency ward.

This enables us to consider seven indicators of an appropriate use of ED, ranged in three categories:

- Direct assessments: one *ex ante* score set at entry in the ward by a care provider (generally a registered nurse), which determines the patient ranking in the waiting list on the basis of the severity of his or her clinical condition; two *ex post* assessments (a quantitative score and a qualitative assessment) provided by a physician at the end of the visit.
- Events during the visit: one indicator refers to the performance of at least one medical procedure, the other indicates if the patient died, or if a hospitalization was decided during the visit.
- Circumstances of the patient's decision to visit ED. One indicator refers to the patient's answers for his or her reasons to come: medical reason and/or difficulties of access to primary care. The second variable indicates if the patient came on self-referral, the alternatives being a GP's advice or formal referral.

Our three indicator categories are the following: direct assessments by care provider, events during the visit and circumstances of the patient decision. The great advantage of our survey is to provide indicators in the first category, i.e. direct assessments, one of which is *ex ante,* the two others being *ex post*.

In the first category, the *ex ante* score is linked to a patients' classification set at entry that determines their ranking in the waiting list. It is based on the assessment by a care provider of the severity of their clinical condition. This indicator has 7 modalities. The first one, CCMU1, refers to patients whose condition is deemed stable, with no medical procedure required. Considering that a visit classified as CCMU1 is likely to be avoidable, we define an indicator of appropriateness by a dichotomic variable indicating that the visit is not classified in CCMU1. This indicator and the resulting definition of appropriateness are criticized by the medical community: physicians warn of a sizeable error rate when comparing this triage with health problems detected after the visit. Actually, the issue at stake is the use of this *ex ante* assessment in decisions regarding admissions at ED. For efficiency purposes, it can be decided to provide incentives for encouraging hospitals to divert some patients towards a primary care consultation, even if such service is not immediately available. It is important to underline that in the regulatory context of our survey the patient's classification in the CCMU has no consequence for the patient admission, except a possible longer waiting time. As concerns ongoing discussions about incentives to discourage avoidable visits, one important issue is the risk of opportunity loss associated to what we call hereafter « type one error », when a patient classified as not serious (CCMU1) at entry, appeared eventually to have needed urgent care, and even hospitalization. Fortunately, our data enables us to compare *ex ante* with *ex post* assessment and with events that occurred during the visits. We examine this point at the end of the paper.

The other two indicators in the first category (direct assessments) are *ex post* assessments by a physician at the end of the visit. One is a grade given by the physician from 0 to 10, where the grade 10 corresponds to a totally appropriate visit. The second indicator is a qualitative *ex post* assessment by the physician, with four alternatives: (i) an emergency care was necessary; (ii) The patient's needs could have been treated in a medical office by a physician (GP or specialist) the same day. (iii) The patient's needs could have been treated in a

medical office the same day, provided that further examinations can be performed in the office. (iv) The patient's needs could have been treated in a medical office the day after. We consider that visits falling in the first modality (i), i.e. deemed necessary by the physician, are appropriate. The visits classified as (ii) or (iii) can be seen as "divertible": it would have been more efficient that these patients seek care from a primary care setting. Otherwise, the visits of type (iv) can be seen as "delayable": there was no emergency and ambulatory care doctors could have taken care of these patients.[5]

Our data enables us to use also indicators that are generally available in administrative data, such as events that occurred during the visit: one indicator refers to the performance of at least one medical procedure, the other indicates if the patient died, or if a hospitalization was decided during the visit. A visit with no procedure corresponds to a simple GP consultation, with no medical imagery (CT-scan, MRI, ultrasound), no biology, no procedure for diagnosis (electrocardiogram etc.) or for care (bandages, stitches, aerosols etc.), and no advice from a specialist.

The third category of appropriateness indicator relies on the circumstances of the patient's decision to visit ED. One variable indicates if the patient came on self-referral, the alternatives being a GP's advice or formal referral. The other indicator relies on information given by patients[6] regarding the reason for their visit to the ED: medical reasons vs accessibility reasons (see table 10in appendix for more details about the items). We consider that seeking emergency care for medical rather than accessibility reasons is more appropriate. However patients can make several answers for this variable. This non-exclusivity of alternatives explains why the sum of percentages exceeds 1 in table 4. This question about accessibility reasons enables us to have information on the system organization, from the patient viewpoint. It can be interesting to know the relation between this patient feeling and the physician appraisal. Note that this question was asked during patients' registration, hence before any medical consultation.

IV. Descriptive statistics

a) Basic features of the data

Table 1 presents statistics on patients' characteristics and care supply characteristics for the total sample, and separating ED visits that were deemed necessary by the physician and officered visits that were not.
Graph 1 shows that the young adults and the elderly are overrepresented in the emergency departments in comparison with the general population.

[5] Divertible, and delayable: we thank Matt Sutton for suggesting this nicely compact terminology.

[6] In practice, nurses were asked to read all items to patients and select those with which they agreed. We checked for, and didn't find, any focal points on the first items of each group of reasons.

The proportion observed in the sample as regards Occupation, Education, and Insurance status are representative of the French population. Nearly 79% of patients have private supplementary health insurance, and 14% have a public supplementary health insurance (called CMU-C). This public insurance is granted to individuals living in France with an annual income below a threshold. This share of individuals covered by a supplementary insurance is representative of the level of coverage in the French population (95% in 2012) (Barlet, Beffy, & Raynaud, 2016). Only 4% of ED patients are not covered by a supplementary insurance[7]. We observe differences according to the occupational status. People in employment are more represented in the sample of non-necessary visits (53% vs 42.0%). This is the opposite for retired people.

As concerns, the characteristics of ED visits, we find that visits occurring between midnight and 8am represent less than 10% of the emergency department activity. Otherwise, a high proportion of patients are self-referred 55.5 % (this proportion raises to 68.5 % among visits deemed avoidable), and 23.8 % of patients are hospitalized (this proportion falls to 4.9 % among visits deemed avoidable).

Over 60% of patients lived close to the emergency department (less than 10 km). However, 10% of patients lived more than 30 km away from the hospital they visited. Half the individuals lived in an area were GP's are available out of office hours. However, this indicator doesn't give information on primary care availibility, since we don't know the number of corresponding GP's.

b) Analysis of the indicators of appropriateness of ED visits

Tables 2, 3 and 4 display statistics for our three categories of indicators: direct assessments by physician (table 2), events during the visit (table 3), and circumstances of the patient's decision to visit ED (table 4).

The grade given *ex post* shows that the physicians considered that 33.8 % of visits were fully appropriate, with a grade equal to 10. The other grades are almost equally distributed, except for 8 and 5 which are slightly more frequent. Turning to the *ex post* qualitative assessment, we find that 52% of the ED visits have been deemed necessary by the physicians. Otherwise, more than 33 % of visits are seen as divertible (19.3 +14.1), and 14.9% as delayable. Finally, the triage score that serves as an *ex ante* indicator suggest that 17 % of visits are deemed avoidable at entry.

We have at two *ex post* direct assessments set by the physician: the 0-10 grade and the qualitative evaluation. To examine more thoroughly the relation between them, we display in Graph 2 the distributions of the quantitative grade for different modalities of the qualitative assessment. The advantage of the qualitative evaluation is that the different modalities allow for dimensions of visit appropriateness that cannot be ordered. Indeed, for a patient with specific needs, the questions at stake in the appraisal of appropriateness refer to two dimensions, i.e the efficient place of care and the right time of care (degree of emergency)..

[7] Note that in France, all residents are covered by the National Health Insurance with a co-payment of 70% for outpatient care and 80% for hospital care (including emergency care).

Graph 2 shows clearly that high grades are given to visits classified in the first modality of the qualitative assessment, i.e. that are deemed necessary. Visits that are appraised as divertible (modality 2 and 3) receive grades that are almost evenly distributed on the range 0-10. This shows that doctors have a great variability in their judgment regarding visits that were urgent, but could have been treated elsewhere. On the other hand, delayable visits (modality 4) receive very small grades, with a high proportion of 0. Most physicians consider that patient with non-urgent needs should not come to ED.

Table 3 display statistics regarding some events that occurred during the visit. Visits with no procedure can be seen *ex* post, as avoidable, although a consultation was probably necessary to respond to the anxiety and questions of the patient. There was no procedure for 18.2 % of visits. At the other extreme, visits that led to a hospitalization were necessary for sure: this is the case for 23.4 % of ED visits.

Table 4 gives information on the circumstances of the patient's decision to visit ED. At the bottom of the table we first note the very high proportion of patients coming on self-referral: almost 55 %. This is similar to what is found for U.K. in Parkinson *et al.* (2018). Patients can give several reasons: the categories are non-exclusive. 81% of patients justified their visit for medical reasons, 57% for accessibility reasons and 20% declared they came to the ED by default. Table 10 in the appendix details the items in each category. The main components of medical reasons are accidents (31%), coming on the advice of a physician (29%), and the thought of a serious condition (22%). The accessibility reasons are driven by the proximity of the ED (23%), the need to fix a health problem quickly (30%) and the possibility to perform additional examinations at ED (23%). Financial explanations are declared in less than 3% of the visits. When looking at patients declaring only one motivation for the ED visit, the medical motivations are predominant (31% *vs* 7% for accessibility reasons).

Finally, we compute in Table 5 the average grade given to the visits, depending on the realization or not of other indicators of appropriateness: the assessment at entry that the patient is not CCMU1; performance of a medical procedure; hospitalization decided during the visit; death during the visit; medical reason for coming, not self-referred coming. The results show with no ambiguity that all indicators are well correlated. Means grades are always significantly higher for visits with a characteristic supposed to be correlated with appropriateness.

V. Econometric analysis of the determinants of appropriate ED visits

Avoidable ED visits can be due to a lack of availability of relevant primary care on time, in which case it results from a default in the health system organization. Otherwise, decision to visit ED can be analyzed as a decision from a patient free to choose between care provided by primary care and by ED. In this case, what matters is the cost of access to ambulatory care, in comparison with the cost of access to care provided in ED. These costs comprise transportation costs and time, as well as waiting time (to get an appointment with the doctor, also in comparison with the waiting time in the ED). From this perspective, distance between ED and the patient's home has an importance. Costs can also be financial, depending on the payment system and coverage of care at GP versus ED.

Depending on the country, these considerations take place in different institutional organizations. In France patients can consult any GP of their choice and can go to see a specialist physician without GP referral (but they bear small financial penalties for some specialties in this case). For outpatient care patients must pay cash in advance. They are reimbursed afterwards up to 70% by the compulsory National Health Insurance (NHI) and 30 % by a supplementary health insurance if they have one (like 96 % French people). There exist no other source of care but emergency department outside the opening hours of medical practices for almost half (44%) of the French population in metropolitan France (source authors). Emergency departments are freely accessible and no cash payment is requested for a consultation (a bill is sent few weeks later to patients). The co-payment is lower for hospital care (including emergency care) than for outpatient care as patients are reimbursed up to 80% by the compulsory NHI but the total out-of-pocket payment is often higher. Before 2002, private physicians were obliged to provide care in case of emergency during the night and on week-ends. It is no longer an obligation and only volunteer physicians provide access to care outside office hours (between 8pm and 8am) in exchange to an additional compensation (Cour des comptes, 2013). Patients seeking medical consultation in emergency when medical offices are closed can dial the "15", which is a 24/24 telephone regulatory platform: physicians evaluate the health problem and send an ambulance for access to ED, or advice to go to ED, or reassure the patient and explain that his or her case is not urgent. In areas where alternatives to emergency care exist during the night or the week-ends, this platform can refer patients to private physicians' on duty.

The French organization enables us to suppose that all variables measuring the availability of primary care during the night should influence the proportion of avoidable ED visits. Otherwise the time of coming is likely to be correlated with appropriateness (with more appropriate visits when there is no alternative).
Turning to individual determinants, the distance to ED, which increases the cost of access, should be positively associated with the appropriateness of the visit, and people with financial limitations should be more prone to make avoidable visits, given the fact that an ED visit prevents the payment of cash in advance for a consultation. We do not observe directly people's income or their financial limitations, but instead variables that correlated with it, such as their education level, occupation, or the lack of coverage by a supplementary health insurance.

a) Method

Given our data, we do not analyse the decision to use ED, but the probability for a patient to have an appropriate recourse to ED, conditionally on the fact that he or she came to ED. We have performed a straightforward multivariate analysis to estimate the influence of individual determinants and of availability of primary care on the appropriateness of ED use. We consider alternatively seven dependent variables, that correspond to our indicators of appropriateness: (i) The three direct assessments: the *ex post* 1-10 quantitative score (Y1), the ex post qualitative assessment indicating that the visit was necessary (Y2) and the *ex ante* triage score indicating that the visit is not classified in the non-urgent category CCMU1 (Y3). (ii) The two indicators linked with events during the visit that are correlated with appropriateness: the performance of at least one medical procedure (Y4)

Exit through hospitalization or death (Y5). (iii) Circumstances of the patient's decision to visit ED that are associated with appropriateness: medical reason for coming (Y6), the patient did not come on self-referral (Y7).

We estimate by OLS the following specification:

$$Y_i^p = \beta_0^p + \beta_1^p D_i + \beta_2^p S_i + \beta_3^p X_z + \alpha_e^p + \varepsilon_i^p \quad , \quad p = 1, \dots, 7 \quad (1)$$

Of course for indicators Y2 to Y7 that are binary, our approach correspond to the estimation of a linear probability model (LPM)[8].

Our specification takes into account fixed effects α_e for each emergency department *e*. This enables us to control for unobserved heterogeneity at ED level that could be correlated with some regressors. By performing OLS on model (1) we use the within-ED variability of our variables to estimate their influence on the appropriateness of the visit. As shown in Table 6, 85.6% of the variance of *Y1* is due to within-ED variance. In other words, the bulk of the score variance is due to individual characteristics rather than structural differences between EDs.

The variables included in the set of controls D_i refer to patients' characteristics: age, occupation status, education level, gender, coverage by supplementary health insurance (SHI), recorded time of ED visit.
We captured the availability of primary care services thanks to variables S_i: distance between patients home and the hospital they visited, the number of GPs and specialists for 1000 inhabitants at the patient's local district level (named GP (or specialist) densities), availability of GPs in the deep night (between midnight and 8am)in the patient's living area, existence of a regulatory system managed by private physicians to address patients to available primary care in the deep night. We also added controls X_z at the patients' zip code level to account for demographic specificities, such as unemployment rate, the poverty rate (share of people under the poverty level), share of the population older than 65, average annual income at the zip code level (€2013). Robust standard errors are specified using the "White" matrix transformation to correct for possible heteroscedasticity of the perturbations.

The estimation of the model explaining the quantitative assessment allows us to identify the individual characteristics and the features of the organization of primary care that have an influence on the appropriateness of the ED visit. . The physician's qualitative assessment can be grouped into three alternatives: urgent visits that are deemed appropriate, visits that are divertible (we merged modalities 2 and 3), and visits that are delayable (non-urgent conditions). In model (1), the binary variable Y2 indicates whether the visit was deemed necessary

[8] We checked that results are very close when we estimate the model without fixed effects by applying OLS to the LPM or by MLE to a Probit specification (results are available on request).

by the physician, without distinguishing divertible visits from delayable visits in the alternatives. Nevertheless, we can reasonably assume that the characteristics associated with appropriateness do not have the same effect when compared to divertible visits or delayable visits.

To investigate this, we specified a multinomial logit model (MNL) to estimate the influence of our explanatory variables on the probability that visits are appraised as divertible or delayable rather than necessary by physicians. The dependent variable is y_i :

$$y_i = \begin{cases} 1 & emergency\ care\ was\ necessary \\ 2 & divertible\ visit \\ 3 & delayable\ visit \end{cases}$$

There are three alternatives $j = 1, \ldots, 3$. We estimated the probability that patient i is classified in alternative j by a maximum likelihood estimator. The probability that the visit is classified in alternative j by the physician is given by (2):

$$P(y_i = j \mid D_i, S_i, X_z) = \frac{\exp(\beta_{1j} D_i + \beta_{2j} S_i + \beta_{3j} X_z)}{1 + \sum_{k \neq j} \exp(\beta_{1k} D_i + \beta_{2k} S_i + \beta_{3k} X_z)} \qquad (2)$$

We define $j = 1$ as the reference (emergency care was necessary). The multinomial logit model relies on the assumption of independence of irrelevant alternatives. In this paper, we run a simple multinomial logit model, without fixed effects.[9]

b) Results

Table 7 gives the estimation of model (1) by OLS with ED fixed effects for our seven appropriateness indicators. Estimates without ED fixed effects are displayed in the appendix (table 11).

As stated above, we have at our disposal credible indicators of the visit appropriateness that result from three direct assessments by physicians. The other four indicators are visit characteristics that are correlated with visit appropriateness, as shown by many studies. In the following, we focus on direct indicators in our comments, with some remarks on the additional lessons that can be drawn from results on the other indicators. All indicators are defined in such a way that an increase in appropriateness translates into a positive coefficient.

We find that the probability to aptly use emergency room services increases in a monotonic way with age. *Ceteris paribus*, the youngest (18-24) have the highest proportion of avoidable visits. People might learn to use

[9] We will introduce fixed effects in further investigations. See note 12 for more details.

appropriately ED with experience, while ageing.[10] By the same way, being retired is associated with a more appropriate use of emergency care: retired people have a higher quantitative score of about 0.32 in average and a 5.4% higher probability that physicians deemed their visit appropriate.

Being a woman is associated with less appropriateness in the use of ED. This is true for all indicators, except the last one: women are coming on self-referral in smaller proportions. The interpretation of these results needs further analysis (it could be useful to record information on the coding physician).

We find that highly educated individuals have less avoidable visits: people with a college degree or more have a significantly higher score of appropriateness of 0.21 and physicians are more likely to deem their visit appropriate. They are also more frequently classified *ex ante* in visits seen as justifiable at entry. The other indicators show similar difference, expect for the probability of hospitalization, which is 2.1 percentage points lower for people with a college degree. This can be linked to the well documented correlation between high education and good health. This result shows that this indicator (hospitalization), if correlated with visit appropriateness, can be as well affected by phenomena that are not related with the question of visit appropriateness.

The possibility that financial barriers increase the risk of avoidable ED visits is supported by our results. Compared to individuals with private supplementary health insurance (SHI), individuals with no SHI have a significantly lower relevance score of 0.34 points and a 5.6% lower probability that their visit is deemed necessary by the coding physician. This suggests that individuals with lower coverage substitute emergency care for primary care. This enables them to avoid the direct cash-in-advance fees they would have to pay if they consulted a GP.

Visits occurring during the day when primary care services are open and available (between 8am and 4pm) are associated with a lower appropriateness: their quantitative score is lower, and there is a smaller proportion of visits judged necessary. On another indicator, we find similarly that the corresponding patients are less likely to be hospitalized following the emergency room visit. Interestingly however, patients who come during the day are less likely to come on self-referral. Our estimates of the multinomial model (commented on hereafter) show that the time of the visit is significantly related to appropriateness for divertible visits only (and not delayable visits). This suggests that while doctors at the ED yard think that these patients could be treated by primary care, these very patients were advised by some care provider to seek care to the emergency room.

We find a positive association between distance and appropriateness. Patients who live close to an emergency department (less than 5 km) have a 0.27 lower quantitative score and a lower proportion of 3.6 percentage points of visits deemed necessary by the physician. In addition, these patients are 2.5% less likely to come for medical

[10] Given the high number of yearly ED visits in France, it is likely that each citizen experienced several ED visits during his or her life.

reasons, showing that patients also considered geographical accessibility to choose emergency care. Similar, but less significant effects are estimated for patients who are between 5 and 10 km far from the ED.

We do not find much significant impacts, on visit appropriateness, of the GP: population ratio and specialist: population ratio in the patient's local district. Logically, an increase in the number of GPs per inhabitant around patient's home should increase the number of alternatives to emergency care and reduce the cost of access to primary care. Our fixed effect estimates show significant influences for one indicator only: Y6, i.e. coming for medical reason. We find that the proportion of patients coming for medical reason is positively influenced by the number of GPs per person (+ 11.6 percentage points) and negatively influenced by the number of specialists par person (- 3.2 %). Table 11 in the appendix shows results for OLS without fixed effects: in this case there is no control for unobserved sources of heterogeneity that could act as confounding factors. We find for many indicators that a higher density of GPs is correlated with a more appropriate use of ED. Conversely, a higher density of specialists is correlated with a less appropriate use of ED. Of course, these results of estimations without ED fixed effects (Table 11) cannot be seen as reflecting causalities. They are like correlations that mostly relate the structure of the supply for primary care around the ED's patients and the behaviour of the corresponding population.

Two other variables provide measures of availability of primary care in the patient's living area: GPs in the deep night (out of hours, i.e. midnight-8am), existence of a regulatory system managed by physicians for primary care or for referral in the deep night. They appear to have no significant impact on visit appropriateness, whatever the indicator considered in the model with fixed effects (Table 7). Conversely, the estimation without fixed effects (table 11 in the appendix) gives evidence of more appropriate visits in areas with a regulatory system managed by physicians for primary care, but no causality can be deduced from this result.

Table 8 displays the results of the estimation by the maximum likelihood estimator of the multinomial logit model (equation (2)). Relative Risk Ratios (RRR) are reported in place of coefficients.

This approach is applied to the *ex post* qualitative assessment provided by the coding physician. This indicator considers two main reasons of an avoidable visit: it can be divertible, i.e. the case could be treated by a doctor in primary care, or delayable, which means that it is not a real emergency; the patient could have waited until the day after. As shown in graph 2, physicians are more severe for delayable visits, for which they give very low grades. Nevertheless, it is important to recognize that these two reasons for avoidable visits refer to dimensions that cannot be ordered. In addition, they are different in their nature: it is possible to think that the patient is responsible for a delayable visit. Conversely, a divertible visit can be due to a deficiency in primary care organization.

This estimation enables us to better understand the impacts already found by our linear model estimations. We limit our comments to the new insights given by this approach.

So, we find that the more appropriate recourse to ED observed for retired people is mostly due to the divertible reason. Otherwise, the more appropriate recourse to ED observed for people with a college degree, is entirely due to the delayable reason, suggesting that more education improves the information that enables people to better know the degree of emergency of their condition. The influence of the day time on the visit avoidability is mostly due to visits that are divertible. And the fact that ED closeness decreases the visit appropriateness is due to visits that are delayable. All these results make sense, and confirm the role of primary care deficiency in many avoidable visits.

By the same way, the existence of a regulatory system managed by physicians for primary care, that was not significant in table 7 (but significant in table 11), appears to reduce significantly visits that are avoidable because they are divertible. Note, however, that we perform here a MLE without ED fixed effects. This result has to be confirmed by further investigations.

VI. Emergency room visits exposed to a "type 1 error"

The existence of a significant share of likely avoidable emergency room visits involves concerns about the efficiency of the healthcare system. The ongoing discussions in France aim at figure out a way to divert avoidable visits to a GP or a specialist consultation in a primary care medical office. The implementation of such regulation at the entry to ED requires being able to perfectly identify non-urgent and so avoidable visits. Otherwise some patients with real urgent conditions will be at risk of a deterioration in their health or even death. These are emergency room visits that are subject to what we call "type 1 errors", i.e. visits that are deemed avoidable *ex ante* but which prove to be appropriate *ex post*, after medical examinations have been carried out. The regulator must be concerned to ensure the efficiency of the healthcare system but also to guarantee the lowest possible risk of type 1 error (ideally zero).

In this context the crucial point is whether it is possible to identify avoidable visits *ex ante* without increasing the risk of loss of opportunity for the patient. We are able to address this question as we observe in our data direct assessments of appropriateness provided by the physician at two different times: at the entry in the ED before the beginning of medical examinations (*ex ante*) and at the end of the emergency care when patients have been treated and/or the medical decision to discharge them has been taken (*ex post*). The *ex ante* indicator we have is the triage score CCMU completed by a care provider at the ED entry that classifies patients into categories which reflects the degree of severity of their conditions. The first category of this score, the CCMU-1, refers to patients with stable conditions that does not require the performance of medical procedure. Following the definition used in an administrative report (Cour des comptes, 2014) one can assume that a visit which received this appraisal is likely to be avoidable. We consider two *ex post* measures of appropriateness: the qualitative assessment by physicians that the visit was necessary and the hospitalization or the death of the patient as an outcome of the ED visit.

This before/after assessment for each visits allow us to explore the triage error rate at the entry of ED by comparing the visits that were initially considered avoidable but turned into appropriate at the end of the visit after medical examinations. Table 9 reports the statistics on the number of type one errors that were made during the day of the survey. One can see that 178 patients who were initially classified in the first category of the CCMU score (i.e. these visits are likely to be avoidable) were finally hospitalized. The type one error rate is even higher for the physician's qualitative judgment, since 1041 visits deemed necessary *ex post* by the physicians were considered likely to be inappropriate *ex ante*. Fortunately this classification in the CCMU score has no impact on patients' admission to the ED and the care they receive since the ED are obliged to treat all the patients who come for care. Thus the health of the patients observed in table 9 who have faced a type one error has not been impacted by this misclassification since the initial error of diagnosis was then fixed by medical examinations. However the CCMU classification may have an impact on waiting times because its purpose is to identify the most urgent patients, i.e. those who should be treated first. So non urgent patients classified in the first category of the score may wait longer before receiving a treatment[11] and may be discouraged from staying in the ED. Table 9 shows that of the 312 patients who left before the end of care, 128 were classified in the first category of the CCMU score. Table 12 in appendix indicates that the proportion of patients classified in the CCMU-1 is much higher among patients who left before the end of care (41%) than among those who stayed until the end of care (17%). In addition, patients who left before the end of care waited significantly longer to see a physician (69 minutes, compared to 52 minutes for individuals who did not leave before the end of care).

We have provided evidence that a non-zero number of emergency room visits were type one errors. What about the consequences on the health of these patients who left before the end of emergency care if a type one error has been made at the entrance? Based on the *ex post* physician's assessment, we see that 4.27% (1041/24371) of patients were at risk of a loss of opportunity, i.e. to see their health deteriorate, if they had not received a medical examination after being classified in the first category of the CCMU score. We do not observe the outcome (needing urgent care or not) for 128 patients at risk of a loss of opportunity (their visit was initially considered inappropriate). Based on this trivial estimate, there are 5 patients per day (128*0.0427) presenting to the ED who experience a loss of opportunity because they leave before the end of care. This reasoning illustrates the importance of not relying on *ex ante* measures to determine avoidable visits, as many type one diagnostic errors are made in practice. Here, we identify a loss of opportunity for patients who left before the end of care. In another regulatory context that would mistakenly divert patients in need of emergency care from ED to inappropriate primary care services or home, this estimate could be much higher. Especially since we found that type one errors were not randomly distributed among patients. Table 13 in appendix presents the results of linear probability models in which we regress the same control variables of individual characteristics and of primary care services characteristics on three type one errors outcomes: the patient was classified in the

[11] This is the case. In our data, a patient classified in the first category of the CCMU score waits on average 54 minutes to see a physician, compared to 41 minutes for a patient classified in category 4 or 5 of the CCMU score.

first category of the CCMU score at the ED entry and (i) the visit was appraised necessary by the physician ex post (first column), (ii) the visit ended in hospitalization or death (second column), (iii) both (third column). Results suggest that unemployed and retired people have a higher probability to be hospitalized after being classified in CCMU-1 compared to employed people. Holding a public supplementary health insurance rather than a private SHI is associated with a lower probability to experience a type one error. The availability of primary care also seems to have an influence since the availability of physician on call between midnight and 8am near the patients' living area is associated with a lower probability of type one errors.

We observe the existence of a loss of opportunity risk for emergency department patients because of misclassification errors at the entry before the start of medical examinations. This loss of opportunity risk is non randomly assigned among patients: it is greater for retired and unemployed individuals, lower for patients with public SHI and for patients with an alternative to urgent care at night near their place of residence.

VII. Conclusion

We have provided an analysis of the determinants of an appropriate use of emergency departments, distinguishing between the influence of individual characteristics and primary care supply characteristics. We use several indicators of appropriateness that are present in our data coming from the survey "Enquête Urgence". This survey was conducted among all patients who visited an emergency department in France over a 24-hour period: between 11 June 2013 from 8a.m. to 12 June 2013 at 8a.m. After sample cleaning and selection of relevant observation, we have at our disposal a sample of 28,929 ED visits (we excluded children under 18 and patients who were admitted through a transfer from a medical or social institution). These emergency room visits were recorded in 590 emergency departments in 586 distinct hospitals. The advantage of this survey in comparison with administrative data is that we observe direct assessments of the visit appropriateness. To our knowledge such information is generally not available in the existing literature. Of these direct assessments, two are completed ex post by the emergency physician and assess the appropriateness of the visit, and one is completed *ex ante* by a care provider (generally a nurse) to determine the severity of the patient's medical condition at entry. In addition, we use indicators used in the existing literature on administrative data that are known to be correlated with appropriateness. These classical indicators give information on the events that occurred during the ED visit (the performance of medical procedures and the hospitalization or the death of the patient) but also on the circumstances of the patient's decision to go to the ED (if the patient came for medical or for accessibility motives, whether the patient came on self-referral or on the advice of a care provider).

The qualitative assessment of the emergency room visit completed by the physician at the end of the visit enables us to assess the share of these visits that are avoidable. The physician assesses whether the visit was necessary, whether it could have been treated in ambulatory care the same day (divertible) or whether it could have been treated in ambulatory care the day after (delayable). Visits considered as "divertible" concern patients with quite

urgent conditions but which do not need to be treated in an emergency department (a GP or a specialist physician could have treat it in a medical office). However delayable visits are non-urgent and thus could be avoided. It is important to recognize that these two reasons for avoidable visits refer to dimensions that cannot be ordered. In addition, they are different in their nature: it is possible to think that the patient is responsible for a delayable visit. Conversely, a divertible visit can be due to a deficiency in primary care organization. In our sample 52 % visits are deemed necessary *ex post* by the physician. 34 % are deemed divertible, and 15% are judged delayable.

We estimate by OLS the determinants of appropriateness, measured by the seven indicators aforementioned. We specify emergency department fixed effects to control for unobserved heterogeneity that could be correlated with some control variables. Then, we estimate a multinomial logit model (MNL) by maximum likelihood (ML) estimator on the physician's qualitative assessment to investigate the influence of our explanatory variables on appropriateness depending on whether the visits were deemed divertible are delayable rather than necessary by physicians. In a future version of this paper, we will follow Chamberlain (1979) and Pforr (2014) to perform a consistent estimation of a MNL model with fixed effects We find that appropriateness increases with age, which may reflect a learning to aptly use ED with experience. The corollary of this result is that the youngest (18 – 24) have the highest proportion of avoidable visits. In addition retired people have a 5.4% higher probability that physician appraised their emergency room visit as necessary. This result is mostly driven by the divertible assessment. Individuals with a high level of education (beyond high-school) are responsible for less avoidable visits: they have a higher relevance score (+0.21), a higher probability to be deemed appropriate by physicians (+ 2,5%), are less often classified *ex ante* at ED entry as avoidable visits and they are more likely to come on referral (+4.1%). On top of that, they are less likely to experience a hospitalization (-2.1%). This positive correlation between education and appropriateness is entirely due to the delayable reasons, suggesting that high educated people have a greater knowledge to infer the degree of emergency required by their condition.
Individuals without supplementary health insurance (SHI) are 6% less likely than individuals with private SHI to have appropriate emergency room visits. This result suggests that people with a lower level of coverage tend to avoid the direct cash-in-advance fees by going to ED instead of consulting a GP. Accessibility of primary care services is also positively associated with appropriateness: patients who go to the ED when medical offices are open (between 8am and 4pm) are more likely to be divertible (but not delayable), and the corresponding visits are associated with lower appropriateness. Because at this time of the day, there is a higher proportion of patients not coming on self-referral, this shows that at the same time: (i) doctors at the ED yard think that many patients could be treated by primary care; (ii) these very patients were advised by some care provider to seek care to the emergency room. This reveals obvious problems in the organization of care supply.
Geographical accessibility is also taken into account by patients: those who live close to an ED (less than 5 km) are less likely to be deemed necessary by the coding physician (- 3.5%). However, we do not find significant impact of GP or specialist densities on appropriateness. Nor do we find any impact of the two indicators of availability of primary care in the patient's living area: existence of GP providing care in the deep night (out-of-hours, i.e. midnight - 8am), existence of a regulatory system managed by physicians for primary care or

referral in the deep night. The influences of these characteristics of care supply is significant in OLS regressions, but they are captured by ED fixed effects and are not significant any more in our fixed effects regressions. This shows that their estimated influence in only due to concomitance.

A current debate in France aims to try to identify *ex ante* avoidable visits based on a triage of patients at the entrance to the ED (the indicator used would not be the CCMU score which is, as we have said, criticised by the medical community). The proposed regulation is to provide hospitals financial incentives to divert visits identified as avoidable towards a primary care medical consultation. One issue that this regulation does not take into account is the risk of opportunity loss for patients. We call this risk "type one errors", which refers to patients who are misclassified at the entrance to the ED and therefore considered inappropriate, when they eventually required urgent care and/or hospitalization. We have *ex ante* and *ex post* measures of appropriateness, which enables us to identify 1041 patients who would have experienced a loss of opportunity if the hospital had wrongly diverted. In addition we found that the loss of opportunity risk is not randomly distributed among patients: retired and unemployed people are more likely to experience a loss of opportunity while patients holding public SHI and patients living in an area with a higher availability of primary care services have a lower risk of type 1 error.

The regulator objective is to ensure the efficiency of the healthcare system so he wants to reduce the number of avoidable emergency room visits as much as possible. However, he does not want this to be accompanied by a deterioration in patients' health or even an increase in deaths. We have shown that these unwanted events would occur with the implementation of a triage of patients set at the entry of the emergency wards. Therefore the way to reduce avoidable visits without increasing the number of type one error is to address the determinants that influence the appropriateness of emergency room visits.

VIII. References

Barlet, M., Beffy, M., & Raynaud, D. (2016). La complémentaire santé. Acteurs, bénéficiaires, garanties, 102.

Berchet, C. (2015). Emergency Care Services. *Trends, Drivers and Interventions to Manage the Demand*, *83*(83).

Buchmueller, T. C., Orzol, S., & Shore-Sheppard, L. D. (2015). The effect of Medicaid payment rates on access to dental care among children. *American Journal of Health Economics*, *1*(No. 20021), 194–223.

Cameron, A. C., & Trivedi, P. K. (2005). *Microeconometrics*.

Chamberlain, G. (1979). Analysis of covariance with qualitative data. *NBER*, *325*(March).

Cour des comptes. (2013). Chapitre XII La permanence des soins, 335–363.

Cour des comptes. (2014). Les urgences hospitalières : une fréquentation croissante, une articulation avec la médecine de ville à repenser. *Rapport Sécurité Sociale 2014, Chapitre XII*, 351–377.

Cunningham, P. J., Clancy, C. M., Cohen, J. W., & Wilets, M. (1995). The use of hospital emergency departments for nonurgent health problems: a national perspective. *Med Care Res Rev*.

Gill, J. M., Mainous, A. G., & Nsereko, M. (2000). The Effect of Continuity of Care on Emergency Department Use. *Archives of Family Medicine*, *9*(4), 333–338.

Grumbach, K., Keane, D., & Bindman, A. (1993). Primary care and public emergency department overcrowding. *American Journal of Public Health*, *83*(3), 372–378.

Keane, M. P. (1992). A Note on Identification in the Multinominal Probit Model. *Journal of Business & Economic Statistics*, *10(2)*(2), 193–200.

Lippi Bruni, M., Mammi, I., & Ugolini, C. (2016). Does the extension of primary care practice opening hours reduce the use of emergency services? *Journal of Health Economics*, *50*, 144–155.

Miller, S. (2012). The effect of insurance on emergency room visits: An analysis of the 2006 Massachusetts health reform. *Journal of Public Economics*, *96*(11–12), 893–908.

Nagree, Y., Camarda, V. J., Fatovich, D. M., Cameron, P. A., Dey, I., Gosbell, A. D., … Mountain, D. (2013). Quantifying the proportion of general practice and low-acuity patients in the emergency department. *Medical Journal of Australia*, *198*(11), 612–615.

Or, Z., & Penneau, A. (2018). SC. *Health Policy*.

Parkinson, B., Checkland, K., Meacock, R., Sutton, M. (2018). What type of emergency department attendances are sensitive to primary care availability and quality ?

Pforr, K. (2015). Multinomial logistic regression with fixed effects. *The Stata Journal*.

Rust, G., Ye, J., Baltrus, P., Daniels, E., Adesunloye, B., & Fryer, G. E. (2008). Practical Barriers to Timely Primary Care Access. *Archives of Internal Medicine*, *168*(15), 1705–1710. https://doi.org/10.1001/archinte.168.15.1705

Taubman, S. L., Allen, H. L., Wright, B. J., & Baicker, K. (2014). Oregon â€™ s Health Insurance Experiment. *Science*, *343*(6168), 263–268.

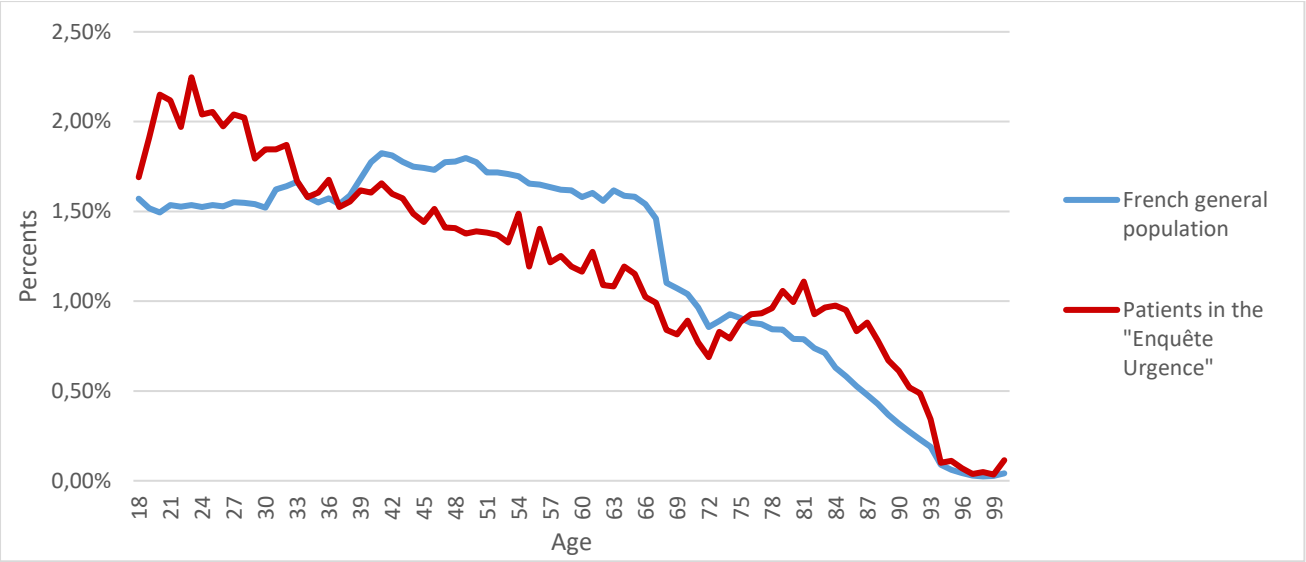
Van den Berg, M. J., Van Loenen, T., & Westert, G. P. (2016). Accessible and continuous primary care may help reduce rates of emergency department use. An international survey in 34 countries. *Family Practice*, *33*(1), 42–50.

Vuagnat, A. (2013). Les urgences hospitalières, qu'en sait-on ? *Le Panorama Des Établissements de Santé, édition 20*, 11–28.

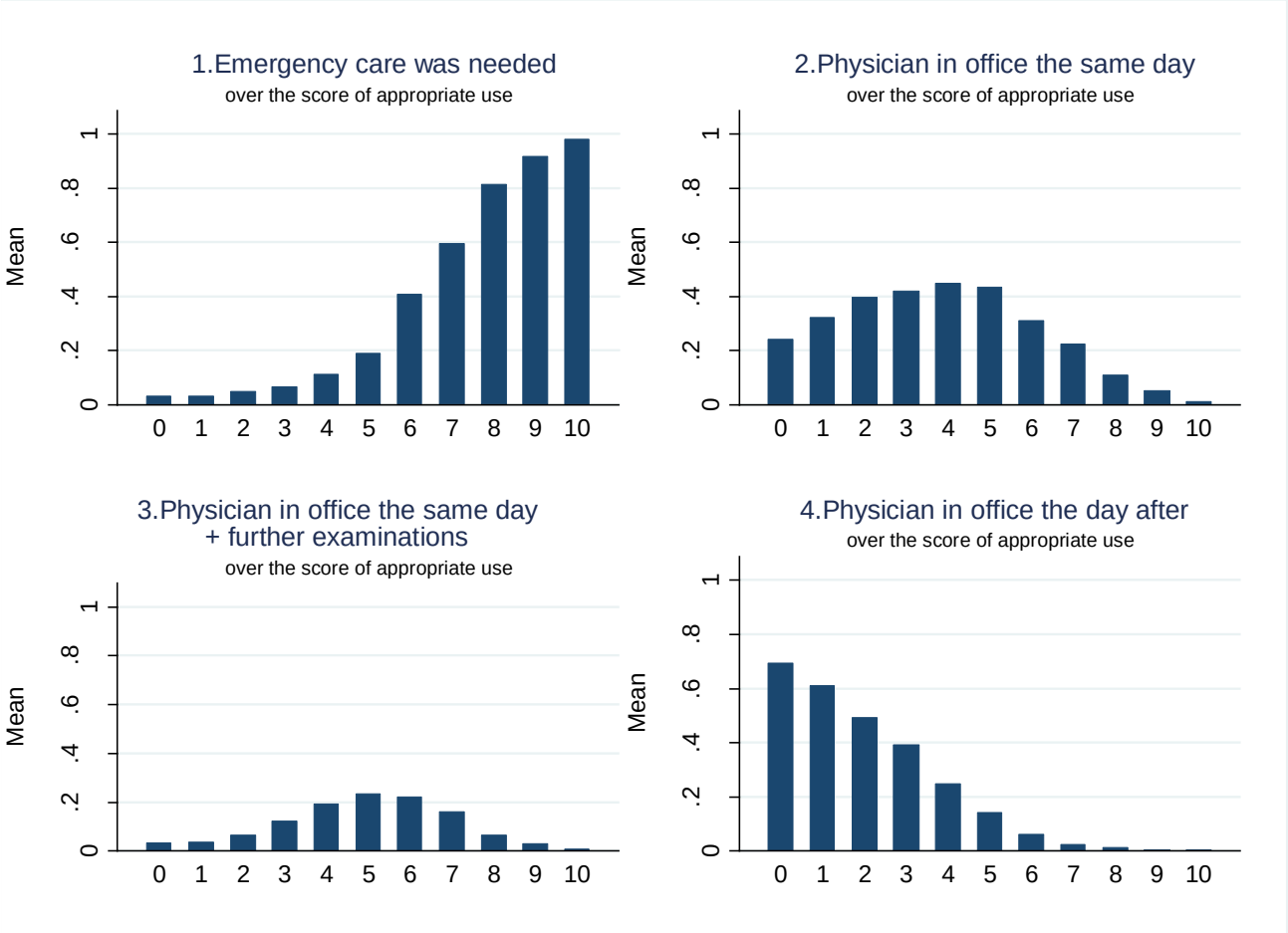
Weber, E. J., Showstack, J. A., Hunt, K. A., Colby, D. C., & Callaham, M. L. (2005). Does lack of a usual source of care or health insurance increase the likelihood of an emergency department visit? Results of a national population-based study. *Annals of Emergency Medicine*, *45*(1), 4–12.

Graphs

Graph 1: Age distribution of the French population vs. ED patients



Graph 2: Distribution of the qualitative assessment of the physician over the score of appropriate ED use



Tables

Table 1. Summary Statistics

		Total	Emergency care wasn't necessary	Emergency care was necessary
	N	Mean or % (sd)	Mean or % (sd)	Mean or % (sd)
Demand characteristics				
Age	27179	48.68 (21.24)	43.50 (19.18)	52.91 (21.89)
Female	23648	48.55 (49.98)	50.32 (50.00)	47.11 (49.92)
Occupation				
Employed	23648	47.15 (49.92)	53.31 (49.89)	42.01 (49.36)
Unemployed	23648	8.50 (27.89)	10.06 (30.08)	7.20 (25.85)
Retired	23648	28.43 (45.11)	19.17 (39.36)	36.17 (48.05)
Student	23648	4.98 (21.76)	6.09 (23.92)	4.05 (19.72)
Other inactive (eg disabled)	23648	6.05 (23.84)	6.34 (24.36)	5.81 (23.40)
Occupation : Doesn't know	23648	0.72 (8.45)	0.65 (8.04)	0.78 (8.78)
Occupation : Other	22109	4.17 (19.98)	4.38 (20.48)	3.98 (19.55)
Education				
No degree	22109	24.18 (42.82)	22.21 (41.57)	25.87 (43.80)
Vocational	22109	32.91 (46.99)	32.59 (46.87)	33.20 (47.09)
High school degree	22109	18.90 (39.15)	21.01 (40.74)	17.09 (37.65)
College degree	22109	20.48 (40.36)	21.12 (40.82)	19.94 (39.95)
Education : doesn't know	26833	3.52 (18.43)	3.07 (17.26)	3.90 (19.36)
Insurance status				
Private supp. Health Insurance (SHI)	24660	78.91 (40.79)	77.61 (41.68)	79.97 (40.02)
Public SHI (CMUC)	24660	14.16 (34.87)	14.94 (35.65)	13.53 (34.20)
No SHI	24660	3.63 (18.70)	4.09 (19.81)	3.25 (17.74)
Doesn't know	24660	3.29 (17.85)	3.35 (18.00)	3.25 (17.72)

Table 1. Summary Statistics (cont.)

	Total		Emergency care wasn't necessary	Emergency care was necessary
	N	Mean or % (sd)	Mean or % (sd)	Mean or % (sd)
Recorded time of the visit				
[midnight;4am[	27179	5.48 (22.76)	5.08 (21.95)	5.81 (23.40)
[4am;8am[	27179	4.28 (20.25)	4.18 (20.02)	4.36 (20.43)
[8am;noon[	27179	25.96 (43.84)	27.90 (44.85)	24.38 (42.94)
[noon;4pm[	27179	24.85 (43.22)	25.15 (43.39)	24.60 (43.07)
[4pm;8pm[	27179	23.35 (42.31)	21.49 (41.07)	24.87 (43.23)
[8pm;midnight[	27179	16.07 (36.73)	16.20 (36.85)	15.97 (36.63)
Referral and follow up attendances				
The patient self-referred	25691	55.54 (49.69)	68.48 (46.46)	44.66 (49.72)
The patient was referred by a GP (or specialist)	25817	8.75 (28.26)	6.26 (24.23)	10.85 (31.10)
The patient came on a physician's advice	25691	25.87 (43.79)	20.15 (40.11)	30.68 (46.12)
The patient came on the advice of another health professional	25691	18.59 (38.90)	11.37 (31.75)	24.66 (43.11)
Follow-up attendances	25817	0.95 (9.72)	0.95 (9.70)	0.96 (9.73)
Patient trajectory following the ED visit				
Discharge : Home return	27154	74.12 (43.80)	92.57 (26.23)	59.07 (49.17)
Hospital admission	27154	23.86 (42.63)	4.92 (21.62)	39.33 (48.85)
Death	27154	0.09 (2.97)	0.00 (0.00)	0.16 (4.00)
Discharge against medical advice	27154	0.66 (8.11)	0.48 (6.94)	0.81 (8.96)
Redirected to a medical office on call	27154	0.13 (3.59)	0.25 (5.03)	0.03 (1.64)
Patient left without waiting	27154	1.13 (10.59)	1.78 (13.22)	0.61 (7.78)

Table 1. Summary Statistics (cont.)

		Total	Emergency care wasn't necessary	Emergency care was necessary
	N	Mean or % (sd)	Mean or % (sd)	Mean or % (sd)
Supply characteristics				
Hospital ownership				
Public	27179	80.50	81.61	79.60
		(39.62)	(38.74)	(40.30)
Private For Profit (PFP)	27179	13.50	12.50	14.31
		(34.17)	(33.08)	(35.01)
Private Non Profit (PNP)	27179	6.00	5.89	6.09
		(23.75)	(23.54)	(23.92)
Distance patient-hospital in kms				
< 5km	26920	43.56	45.91	41.64
		(49.58)	(49.83)	(49.30)
5 to 10 km	26920	18.28	18.67	17.96
		(38.65)	(38.97)	(38.39)
10 to 20 km	26920	18.14	16.86	19.18
		(38.53)	(37.44)	(39.37)
20 to 30 km	26920	8.30	7.65	8.83
		(27.59)	(26.58)	(28.37)
> 30km	26920	9.75	9.10	10.28
		(29.66)	(28.76)	(30.37)
Patient and hospital are from the same département	26529	86.69	86.77	86.61
		(33.97)	(33.88)	(34.05)
Density of GP / 1000 inhabitants at the patients' département level	26378	1.54	1.53	1.54
		(0.26)	(0.27)	(0.27)
Density of specialists / 1000 inhabitants at the patients' département level	26378	1.71	1.72	1.72
		(0.80)	(0.82)	(0.80)
Availability of GPs out of office hours in the patient's living area	25571	52.92	52.80	53.02
		(49.92)	(49.92)	(49.91)
Existence of a regulatory system for primary care services out of office hours	25571	68.27	66.89	69.40
		(46.54)	(47.06)	(46.09)
Demographic characteristics at the patient zip code level				
Unemployment rate	24310	14.03	14.23	13.87
		(5.46)	(5.44)	(5.48)
Poverty rate (less than 60% of median income)	20510	13.90	14.33	13.54
		(8.18)	(8.32)	(8.04)
Share of population over 65	24310	18.11	17.90	18.29
		(5.32)	(5.27)	(5.35)
Income (zip code level)	23744	20188.86	20107.63	20254.77
		(3621.27)	(3559.20)	(3669.67)
Observations	28929			
Missing values	1750			

Source : 'Enquête Urgence', 2013, DREES, sample of adult patients (18+), 28,929 observations

Table 2. Direct assessments by physician or care provider

	Statistics	
	N	%
Ex post score of appropriate use of ED by physician		
0	1629	6.23
1	950	3.64
2	1738	6.65
3	1701	6.51
4	1383	5.29
5	2931	11.22
6	1620	6.20
7	1751	6.70
8	2667	10.21
9	924	3.54
10 : Fully appropriate	8835	33.81
Total	26129	100.00
Ex post qualitative assessment of appropriate use of ED by physician		
Emergency care was necessary	14966	51.73
The visit could have been treated by a physician in office the same day	5572	19.26
The visit could have been treated by a physician in office the same day provided the possibility to perform further examinations	4072	14.08
The visit could have been treated by a physician in office the day after	4319	14.93
Total	28929	100.00
CCMU triage score, *ex ante* (CCMU=1 : avoidable visit)		
1 : Stable state. No procedure required	4304	17.02
2 : Stable state. Some procedures required	15018	59.38
3 : Possible deterioration, no life-threatening risk	4523	17.88
4 : Life-threatening risk, no immediate resuscitation required	870	3.44
5 : Life-threatening, immediate resuscitation required	189	0.75
P : Psychiatric problem	386	1.53
Total	25290	100.00

Source : 'Enquête Urgence', 2013, DREES, sample of adult patients (18+), 28,929 observations

Table 3. Events during the visit

	Statistics	
	N	%
Number of medical procedures performed		
0	5241	18.20
1	8319	28.89
2	6774	23.52
3	4634	16.09
4	3163	10.98
5	668	2.32
Total	28799	100.00
Hospitalization during the visit		
Yes	6755	23.39
No	22129	76.61
Death during the visit		
Yes	24	0.08
No	28860	99.92
Total	28884	100.00

Source : 'Enquête Urgence', 2013, DREES, sample of adult patients (18+), 28,929 observations

Table 4. Circumstances of patient decision

	Statistics	
	Frequencies	%
Patients reasons for visiting ED		
Medical	23547	81.40
Accessibility	16549	57.21
By default	5736	19.83
Other reasons	903	3.12
Medical only	8914	30.81
Accessibility only	1969	6.81
By default only	548	1.89
Other reasons only	250	0.86
The patient has not self-referred		
Yes	12208	45.05
No	14890	54.95

The % are based on the total number of respondents, note that several answer are possible for the reasons of the visit (sum is $\neq 100$).

Source : 'Enquête Urgence', 2013, DREES, sample of adult patients (18+), 28,929 observations.

Table 5. Correspondence between indicators of appropriateness of ED visits

	Average quantitative score of appropriateness (*ex post* by physician)[1]		
	Yes	No	P value
Assessment ex ante *at entry by a care provider*			
Not CCMU-1	7.00 (3.09)	3.99 (3.32)	0.000
Medical decision or event during the visit			
At least one medical procedure	7.03 (3.08)	3.94 (3.30)	0.000
Hospitalization	8.90 (1.96)	5.74 (3.31)	0.000
Death	9.91 (0.43)	6.49 (3.33)	0.000
Circumstances of patient decision			
Medical reason	6.68 (3.26)	5.63 (3.50)	0.000
No self-referred	7.30 (3.07)	5.77 (3.37)	0.000

Mean score; sd in parentheses. The third column reports the pvalue of the test for difference between mean scores.
Source : 'Enquête Urgence', 2013, DREES, sample of adult patients (18+), 28,929 observations
1Reading: the score of appropriateness (0-10) given by the physician at the end of the visit is on average equal to 7.00 for patients not classified in CCMU – 1, and to 3.99 for patients classified in CCMU – 1. The difference is significant.
(remind: CCMU – 1 = Stable state. No procedure required).

Table 6: Structure of variance of the quantitative score

	Between ED	Within ED	Total
Variance	1.594	9.493	11.087
Standard deviation	1.262	3.081	3.324
Percentage	14.37	85.63	100.00

Table 7. *Analysis of the determinants of an appropriate use of ED among adults (18+). OLS with ED fixed effects.*

	Direct assessments			Events during the visit		Circumstances of patients' decision to visit ED	
	(Y1) Relevance note	(Y2) Emergency care was necessary	(Y3) CCMU score	(Y4) At least one medical procedure	(Y5) Hospitalization or death	(Y6) Medical reason	(Y7) No self-referred
	b/se	b/se	b/se	b/se	b/se	b/se	b/se
[18;25[	-1.879***	-0.306***	-0.133***	-0.143***	-0.377***	-0.092***	-0.354***
	(0.17)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
[25;45[	-1.397***	-0.234***	-0.109***	-0.128***	-0.340***	-0.079***	-0.293***
	(0.14)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
[45;65[	-0.896***	-0.163***	-0.074***	-0.091***	-0.257***	-0.062***	-0.203***
	(0.13)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
[65;75[	-0.606***	-0.105***	-0.036***	-0.053***	-0.200***	-0.023**	-0.148***
	(0.11)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
>75 (ref)	-	-	-	-	-	-	-
Female	-0.481***	-0.074***	-0.015**	-0.017**	-0.021***	-0.025***	0.019**
	(0.06)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Employed (ref)	-	-	-	-	-	-	-
Unemployed	-0.085	0.008	0.021	-0.043***	0.050***	-0.005	0.030**
	(0.12)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Retired	0.318**	0.054***	0.014	0.017	0.089***	0.005	0.088***
	(0.13)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
Student	0.100	0.039*	0.016	-0.010	0.031***	0.003	0.038*
	(0.14)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.02)
Other inactive (eg disabled)	0.135	0.029	0.012	-0.021	0.078***	0.028**	0.047***
	(0.12)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Occupation : Doesn't know	0.468*	0.145***	0.053	0.070**	0.071	0.066***	0.143***
	(0.28)	(0.04)	(0.04)	(0.03)	(0.05)	(0.03)	(0.05)
Occupation : Other	0.006	0.040*	0.001	-0.005	0.091***	0.010	0.022
	(0.15)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)
No degree (ref)	-	-	-	-	-	-	-
Vocational	0.177**	0.010	0.015*	0.007	-0.018*	0.009	0.017
	(0.07)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
High school degree	0.102	0.003	0.006	-0.008	-0.022**	0.002	0.032**
	(0.09)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
College degree	0.215***	0.026**	0.019*	0.018*	-0.021**	0.003	0.041***
	(0.08)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Education : doesn't know	0.122	-0.012	0.017	-0.007	0.045**	-0.010	0.089***
	(0.17)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)

Table 7. (cont.)

	Direct assessments			Events during the visit		Circumstances of patients' decision to visit ED	
	(Y1) Relevance note	(Y2) Emergency care was necessary	(Y3) CCMU score	(Y4) At least one medical procedure	(Y5) Hospitalization or death	(Y6) Medical reason	(Y7) No self-referred
	b/se	b/se	b/se	b/se	b/se	b/se	b/se
Private SHI(ref)	-	-	-	-	-	-	-
Public insurance (CMUC)	-0.127	-0.006	0.006	-0.020*	-0.015	-0.008	-0.023*
	(0.10)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
No SHI	-0.346**	-0.058***	-0.025	-0.021	0.007	0.007	-0.033
	(0.15)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Insurance doesn't know	-0.127	-0.008	-0.022	-0.012	0.004	0.023	-0.006
	(0.17)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)
[midnight;4am[(ref)	-	-	-	-	-	-	-
[4am;8am[	-0.244	-0.050**	0.019	0.027	-0.016	-0.044**	-0.065***
	(0.17)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)
[8am;noon[	-0.472***	-0.085***	-0.003	0.020	-0.043***	0.012	0.043**
	(0.14)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
[noon;4pm[	-0.311**	-0.057***	0.019	0.023	-0.023	0.016	0.077***
	(0.13)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
[4pm;8pm[	-0.089	-0.015	0.021	0.031*	-0.009	0.015	0.109***
	(0.13)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
[8pm;midnight[	-0.162	-0.036*	-0.006	-0.003	-0.015	-0.002	-0.004
	(0.13)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)
< 5km	-0.267**	-0.035**	0.000	0.013	-0.019	-0.026**	-0.026
	(0.12)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
5 to 10 km	-0.221*	-0.025	0.018	0.017	-0.004	-0.009	-0.007
	(0.12)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
10 to 20 km	-0.125	-0.004	0.011	0.027**	0.009	-0.007	0.032*
	(0.11)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
20 to 30 km	-0.062	0.013	0.002	0.019	0.028*	0.004	0.075***
	(0.13)	(0.02)	(0.01)	(0.02)	(0.02)	(0.01)	(0.02)
> 30 km (ref)	-	-	-	-	-	-	-
Patient and hospital are from the same département	-0.006	-0.005	-0.006	-0.018	0.013	-0.000	0.012
	(0.09)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Density of GP / 1000 inhabitants at the département level	-0.337	-0.049	-0.032	-0.006	-0.034	0.116**	-0.012
	(0.48)	(0.07)	(0.06)	(0.06)	(0.05)	(0.05)	(0.07)

Table 7. (cont.)

	Direct assessments			Events during the visit		Circumstances of patients' decision to visit ED	
	(Y1) Relevance note	(Y2) Emergency care was necessary	(Y3) CCMU score	(Y4) At least one medical procedure	(Y5) Hospitalization or death	(Y6) Medical reason	(Y7) No self-referred
	b/se	b/se	b/se	b/se	b/se	b/se	b/se
Density of spécialists / 1000 inhabitants at the département level	0.063	0.008	0.006	0.008	0.010	-0.032**	-0.015
	(0.15)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)
Availability of GPs OOH in the patient's living area	0.042	0.012	0.006	0.005	0.006	0.005	0.008
	(0.10)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Existence of a regulatory system for primary care services OOH	0.039	-0.002	0.011	-0.006	0.011	0.005	-0.020
	(0.12)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Zip code controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ED Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	14897.000	15396.000	14292.000	16122.000	16128.000	16143.000	16040.000
R2	0.054	0.057	0.020	0.029	0.145	0.014	0.098

Coefficients are reported, standard errors corrected for heteroscedasticity by the "White" matrix in parentheses.. Results are estimated by OLS. *** p<0.01, ** p<0.05, * p<0.1

Table 8. *Multinomial analysis of the determinants of physicians' qualitative assessment of an appropriate ED use*

	Divertible / Urgent e(b)/se	Delayable / Urgent e(b)/se
[18;25[	3.085***	4.747***
	(0.36)	(0.70)
[25;45[	2.455***	3.022***
	(0.26)	(0.42)
[45;65[	1.863***	2.236***
	(0.18)	(0.28)
[65;75[	1.516***	1.729***
	(0.13)	(0.20)
>75 (ref)	-	-
Female	1.318***	1.440***
	(0.06)	(0.08)
Employed (ref)	-	-
Unemployed	0.895	1.042
	(0.07)	(0.09)
Retired	0.719***	0.829*
	(0.06)	(0.09)
Student	0.843*	0.788**
	(0.08)	(0.09)
Other inactive (eg disabled)	0.774***	0.871
	(0.07)	(0.09)
Occupation : Doesn't know	0.649*	0.451**
	(0.14)	(0.14)
Occupation : Other	0.798**	0.894
	(0.08)	(0.10)
No degree (ref)	-	-
Vocational	0.974	0.892*
	(0.05)	(0.06)
High school degree	1.027	0.936
	(0.06)	(0.07)
College degree	0.965	0.723***
	(0.06)	(0.06)
Education : doesn't know	1.178	1.073
	(0.14)	(0.16)
Private SHI (ref)	-	-
Public insurance (CMUC)	0.963	1.089
	(0.07)	(0.09)
No SHI	1.150	1.511***
	(0.12)	(0.19)
Insurance doesn't know	1.079	1.237
	(0.13)	(0.18)

Table 8. (cont.)

	Divertible / Urgent e(b)/se	Delayable / Urgent e(b)/se
[midnight;4am[(ref)	-	-
[4am;8am[	1.732***	0.876
	(0.23)	(0.14)
[8am;noon[	2.002***	0.904
	(0.20)	(0.10)
[noon;4pm[	1.720***	0.915
	(0.17)	(0.10)
[4pm;8pm[	1.380***	0.804**
	(0.14)	(0.09)
[8pm;midnight[	1.314**	1.059
	(0.14)	(0.12)
< 5km	1.120	1.210*
	(0.09)	(0.13)
5 to 10 km	1.049	1.206*
	(0.09)	(0.13)
10 to 20 km	0.928	1.057
	(0.08)	(0.11)
20 to 30 km	0.876	1.151
	(0.08)	(0.14)
> 30 km (ref)	-	-
Patient and hospital are from the same département	1.086	1.044
	(0.07)	(0.08)
Density of GP / 1000 inhabitants at the patients' département level	1.178	0.953
	(0.17)	(0.18)
Density of spécialists / 1000 inhabitants at the patients' département level	0.913*	1.043
	(0.05)	(0.07)
Availability of GPs OOH[13] in the patient's living area	0.940	1.024
	(0.04)	(0.05)
Existence of a regulatory system for primary care services OOH	0.872***	1.023
	(0.04)	(0.06)
Zip code controls	Yes	
N	15396.000	

Relative Risks are reported, standard errors corrected for heteroscedasticity by the "White" matrix in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

[13] Out of Office Hours.

Table 9. Number of type 1 classification errors

	The patient was classified in the CCMU-1		
	Yes	No	Total
Patients trajectory following the visit			
Discharge : Home return	3958	14770	18728
Hospital admission	178	5831	6009
Death	0	22	22
Discharge against medical advice	9	162	171
Redirected to a medical office on call	28	7	35
Patient left without waiting	128	184	312
Total	4301	20976	25277
Qualitative assessment of the visit by the physician			
Emergency care was necessary	1041	12371	13412
The visit could have been treated by a physician in office the same day	1589	5495	7084
The visit could have been treated by a physician in office the day after	1470	2405	3875
Total	4100	20271	24371

Source: 'Enquête Urgence', 2013, DREES, sample of adult patients (18+), 28,929 observations

Appendix

Table 10. Detailed circumstances of the patient's decision to visit the ED

	Statistics	
	Frequencies	%
Details of medical reasons		
Accident	8309	30.70
Physician advice	7683	28.39
Thought it was serious condition	6028	22.28
Patient brought in by the mobile rescue services	3874	14.32
Thought hospitalization was necessary	1523	5.63
Anxious patient	2632	9.73
Details of accessibility reasons		
Proximity	6182	22.84
Need my health problem fixed quickly	8080	29.86
Faster to wait in the ED than looking for a GP	2150	7.95
Additional examinations can be carried out	6173	22.81
Specialists physicians can be consulted	3198	11.82
Possibility to have a medical consultation out of office hours	720	2.66
Details of "by default" reasons		
No cash payment at the ED	618	2.28
Patient's referring physician was absent	1465	5.41
Patient found no physician available in office	642	2.37
Patient didn't find any physician making home visits	338	1.25
patient needs a medical consultation quickly but cannot find an appointment	1355	5.01
Patient tried to treat himself without result	1299	4.80
Patient has consulted but is not getting better despite treatment	1406	5.20
Other reasons		
Patient couldn't stay at home (elderly or isolated)	69	0.25
Other reason for the ED visit	836	3.09
Observations	27061	

The % are based on the total number of respondents, note that several answer are possible (sum is ≠ 100).
Source : 'Enquête Urgence', 2013, DREES, sample of adult patients (18+), 28,929 observations

Table 11. *Analysis of the determinants of an appropriate use of ED among adults (18+). OLS without ED fixed effects.*

	Direct assessments			Events during the visit		Circumstances of patients' decision to visit ED	
	(Y1) Relevance note	(Y2) Emergency care was necessary	(Y3) CCMU score	(Y4) At least one medical procedure	(Y5) Hospitalization or death	(Y6) Medical reason	(Y7) No self-referred
	b/se	b/se	b/se	b/se	b/se	b/se	b/se
[18;25[	-1.838***	-0.297***	-0.136***	-0.139***	-0.384***	-0.090***	-0.362***
	(0.16)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
[25;45[	-1.323***	-0.221***	-0.112***	-0.128***	-0.344***	-0.083***	-0.298***
	(0.14)	(0.02)	(0.02)	(0.01)	(0.02)	(0.01)	(0.02)
[45;65[	-0.808***	-0.151***	-0.081***	-0.094***	-0.263***	-0.063***	-0.211***
	(0.13)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
[65;75[	-0.584***	-0.098***	-0.039***	-0.051***	-0.201***	-0.019*	-0.150***
	(0.11)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
>75 (ref)	-	-	-	-	-	-	-
Female	-0.460***	-0.072***	-0.018***	-0.017***	-0.022***	-0.024***	0.014*
	(0.06)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Employed (ref)	-	-	-	-	-	-	-
Unemployed	-0.048	0.012	0.014	-0.043***	0.052***	-0.003	0.042***
	(0.11)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Retired	0.415***	0.067***	0.021	0.019	0.090***	0.002	0.095***
	(0.12)	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)	(0.02)
Student	0.186	0.048**	0.025	-0.003	0.033***	0.003	0.036*
	(0.14)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)	(0.02)
Other inactive (eg disabled)	0.204	0.050***	0.015	-0.020	0.086***	0.014	0.061***
	(0.13)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
Occupation : Doesn't know	0.141	0.132***	0.039	0.076**	0.075*	0.071***	0.140***
	(0.35)	(0.05)	(0.04)	(0.03)	(0.04)	(0.03)	(0.04)
Occupation : Other	-0.002	0.044**	0.006	-0.006	0.088***	0.012	0.024
	(0.15)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)
No degree (ref)	-	-	-	-	-	-	-
Vocational	0.175**	0.013	0.012	0.009	-0.016*	0.014*	0.014
	(0.08)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
High school degree	0.089	0.001	0.001	-0.008	-0.020**	0.009	0.024*
	(0.09)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
College degree	0.261***	0.031**	0.015	0.016*	-0.017*	0.013	0.045***
	(0.09)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Education : doesn't know	-0.046	-0.029	-0.000	-0.004	0.041**	0.006	0.076***
	(0.16)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)

Table 11. (cont.)

	Direct assessments			Events during the visit		Circumstances of patients' decision to visit ED	
	(Y1) Relevance note	(Y2) Emergency care was necessary	(Y3) CCMU score	(Y4) At least one medical procedure	(Y5) Hospitalization or death	(Y6) Medical reason	(Y7) No self-referred
	b/se	b/se	b/se	b/se	b/se	b/se	b/se
Private insurance (ref)	-	-	-	-	-	-	-
Public insurance (CMUC)	-0.147	-0.003	0.010	-0.017	-0.008	-0.002	-0.017
	(0.10)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
No SHI	-0.449***	-0.058***	-0.030	-0.030*	0.007	0.008	-0.028
	(0.16)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)
Insurance doesn't know	-0.361**	-0.030	-0.006	-0.017	0.003	0.034**	-0.004
	(0.17)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
[midnight;4am[(ref)	-	-	-	-	-	-	-
[4am;8am[	-0.384**	-0.065**	0.009	0.025	-0.018	-0.045**	-0.068***
	(0.18)	(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
[8am;noon[	-0.549***	-0.090***	-0.027*	0.014	-0.054***	0.012	0.025
	(0.13)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)
[noon;4pm[	-0.403***	-0.067***	-0.001	0.016	-0.034**	0.019	0.063***
	(0.13)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)
[4pm;8pm[	-0.183	-0.023	-0.000	0.024	-0.021	0.019	0.094***
	(0.13)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)
[8pm;midnight[	-0.238*	-0.041**	-0.015	-0.010	-0.020	-0.001	-0.012
	(0.14)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)
< 5km	-0.271**	-0.033*	-0.013	0.008	-0.044***	-0.020*	-0.064***
	(0.11)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
5 to 10 km	-0.248**	-0.022	0.003	0.006	-0.025*	0.004	-0.031*
	(0.12)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
10 to 20 km	-0.085	0.007	0.007	0.020	-0.005	0.009	0.021
	(0.11)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)
20 to 30 km	-0.177	0.009	-0.003	0.001	0.025	0.012	0.080***
	(0.13)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)
> 30 km (ref)	-	-	-	-	-	-	-
Patient and hospital are from the same département	-0.100	-0.016	0.038***	0.009	0.029***	-0.010	0.022*
	(0.09)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)

Table 11. (cont.)

	Direct assessments			Events during the visit		Circumstances of patients' decision to visit ED	
	(Y1) Relevance note	(Y2) Emergency care was necessary	(Y3) CCMU score	(Y4) At least one medical procedure	(Y5) Hospitalization or death	(Y6) Medical reason	(Y7) No self-referred
	b/se	b/se	b/se	b/se	b/se	b/se	b/se
Density of GP / 1000 inhabitants at the patients' département level	0.215	-0.021	0.030	0.121***	0.034	0.062***	0.088***
	(0.21)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)	(0.03)
Density of spécialists / 1000 inhabitants at the patients' département level	-0.015	0.010	-0.040***	-0.042***	-0.015*	-0.014**	-0.027***
	(0.07)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Availability of GPs OOH in the patient's living area	-0.062	0.007	0.021***	-0.004	0.013*	0.008	0.034***
	(0.06)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Existence of a regulatory system for primary care services OOH	0.136**	0.020**	-0.003	0.007	0.019***	-0.005	0.000
	(0.06)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Constant	7.357***	0.768***	0.895***	0.760***	0.459***	0.875***	0.458***
	(0.32)	(0.05)	(0.04)	(0.04)	(0.04)	(0.03)	(0.05)
Zip code controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ED Fixed Effects	No	No	No	No	No	No	No
N	14897.000	15396.000	14292.000	16122.000	16128.000	16143.000	16040.000
r2	0.054	0.056	0.030	0.035	0.156	0.015	0.106

Coefficients are reported, standard errors corrected for heteroscedasticity by the "White" matrix in parentheses. Results are estimated by OLS. *** p<0.01, ** p<0.05, * p<0.1

Table 12. Unobserved type one errors

	Patients left before the end of emergency care				
	Yes		No		P value
	N	Mean/sd	N	mean/sd	
CCMU 1	312	0.41 (0.49)	24965	0.17 (0.37)	0.000
Time in minutes between patients registration at ED and :					
The first examination by a nurse	582	14.31 (30.74)	28182	12.64 (26.60)	0.134
The start of medical care	345	69.43 (101.95)	27503	52.28 (63.48)	0.000
Discharge or hospitalization	584	163.49 (198.24)	28283	279.37 (420.22)	0.000
Observations			28884		

Source : 'Enquête Urgence', 2013, DREES, sample of adult patients (18+), 28,929 observations

Table 13. I*s the risk to experience a type one error randomly distributed among individuals? OLS without fixed effects.*

	Type 1 errors for visits appraised necessary ex post by physicians	Type one errors for hospitalizations	All type 1 errors
	b/se	b/se	b/se
[18;25[	-0.015	-0.011*	-0.001
	(0.02)	(0.01)	(0.01)
[25;45[	-0.009	-0.009	-0.001
	(0.02)	(0.01)	(0.01)
[45;65[	-0.006	-0.009	-0.001
	(0.02)	(0.01)	(0.01)
[65;75[	-0.011	-0.012**	-0.009
	(0.02)	(0.01)	(0.01)
>75 (ref)	-	-	-
Female	-0.009	0.002	0.001
	(0.01)	(0.00)	(0.00)
Employed (ref)	-	-	-
Unemployed	-0.011	0.008**	-0.004
	(0.01)	(0.00)	(0.01)
Retired	0.008	0.010**	0.005
	(0.01)	(0.00)	(0.01)
Student	-0.008	0.001	-0.009
	(0.01)	(0.00)	(0.01)
Other inactive (eg disabled)	-0.009	0.003	-0.005
	(0.01)	(0.00)	(0.01)

Table 13. (cont.)

	Type 1 errors for visits appraised necessary ex post by physicians	Type one errors for hospitalizations	All type 1 errors
	b/se	b/se	b/se
Occupation : Doesn't know	0.073	0.020	0.042
	(0.05)	(0.02)	(0.03)
Occupation : Other	0.007	-0.001	0.004
	(0.02)	(0.00)	(0.01)
No degree (ref)	-	-	-
Vocational	-0.003	0.003	-0.004
	(0.01)	(0.00)	(0.01)
High school degree	-0.004	0.004	-0.004
	(0.01)	(0.00)	(0.01)
College degree	0.010	-0.001	0.002
	(0.01)	(0.00)	(0.01)
Education : doesn't know	-0.006	0.015	0.009
	(0.02)	(0.01)	(0.01)
Private SHI (ref)	-	-	-
Public SHI (CMUC)	-0.013	-0.000	-0.011*
	(0.01)	(0.00)	(0.01)
No SHI	-0.011	0.002	-0.003
	(0.02)	(0.00)	(0.01)
Insurance doesn’t know	-0.026	-0.002	-0.014
	(0.02)	(0.00)	(0.01)
[midnight;4am[(ref)	-	-	-
[4am;8am[	-0.025	-0.000	-0.010
	(0.02)	(0.00)	(0.01)
[8am;noon[	-0.003	0.002	0.005
	(0.02)	(0.00)	(0.01)
[noon;4pm[	-0.016	-0.001	-0.003
	(0.02)	(0.00)	(0.01)
[4pm;8pm[	0.007	-0.001	0.005
	(0.02)	(0.00)	(0.01)
[8pm;midnight[	0.010	0.005	0.010
	(0.02)	(0.00)	(0.01)
< 5km	-0.004	-0.004	-0.004
	(0.01)	(0.00)	(0.01)
5 to 10 km	-0.015	-0.002	-0.011
	(0.01)	(0.00)	(0.01)
10 to 20 km	-0.000	-0.003	-0.002
	(0.02)	(0.00)	(0.01)
20 to 30 km	0.000	0.001	-0.000
	(0.02)	(0.00)	(0.01)
> 30 km (ref)	-	-	-

Table 13. (cont.)

	Type 1 errors for visits appraised necessary ex post by physicians	Type one errors for hospitalizations	All type 1 errors
	b/se	b/se	b/se
Patient and hospital are from the same départements	-0.030**	-0.002	-0.015**
	(0.01)	(0.00)	(0.01)
Density of GP / 1000 inhabitants at the département level	0.007	-0.000	0.008
	(0.02)	(0.01)	(0.01)
Density of spécialists / 1000 inhabitants at the départements level	0.021**	0.002	0.011**
	(0.01)	(0.00)	(0.01)
Availability of GPs OOH in the patient's living area	-0.018***	-0.000	-0.012***
	(0.01)	(0.00)	(0.00)
Existence of a regulatory system for primary care services OOH	0.017***	0.003*	0.010***
	(0.01)	(0.00)	(0.00)
Constant	0.055	0.012	0.021
	(0.04)	(0.01)	(0.02)
Zip code controls	Yes	Yes	Yes
ED fixed effects	No	No	No
N	7674.000	12777.000	13085.000
R2	0.014	0.009	0.007

Liner probability models are estimated. Coefficients are reported, standard errors corrected for heteroscedasticity by the "White" matrix in parentheses. *** p<0.01, ** p<0.05, * p<0.1