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Micro-econometrics analyses of the role served by Emergency Departments within the French health care system

Alexis Dottin

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THÈSE DE DOCTORAT
DE L'UNIVERSITÉ PSL

Préparée à l'Université Paris-Dauphine

**Micro-econometrics analyses of the role served by
Emergency Departments within the French health care
system**

Soutenue par

Alexis DOTTIN

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Composition du jury :

Brigitte DORMONT Professeure, Université Paris-Dauphine, PSL	<i>Directrice de thèse</i>
Clémentine GARROUSTE Maître de conférences, Université Paris- Dauphine, PSL	<i>Examinatrice</i>
Michel GRIGNON Professeur, McMaster University	<i>Rapporteur</i>
Florence JUSOT Professeure, Université Paris-Dauphine, PSL	<i>Présidente du jury</i>
Matthew SUTTON Professeur, University of Manchester	<i>Rapporteur</i>
Fabien TOUTLEMONDE Chef de bureau, DREES, Ministère de la Santé	<i>Examineur</i>

L'Université Paris-Dauphine n'entend donner aucune approbation ni improbation aux opinions émises dans les thèses ; ces opinions doivent être considérées comme propres à leurs auteurs.

*À mes parents,
et à Morgane.*

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General introduction

For decades, almost all OECD countries have experienced a critical increase in the number of Emergency Department (ED) visits. This trend is far beyond the increase in needs that arises from the natural growth rate of the population of the countries, and is growing even faster than the ageing of the populations. This assertion has been echoed by many experts around the world. The main concern raised by this uncontrollable increase is the efficiency of the public health expenditure. And since this concern is not specific to France, regulating EDs has also become a major challenge for health care systems worldwide. Several explanations can be considered: (a) the utilization of EDs for inappropriate reasons, (b) the organization of care supply outside the Hospital, and (c) the payment system for hospitals. In this thesis, our objective is to examine some aspects of the drivers that contribute to the increase in ED visits, and to provide some insights to relieve EDs from congestion.

The increasing number of national reports and international scientific publications on this topic testify for the unequivocal growing concern about EDs. As for France alone, there have been no less than four reports made to the Senate since the late 1980s [58, 59, 27, 12] and two reports from the Cour des Comptes¹ over the last 10 years [14, 15] on this specific issue. When reading these reports, we strikingly notice that the problems raised by EDs, their causes and the suggested solutions to improve efficiency have been confusingly the same for more than 30 years. ED visits are increasing at rapid pace, and the medical resources allocated to EDs to absorb this increase in demand appear to be insufficient. Changes in the medical conditions of patients coming to the ED (involving mutations in medical practices), as well as a rise in the share of visits for non-urgent reasons are the main causes identified in these reports. Popular suggested solutions, among others, intend to improve the cooperation between primary care services (with the General

¹French institution in charge of the conformity of the State's public finances. It formulates informative but non-binding observations.

Practitioner (GP) in the front line) and hospitals. It highlights the specific role served by EDs within the French health system: a gateway between out-patient care and hospital care where patients sometimes fail to target the adequate care provider.

The objective of this introduction is to expose the challenges raised by EDs and their consequences on the efficiency of the French health system. Since EDs are inherent to hospitals, we will first delve a little into the history of the hospital industry in France to understand these challenges. Then we will show that demographic changes, and changes in morbidity are insufficient to explain the increase in the number of ED visits. Therefore, we will address the possible influences of (i) inappropriate visits and of (ii) the regulation of hospitals as additional explanations. This increase in ED visits has important consequences on the French health system that are eventually discussed. Then, we present in details the thesis purpose and the research questions which are addressed in each of the three chapters.

History of French Emergency Departments

In the French language, EDs are commonly called "Urgences", a common noun derived from the adjective *urgent* whose verb is *urger*. Etymologically, *urger* comes from the Latin verb *urgeo* which means "to hurry". In the English language, the first mention of the word "emergency" dates back to the 1630s. It is defined as an "unforeseen occurrence requiring immediate attention" that comes from Latin *emergens*, present participle of Latin verb *emergere* which means "to rise out"². From this Latin root, we can define Emergency Departments as medical treatment facilities dedicated to dealing with situations that can not wait and handle patients who require immediate attention. These situations are by the very nature of an emergency random events and unforeseen conditions such as accidents, injuries and a wide range of illnesses³. For example, EDs in the United-Kingdom (UK) are called "Accident & Emergency Department" (A&E) which emphasises the unpredictable nature of emergency care. So the observed increase in ED visits for the past twenty years - and at a rate higher than the population growth rate - cannot reasonably be attributed only to an increase in unforeseen emergency attendances.

Nowadays, emergencies are treated in an ED which is an autonomous department of a hospital. Although this form of organisation is recent, the reception of emergencies has always been handled by the Hospital. Over the centuries, hospitals' mandates have

²We refer to <https://www.etymonline.com/word/emergency>.

³When these conditions are the result of a risky behaviour (for instance drinking alcohol and driving), they are not randomly assigned.

changed and so has the way of handling emergencies. The primitive form of Hospital was "hospitality homes". It was created by Christians with the approval of the Catholic Church between the 4th and the 5th century A.D. They were supposed to provide shelter and assistance to the unfortunate, the sick or the elderly, or to pilgrims on the way to Santiago de Compostela (*Saint-Jacques de Compostelle*). In 1662, King Louis XIV ordered the creation of a "Hôtel-Dieu" and a "hospice" in each major French city to host (and also confine) the poor, the elderly, the vagrants, the orphans and the prostitutes [54]. The hospice mandate was extended to the internment of mentally ill people in 1838. Before the French Revolution of 1789, hospices were run by religious communities. Later, the administration of hospices was transferred to local authorities [11].

Only in 1941 were hospitals managed by the French State. It is also at this time that the Hospital stopped welcoming solely the indigents, and opened to all individuals in need for medical care. The fact that part of the patients were now having resources changed considerably the importance of roles that were historically devoted to the Hospital. Providing shelter and assistance to the poorest was gradually replaced by providing acute medical care to all. This transition was supported by the creation of the Social Security in 1945, of which the National Health Insurance (NHI) is one of the five components. The NHI was designed to promote equality in access to hospital care, regardless of the social status. It originally implemented a horizontal redistribution of resources (from the healthy to the sick) and a vertical redistribution (from the rich to the poor) following a principle of solidarity [20]. Health care expenditure are (partially) covered by the Social Security, which is funded by contributions and taxes that are proportional to the citizens' income. An important reform for public hospitals was implemented in 1958, with the creation of academic hospitals⁴, and the position of full-time hospital practitioner, who are civil servants and share their time between teaching and medical practice [54].

In the 70s was undertaken a profound reorganization of the Emergency activity. This reorganization was motivated by the number and the severity of car accidents [12], which represented the first major issue for emergency services after the war. At that time, emergencies were handled by EDs and two other hospital's departments: the *Service Mobile d'Urgence et de Réanimation (SMUR)*, created in 1965, which is a medical mobile unit designed to provide rapid medical care directly on an emergency site, and the *Services d'Aide Médicale Urgente (SAMU)*, created in 1968 to manage the SMUR activity through the regulation of emergency calls. In 1986, a reform outlined the cooperation between EDs, SAMU and SMUR⁵, in an effort to improve efficiency.

Reforms went further. In 1995, EDs were declared autonomous and independent from

⁴Centre Hospitalier Universitaire (CHU).

⁵Loi n° 86-11 du 6 janvier 1986.

other Hospital departments. For the first time, all French EDs were organized according to a common model and hospitals were asked to provide a higher level of resources to their functioning. The 1995 decree ensured, for example, the continuity of care through the compulsory presence of a medical team composed of at least one emergency doctor 24 hours a day, 365 days a year. The internal organization of these services was also specified with *a minima* the presence of a reception area, a resuscitation room and a short-term hospitalization unit (an early version of what became later the clinical decision unit (CDU)) for patients with unstable conditions⁶. In addition, an imaging centre and a laboratory for biological analyses must be accessible at any time for the realization of additional examinations. At that time, three types of emergency structures coexisted: the "usual" ED (Service d'Accueil des Urgences "SAU"), smaller local ED services (Unité de Proximité d'Accueil, de Traitement et d'Orientation des Urgences, "UPATOU") and EDs dedicated to specific medical disciplines (Pôle Spécialisé d'Accueil et de Traitement des Urgences, "POSU"). The last major reform of French EDs occurred in 2006⁷, when the coexistence of different structures was abolished in favour of a single form of organization, the ED (Structure des Urgences). So EDs' activity, organization and regulation were harmonized at the national level. EDs are now highly accessible and fully equipped to provide medical or surgical care to any patient requiring immediate care or resuscitation. They are open 24/7 (regardless of the nature of the medical intervention), and no upfront payment is required in the vast majority of EDs.

The initial mission of the hospital "hospice" was to take care of the most vulnerable populations. This mission is now devoted to EDs, since they are highly accessible. It is the result of the successive reorganizations that shaped the modern Hospital. These changes led to a shift in the Hospital mandates from hospitality towards the provision of high-level specialized care and medical research. But these changes did not eliminate the demand for social assistance. Therefore, it is interesting to note that the visits of patients who are in very fragile social situations are pointed out in all the reports which analyze the problems faced by EDs since the 1980s [58, 59, 27, 12]. If alternatives to EDs are not easily accessible to people in situations of social deprivation, EDs will always be the recipient of that demand since the Hospital is the most visible entity of the health care system. And the ED is the place that ensures access to care to all, at any time.

⁶These "*Zones d'Hospitalisation de très Courte Durée (ZHCD)*" in French were replaced by the "*Unités d'Hospitalisation de Courte Durée (UHCD)*" in 2006 which can be assimilated to the Clinical Decision Unit (CDU) that exist in EDs in the United-Kingdom (UK). They are designed to keep patients under observation for 24 hours maximum before a discharge or a decision of hospitalization is taken.

⁷Decrees No. 2006-576 and 2006-577 of 22 May 2006.

The main causes of the increase in ED visits

The influence of natural drivers

Researchers from several disciplines have shown interest for EDs mainly because of the increase in the number of ED visits that lasts for decades in a majority of countries and seems uncontrollable. An OECD report published in 2015 made the same observation for almost all OECD countries [5]. For countries, it raises the question of the sustainability of the additional health care expenditure that are generated by these rising trends in ED visits, and for several reasons.

First, the increase in ED visits cannot be explained by population growth alone [41]. Figure 1 illustrates these trends for the period 2002-2018 in England, France, Portugal and Spain. The National Institutes of Statistics of the respective countries have made available historical data on ED visits without interruption or changes in data collection method since the early 2000s, offering an opportunity for international comparisons. One can see that the number of ED visits has grown much faster than the population over the last 20 years in these four countries. ED visits per 100 inhabitants have increased by 57% between 2002 and 2018 in England, by 46% in France, by 23% in Spain and, less importantly by 11% in Portugal. To give an order of magnitude, the trend in England corresponds to a supplement of nearly 11 million ED visits or an additional 16 visits per 100 population in sixteen years. In France, this trend represents a 8 million rise in ED visits and an increase of 10 visits per 100 population.

It is worth mentioning that these statistics do not control for the ageing of the population. This is a second possible explanation for the increase in ED visits, together with the growing burden of chronic conditions associated with aging [5]. However, even if elderlies are over-represented in the population of ED users⁸ [6], people aged 75 or more still represent only 12% of the total adult population in the French EDs (2 p.p. more than the proportion in general population)⁹. Plus, the share of elderlies in general population is growing at a lower rate than the number of ED visits. For instance, the share of the population aged 65 or more has grown at a 22% rate between 2002 and 2018 in France¹⁰ and at a 15.3% rate in England¹¹.

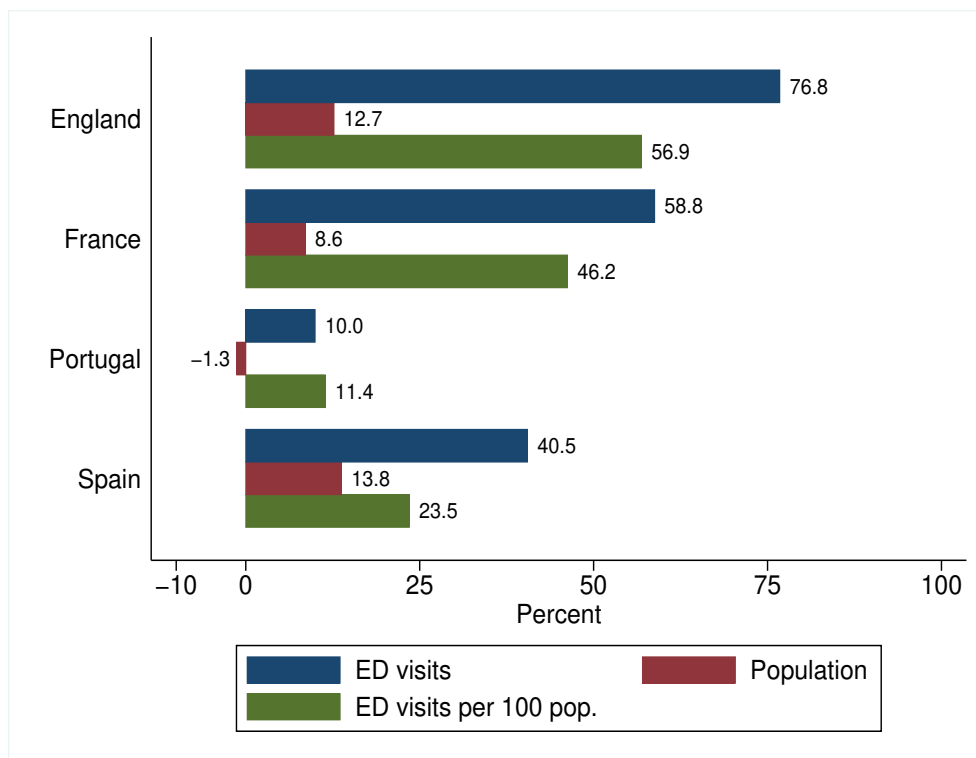
⁸It is also the case for the very young children.

⁹Source: "Enquête Urgence", DREES.

¹⁰Source: Demographic data from National Institute of Demographic Studies available at <https://archined.ined.fr/view/AXWs9WivkgKZhr-blhHr>

¹¹Source: World Bank staff estimates based on age/sex distributions of United Nations Population Division's World Population Prospects: 2019 Revision; available at <https://data.worldbank.org/indicator/SP.POP.65UP.TO.ZS>.

Figure 1: Growth rates (%) in ED visits and population in European countries between 2002 and 2018



Sources: Author's calculations from National Statistics. Data on ED for France comes from the "*Statistique Annuelle des Etablissements de santé (SAE)*" and is yearly published in a report of the French Ministry of Health, the "*Panorama des Etablissements de Santé*". Data from England is accessible through the National Health Service (NHS) website at <https://www.england.nhs.uk/statistics/statistical-work-areas/ae-waiting-times-and-activity/>. Spanish data arises from the "*Sistema de Información de Atención Especializada (SIAE)*" available on the Ministry of Health website at <https://pestadistico.inteligenciadegestion.mscbs.es/publicoSNS/S>. Portugal data on ED visits is available on the Portuguese National Institute of Statistics at <https://www.ine.pt/>. Population time series estimates are from World Bank database freely accessible from <https://data.worldbank.org/indicator/SP.POP.65UP.TO.ZS>.

To sum up, population growth and aging fail to fully explain this increase, and other explanations must be considered. For this purpose, we now examine the possible influence of inappropriate visits.

The influence of inappropriate ED visits

Part of the observed increase in ED visits can be attributed to an increase in the use of EDs for "non-urgent" or "inappropriate" reasons. Since EDs started to be studied in the 1980s, a significant amount of work has been undertaken to address this question [30, 10, 7, 29, 16, 55, 52, 44]. One of the first empirical studies conducted by economists on EDs related issues dates back, to our knowledge, to the the RAND health insurance experiment. This experiment was conducted in the United-States and randomly assigned

individuals to different health insurance's plans as regard the level of copayment¹². In a 1985 paper, the authors provided evidence that demand for emergency care increases with the level of insurance coverage, in particular for "less serious diagnoses" [45]. In 1989, a public report to the French Senate stated that "a large number of patients treated in emergency in public hospitals present only trivial disorders that require only a medical contact, a quick check-up, a simple treatment or a psychological relief. Many of them could have been treated by practitioners outside the hospital and often even outside of an emergency context."¹³ [58].

More recently, interest for "non-urgent" visits to ED has been growing in the literature, and several systematic reviews have gathered relevant information on this topic [8, 22, 61]. But the understanding of inappropriate ED visits and its determinants is far from complete since there is no consensus on the definition of "appropriateness". A very recent publication (2021) from England proposes a classification of so-called "avoidable" ED visits to clarify the concept [49]. The authors point out that the heterogeneity of the terminology, definitions and indicators used to assess the importance of inappropriate ED visits yield to a large variability in the estimations. The same observation was made in an OECD report where the proportion of inappropriate ED visits ranges from 12% to 56% [5] between countries, because of the use of different indicators and definitions. One literature review found a variability of 20% to 40% in the prevalence of inappropriate ED visits[8]. Another review found a larger discrepancy from 5% to 90%[22]. In France, an administrative report stated that 20% of ED visits were non-urgent [14] but this estimation relied on a proxy of appropriateness (ED visits for which no medical act was performed).

At the current state of the art, there is a need for a direct observation of appropriateness based on a clear definition of the concept to provide reliable estimates of its proportion in ED patients. To overcome this lack of data, papers use indicators that are (imperfectly) correlated with appropriateness such as patients coming on self-referral, non-hospitalized ED visits, or discharge without any doctor consultation or treatment [38, 48, 9, 47, 16]. The inappropriateness of ED visits often refers to attendances that should not have occurred from the regulator perspective. Parkinson et al. [49] categorize these attendances into three categories: (1) Divertible attendances that can be treated more appropriately by other non-urgent health care facilities; (2) Preventable attendances that represent urgent care needs that could be avoided by vaccination, preventive care

¹²Results from this famous experimentation are still being explored 30 years after [2].

¹³Translated from French.

or care management; (3) Unnecessary attendances that do not require any clinical care. In this thesis, we give a clear definition of what we mean by "inappropriate" ED visits that is in line with the categorization of Parkinson et al. (2021). We consider, from the regulator perspective, that an ED visit is "inappropriate" if the patient's medical condition is non-urgent and could be treated by a general practitioner (GP) or a specialist consultation in a primary care setting more efficiently, i.e. at lower cost and equal risk. Since they represent non-urgent clinical conditions, limiting the number of these visits is of interest to optimize ED utilization¹⁴.

This definition of inappropriateness is supported by empirical evidence suggesting that EDs are used as substitutes for general general practices or other primary care facilities. There are two main reasons for which patients might prefer EDs to general practices: non-financial reasons and financial reasons.

On the one hand, EDs are highly accessible facilities opened 24/7 to anyone coming in without discrimination, and with the ability to treat almost any kind of medical condition from a minor injury to a life-threatening emergency¹⁵. In contrast, general practices are not accessible during out-of-office hours (between 8pm and 8am) or on weekends, and the few existing alternatives to EDs are insufficient to meet the demand¹⁶ [12, 13]. Therefore, patients may substitute EDs to general practices for accessibility reasons, especially during nights and weekends. Empirical evidence shows that higher accessibility to primary care services is associated with lower ED utilization [18, 62, 46, 53, 47]. Accessibility is a broad concept that encompasses multiple dimensions: the availability of care services, the physical accessibility (in terms of distance) and its associated transportation costs, the convenience of these services (extending hours, appointment systems, telephone services, walk-in facilities...) and their affordability [51]. In an unpublished work done in collaboration with the French Ministry of Health (DREES¹⁷) I found that the majority of adult patients from the survey "Enquête Urgence"¹⁸ reported coming to EDs for convenience motives (51%). Convenience motives include the need to treat a health concern rapidly, the possibility to carry out additional examinations, the possibility to consult a doctor out of office hours, among others.

On the other hand, in addition to coverage by the NHI, French EDs are exempt from

¹⁴Unnecessary attendances are generally made by vulnerable population in need of social assistance and therefore, they are a matter of social welfare that is beyond the scope of this thesis.

¹⁵However, EDs are not always equipped to treat few specific care needs as for dental emergencies.

¹⁶Before 2002, liberal physicians were responsible for organizing the provision of care during out-of-office hours through on-call duty. This obligation stopped in 2002 and was replaced by a system based on volunteer physicians which fails to ensure a continuity of care.

¹⁷Head of Research, Studies, Evaluation and Statistics.

¹⁸A 2013 survey of all patients who visited an ED in France during a 24 hour period (nearly 50,000 visits were recorded). See chapter 2 for a detailed presentation of the survey.

direct payments¹⁹. Direct payments are not required for ED visits because EDs have a legal obligation to treat all patients, regardless of their ability to pay for treatment. In practice, patients receive at home a bill for a copayment equal to 20% of the cost of care after their visit²⁰. This exemption from direct payment is at the root of the fallacy that EDs are free. According to the ED medical staff, this misconception is widespread among French ED patients [12]. In contrast, upfront payments are required for primary care consultations. For instance, patients have to pay €25 after a GP consultation and they are eventually reimbursed 70% of the price by the French NHI a few days later. The remaining 30% is covered by the complementary health insurance (CHI) of the patient if any (95% of French citizens are covered by a CHI). Therefore, individuals may substitute emergency care to primary care to avoid the payment of a consultation. However, empirical evidence on the existence of such a substitution is scarce, and papers which investigated this question found mixed results. There are two mechanisms through which people might be incentivized to substitute emergency care to GP care. First, a lower level of cost-sharing for an ED visit compared to a GP consultation. Second, an absence of direct payments for ED visits. In 2006, a Massachusetts reform introduced new or better coverage for out-patient care. It resulted in a decrease of the number of ED visits per capita, that mainly concerned "non-urgent" visits [40]. But the expansion of Medicaid eligibility through the Oregon health experiment resulted in an increase in ED utilization [60], suggesting a complementary between both types of care among the population of low-income individuals. In Ireland, a reform that removed copayments for GP consultations of children under 6 had no impact on ED visits [63].

The incentives which are at stake to explain the substitution from primary care to emergency care are clear. But the distinction between the role of individual's preferences and the role of the organization of the health system in the decision to substitute is still unclear. Therefore, the use of EDs for inappropriate reasons is a sensitive issue for French politicians. They are very cautious to not taking patients responsible for it in the public debate, even if they think they are²¹. But the question of the health system organization should also be addressed in France. In particular, the organization of primary care services and the payment system for hospitals are likely to play a role on the increase in ED visits.

¹⁹The terminology "upfront payments" can be used as an alternative to the terminology "direct payments" to define payments supported by patients which take place at the moment when care is consumed.

²⁰All type of hospital care, including emergency care, is covered at 80% by the French NHI. The remaining 20% is covered by complementary health insurances (CHI).

²¹In 2022, a fixed fee of €18 will be claimed for each ED visit that do not end up with an hospitalization. The political aim of this measure is to change the patients' misperception that EDs are free.

The role of the regulation of care supply

In France, as in many developed countries, the health care system is regulated by the State directly, and through the universal National Health Insurance (NHI). Health expenditure are split into several components, of which the main are out-patient care expenditure (€85.1 billion in 2016) and hospital care expenditure (€77.6 billion in 2016) [21]. The regulation of public expenditure within each of these components is different. Out-patient care (medical and paramedical consultations, prescriptions fills...) is regulated through a cost-reimbursement scheme. Under this scheme, patients pay the care provider for the care consumed, and are reimbursed afterwards by the NHI. This system introduces a cost-sharing for patients: in the majority of cases, the French NHI reimburses 70% of consultations and drugs prices. In a market subject to imperfect information, cost-sharing permits to limit *ex-post* moral hazard by providing patients incentives to chose the optimal level of care [3, 36]. But the French health insurance system is specific since private insurance companies are allowed to propose complementary coverage to cover out-of-pocket expenditure. Therefore, we are in a situation of full coverage where demand is not price-elastic, which can lead to over-consumption of care [42, 50]. Under a full cost-reimbursement scheme, allocative efficiency (where the marginal benefit of a treatment equals its marginal production cost so that it represents the optimal quantity of care) is not ensured.

In France, the funding of hospitals is regulated by the State through a prospective payment system which was progressively implemented from 2004 to 2008. It was inspired by the Diagnosis Related Group (DRG) classification introduced in 1983 in the US. The theory of yardstick competition, proposed by A. Shleifer in 1985, is the theoretical foundation of this prospective payment [57]. Basically, it consists in setting up a fixed price that is equal to the average production cost of all other competing hospitals (which are assumed to be identical) for the production of a homogeneous good (a treatment). It encourages hospitals to invest in cost-reduction efforts - theoretically up to the optimal level - to avoid losses. Because information is incomplete, the regulator does not know the cost function of hospitals and so cannot observe cost-reduction efforts. The advantage of yardstick competition is that it still encourages hospitals to reach the efficient production level²². [57].

However in practice, the implementation of the French version of the DRG prospec-

²²Prospective payments also have adverse effects such as a lower level of quality of care provided to patients (if costs increase with quality), a selection of profitable patients, or a lower intensity of treatment, among other [31, 56]. For broader discussion on this subject in the French context, see for instance Mougeot & Naegelen (2014) [43].

tive payment for hospitals has been accompanied by several adjustments with respect to the original mechanism, which ultimately fails to achieve productive efficiency [43]. In particular, hospital prices are adjusted every year according to the actual evolution of the hospital activity, in comparison to the expected activity. Indeed, health expenditure are constrained within a capped budget whose evolution is decided by the Parliament. At the end of the year, if achieved health care expenditure exceeds the initial forecasts, hospital prices are lowered to meet the target²³. Out-patient care expenditure often exceeds the budget since they are regulated through a cost-reimbursement system [20]. In consequences, hospitals are subject to dramatic budget restrictions, which is not consistent with the logic of yardstick competition.

EDs are also funded through an activity-based payment scheme. French EDs receive a fixed fee of €27.05²⁴ per visit of which 80% is from the French NHI and 20% is paid by the patients after the visit. In addition, EDs receive from the NHI a lump sum function of the annual number of visits per ED. If patients are hospitalized, the fixed fee is replaced by the price of the DRG²⁵. This price is adjusted by the average cost of resources used at the ED by patients of the same DRG hospitalized after an ED visit. This payment system has been criticized on the grounds that it provides EDs the incentive to increase their activity [14]. In fact, EDs represent an opportunity for hospitals to recruit inpatients (and even to select the most profitable ones). But since data on the cost of an ED visit are lacking, the productive efficiency of EDs cannot be assessed.

To sum up, none of the mechanisms that are used for the regulation of care supply in France, whether it concerns the supply of outpatient care or the supply of hospital care (including emergency care), are designed to ensure efficiency in health expenditure. Because EDs are a go-between out-patient care and hospital care, they are the recipient of both *ex-post* moral hazard behaviors coming from the patients and supplier-induced demand behavior coming from the hospital. These undesirable effects arising from the regulation of the health system are likely to be partly responsible for the increase in the number of ED visits.

Another aspect of the regulation of care which influence should not be ignored is the organization of primary care provision out of office hours (OOH), i.e., during the night and weekends. Before 2002, it was mandatory for liberal physicians to ensure a continuity in the provision of OOH care. They were free to organize themselves physicians' shifts. In

²³In 2016, the amount of the global budget was €162.6 billion. Hospital expenditure were €77.6 billion, and out-patient care expenditure were €85.1 billion [21].

²⁴Prices for the year 2021 available (Source: Arrêté du 30 mars 2021, article 2).

²⁵French version of the Diagnosis Related Groups (DRG) is the *Groupe Homogène de Malade (GHM)*.

2001, liberal physicians went on strike and stopped providing OOH care [13]. It resulted in the "Mattei" reform of 2002, which provides that the provision of OOH care is decided by the regional authority²⁶, and that liberal physicians are no longer obliged to participate to this provision. In addition, the 2002 reform introduced a new payment system for OOH consultations. Primary care physicians who chose to provide OOH care receive fixed fees which depend on the time frame when the consultation takes place. These changes have resulted in a deterioration of the provision of OOH care that has been pointed out in several reports [5, 13, 12]. Although the creation of primary care communities has been encouraged by the regulator to ensure the provision of OOH care, there are not enough of these facilities and their activity is rather low [13]. In consequences, there are many places on the French territory where there is no alternative to EDs during OOH. Such failures in the organization of care supply might influence the inefficient utilization of EDs.

Consequences on efficiency

The efficiency of health expenditure

The increase in ED visits raises concerns about the efficiency of health care expenditure, because an ED visit is far more costly than a primary care consultation. In addition, inappropriate ED patients generally benefit less from an ED visit than from a GP or a specialist consultation in an ambulatory care setting (because there is no continuity of care, longer waiting times...). Therefore, public health expenditure are not efficient if a sizeable proportion of ED visits is deemed inappropriate. There are very few estimates of the cost of an ED visit for the National Health Insurance (NHI) in France. A French report estimated by a trivial calculation that cost at €161.5 in 2014. Compared to the cost of a GP consultation (€25) this report calculated that a proportion of 20% inappropriate ED visits would lead to excessive expenditure of about €500 Million [14]. A more reliable estimation of the French NHI estimated the average cost of an ED visit at about €227 [12].

Because inappropriate ED visits are a source of undesirable increase in health care expenditure, several types of public interventions have been designed to limit them. The introduction of copayments for ED visits effectively decreases ED utilization [24, 33, 18, 55]. Policies aiming at increasing accessibility to primary care services also appears to be efficient to stem patients away from EDs [24, 17, 35, 64]. Other interventions implement a triage of patients at their arrival to the ED on the basis of the urgency of their condition. According to the triage outcome, inappropriate patients can either face higher delays in

²⁶The *Agences Régionales de Santé (ARS)* are responsible for the organization of care supply at the region level.

access to treatment, or be redirected to a primary care facility, if any available. Triage policies seem ineffective to reduce ED utilization [19], but empirical evidence is lacking. In particular, such policies can be detrimental to patients if a triage error is made. Such errors, although infrequent, do happen. Since they are often reported in the media, they expose the failures of a system that is already under pressure to the public. To ensure the protection of patients' health - as well as the reputation of EDs and their mission - public policies designed to improve efficiency by preventing inappropriate visits have to be carefully chosen.

The trade-off between Health and Efficiency

The inappropriate utilization of EDs is encouraged by the free and unrestricted access of these services. Since inappropriateness threatens efficiency, it seems reasonable that governments attempt to restrict access to EDs for inappropriate patients through the implementation of copayments or patients' triage systems. However, these measures can have negative counterparts.

Since they are generally not defined as a function of patients' income, copayments are a source of inequalities in access to care. In other words, among people with identical care needs, the probability to consume care increases with income. And since people with the lowest resources also declare poorer health outcomes [1, 34, 23], copayments may limit the access to emergency care of people who actually need it. Available evidence from the US suggests that modest copayments do not increase mortality [33], but this result needs to be supported by additional studies.

The triage of patients at their arrival to ED is helpful for prioritising patients according to their degree of urgency. But in the UK, Switzerland and the Netherlands, patients who are considered inappropriate after being screened by a GP at the ED entrance are redirected to a primary care consultation. The problem is that triage errors can be made, putting at risk the health of patients who have been denied access to EDs because their conditions was wrongly deemed inappropriate. French EDs use a triage system to evaluate the severity of patients' condition at their arrival in the service²⁷. This is a non-binding triage system since all patients are eventually seen by a doctor. But results of the triage are used to order patients on the waiting list, with the most urgent patients on top. In the 2013 "Enquête Urgence" survey mentioned above, triage errors were made for 4.7% of all patients. Put differently, it means that 4.7% of ED visits were deemed inappropriate

²⁷Clinical Classification of Emergency Patients (*Classification Clinique des Malades des Urgences (CCMU)*).

at the triage process but appropriate after a consultation with a physician²⁸. These errors accounted for 21% of patients who received the "inappropriate" evaluation at the triage process.

Restricting access to EDs increases the risk of occurrence of undesirable clinical outcomes. On the contrary, ensuring unrestricted access to EDs can favour the increase in the number of inappropriate ED visits and so can contribute to deteriorate efficiency. Therefore, (1) preserving the health of patients, and (2) ensuring the efficiency of the system appear as conflicting objectives. The existence of this trade-off is important to bear in mind for policy makers. Policy interventions aiming at increasing access to primary care to provide alternatives to EDs try to match these two objectives, since they seek to reduce inappropriate utilization without restricting access.

The overcrowding of EDs

The other problem raised by the increase in inappropriate ED visits, beyond efficiency concerns, is the congestion of EDs [4]. Of course, the overcrowding of EDs is also cyclical, and it increases during the influenza season [32]. But congestion can be observed outside epidemic peaks. This suggests that congestion is influenced by other determinants, such as the proportion of inappropriate ED visits, a lack of resources and bed availability constraints to hospitalize or transfer patients after a visit [32, 41].

In fact, although EDs are highly accessible, they have the properties of a common good: they are almost always non-excludable, but evidence of overcrowding and its consequences show that they are rivalrous. For a given individual, the utilization of EDs by other patients is a source of negative externalities for the utility he or she can get from its own utilization. In particular, the increase in ED queuing decreases the amount of resources available per patient, resulting in a decrease in the intensity of treatment [37]. Intuitively, ED overcrowding increases waiting times [37] for all patients, including those with urgent care needs [39]. It results in a decrease in patient's satisfaction [41]. But more importantly, it has negative consequences on patients' health outcomes since it increases the risk of serious complications and even mortality [39, 32, 41]. Doctors in the ED are aware of these consequences. They know that they are more prone to make errors in times of congestion so they offset this risk by taking conservative decisions for patients' health. Evidence show that hospitalization rates increase with ED congestion [26]. In particular, probabilities of

²⁸The triage indicator has seven categories. First "inappropriate" category represents patients who are in a stable condition and who do not require any treatment. This category was initially used in a public report to assess the proportion of inappropriate ED visits in France [14].

unnecessary hospitalizations increase with congestion. Currently, two-stage triage systems are introduced to limit wrongful discharges²⁹ [25].

Therefore, overcrowding has a negative impact on ED efficiency and hospital revenues [39, 32]. It also has negative consequences on the ED staff since it increases stress and the exposure to violence, and decreases the adherence to best practice guidelines [41].

In order to reduce congestion, the NHS in the UK popularised a within-ED policy intervention which obtained positive results. Under this policy, called the "four-hour target", EDs are strongly incentivized to treat the majority of patients within 4 hours. Results of a study that evaluated the effects of this policy target found that it decreased waiting times and mortality [28]. The four-hour target is used in several countries, including France, as an indicator of production efficiency of EDs. But the overcrowding of EDs is mainly caused by the increase in inappropriate ED utilization and bed managements issues in the other services of the hospital. Therefore, the solutions to this problem lie essentially outside the ED (by increasing primary care alternatives and improving bed management) [41].

The thesis purpose

In this thesis, we study the role served by EDs within the French health system. EDs are the recipient of urgent conditions that are hospitals' and EDs' concerns. But they are also the recipient of conditions that are the concern of general practices and primary care services more broadly. For decades, ED visits are increasing faster than care needs resulting from population's growth and aging. This suggests a rise in the proportion of ED visits that are deemed inappropriate, i.e. that could be treated in an out-patient care setting. The growing burden of inappropriate visits threatens the efficiency of EDs. In addition, the rise in ED visits was encouraged by the implementation of a prospective payment system to regulate French hospitals and EDs. In this thesis, we use micro-econometrics' analyses to address the following question: (1) What is the impact of the opening (or closing) of an ED on a private hospital activity and revenue ?; (2) To which extent are patients responsible for inappropriate ED visits ?; (3) Does the abolition of direct payments for medical consultations reduce ED visits ? Our findings provide some insights on the mechanisms that contribute to the rise in ED visits, which enables us to derive solutions in terms of public interventions to improve efficiency.

²⁹Under a single-stage gatekeeping system, the physician in charge of the triage must take a univoqual decision: the patient is either admitted or discharged. Under a two-stage gatekeeping system, the physician has the possibility to refer the patient to a clinical decision unit (CDU) if the decision is unclear. The CDU is less time constraining to treat patient. They can carry out additional examinations and tests. The final decision to admit or not the patient is ultimately taken by the CDU on the basis of the tests' results.

The data

This empirical thesis relies on several different databases regarding hospitals (Chapter 1), ED visits (Chapter 2) and patients (Chapter 3). We use them to implement micro-econometrics' analyses in each chapter. In the first chapter, we use an administrative data-set built from the *Statistique Annuelle des Etablissements de santé (SAE)* database. These data contain information on hospitals' inputs and outputs that we use to identify openings and closings of EDs taking place at the hospital level. We have merged these data with hospitals' number of admissions coming from the administrative PMSI database, and study the impact of EDs' openings (respectively closings) on hospital's activity and revenue.

The second chapter uses a survey headed by the French Ministry of Health that records information about all the visits to EDs that took place on one day of 2013. These information include patients' characteristics, and characteristics of the health system (the provision of out-patient care around EDs). These data have the advantage to provide a direct measure of the visit appropriateness completed by physicians at the ED. We rely on this survey to analyze the determinants of inappropriate ED visits, and the respective contributions of patients' and system's characteristics to the appropriateness of visits to EDs.

In the third chapter, we use another administrative data-set which comes from panel database that exhaustively³⁰ records out-patient care and hospital care consumed by all individuals who are affiliated to the French NHI³¹. In France, all the care consumed by these individuals is recorded in the *Système National d'Information Inter-Régimes de l'Assurance Maladie (SNIIRAM)*. These data are part of the *Système National des Données de Santé (SNDS)*, a pool of several databases managed by the French NHI. The data we use are the *Echantillon Généraliste de Bénéficiaires Simplifié (EGB-S)* which consist of a longitudinal sample of 1/97 individuals from the SNIIRAM data. This sample has the advantage to provide historical data on the care consumption of individuals up to 20 years. We rely on this database to assess the effect of a 2017 reform that abolished direct payments for all the care consumed by pregnant women after 6 months of pregnancy.

Access to these databases is restricted for two of them³²: the "Enquête Urgence" and the EGB-S (SNIIRAM).

³⁰Since 2016, data cover 95.6% of the French population.

³¹All French residents are covered by the French NHI.

³²Data used in the first chapter consists of a total of the number of admissions by hospital-year extracted from the PMSI. This data is not sensitive since there are no information reported at the individual (patient) level. Therefore, access to this data did not require any form of accreditation. We thank the Fédération Hospitalière de France (FHF) for extracting the data used in this chapter.

Data from the "Enquête Urgence" are managed by a department³³ of the French Ministry of Health³⁴. The data are anonymized and used exclusively for research and/or statistical purposes. The use of the database "Enquête Urgence" in this thesis was made possible through a collaboration between the University of Paris Dauphine and the French Ministry of Health (DREES). This collaboration provided resources (an office and a computer) and access to the survey to the author of this thesis, in return for the author's participation in DREES projects³⁵. This collaboration ensured the independence of the researchers of the University of Paris Dauphine. The DREES did not contribute to the research reported in this thesis but provided useful comments at conferences or seminars. We are grateful to them.

For the third chapter of the thesis, we use longitudinal data from the SNIIRAM database (EGB-S). Access to this data is restricted to researchers because it contains patients' personal details. However, a lot of safeguards are introduced to prevent the identification of patients. For instance, the simultaneous display of so-called "sensitive" variables (patient's age, place of residence, date of death and the date of care at the daily level) is prohibited. More precisely, a data-set is made accessible to researchers if it records only one out of these four variables. The permission to have several sensitive variables in a unique data set can be granted only if the analyst is a physician or if it is supported by the research project. In the case of this research, we justified for the need to observe the patients' age, place of residence and date of care. Another safeguard to mention is the data environment. Data are supplied within a secured SAS environment. Access is made through a portal dedicated to the identification of data users through an encrypted password. The export of data at the individual level is not allowed by the system. Therefore, all analyses must be carried out within the SAS environment. A memory size of 2,684,354,560 bytes is attributed to each user personal environment. But this memory is often insufficient to perform econometrics estimations that require resource-intensive matrix operations (as for fixed effects models with large N). The problem of insufficient memory limits the potential for econometrics analyses on big data. Getting access to these data was a long and tedious process.

Before the data can be used, a request of access must be sent to the Health Data

³³Direction de la Recherche, des Etudes de l'Evaluation et des Statistiques (DREES).

³⁴More informations available from [this URL](#).

³⁵The author contributed to the construction of a database that indicates the availability of primary care services out-of-office hours at the zip code level. This database can be merged to the survey "Enquête Urgence" to control for care alternatives to EDs during the night. In addition, the author completed an unpublished research project on "the patients' reasons for coming to EDs", using data from the "Enquête Urgence".

Hub. This organisation controls and delivers access to SNDS databases. The request must present the research projects and motivate the needs for the data. A committee composed of independent researchers called the CESREES³⁶ is mandated to produce an evaluation of the project. This evaluation takes into account the public utility of the research and the feasibility of the project. The final decision to authorize access to the data is taken by the *Commission Nationale de l'Informatique et des Libertés (CNIL)*³⁷, based on the evaluation produced by the expert committee. We presented a request application for the EGB-S database in January 2019. Access to data was authorized by the CNIL in October 2019. But to be accredited to work on this data, the data analyst must complete two training programs: (1) a theoretical course that presents the structure of the SNIIRAM data, and (2) a three-days program specific to the EGB-S database, with practical applications on the data. In 2019, the cost of training program (1) was €362 and the cost of training program (2) was €976. We completed these programs by the end of January 2020.

Finally, we obtained data consistent with the needs of the research in September 2020. It took a year and a half to obtain effective access to SNDS data. So, in addition to the well-known difficulty to manage these data, it is important to underline that procedures to get access to them are both time and money consuming.

Chapter I

In 2001, a French reform encouraged the creation of EDs among the private-for-profit (PFP) sector. The first chapter analyzes the consequences of this reform on the activity of PFP hospitals. Specifically, we study the impact of ED opening (or closing) on hospital's activity and revenue. Most of the literature on EDs focuses on the influence of inappropriate ED visits to explain the observed increase in the number of visits. However, a few papers have analyzed the influence of supply-side factors on this increase. We use an unbalanced panel dataset coming from the SAE and the PMSI databases which consists of 376 French PFP hospitals observed between 2002 and 2012. Data allows us to observe the openings and closings of EDs. It also contains indicators of hospital's activity, such as the number of stays (with or without overnight), bed occupancy rates, the average length of long stays (stays with overnight) and revenue. The impact of ED opening or closing is estimated through hospital fixed-effects models. Our results show that increasing their participation to the public service through the opening of an ED is positive for a PFP hospitals. We find that an ED opening leads to a +11% increase in

³⁶ *Comité éthique et scientifique pour les recherches, les études et les évaluations dans le domaine de la santé.*

³⁷ French agency in charge of the protection of personal data.

the revenue per admission through an increase in the proportion of long stays (+12.6%) and in their intensity. Consequently, we find a positive impact of an ED opening on the total revenue of the hospital (+6.5%). These results are, to our knowledge, the firsts to provide empirical evidence of the influence of EDs on hospitals' activity. They suggest that beyond the direct income coming from ED visits, EDs have an indirect impact on hospitals' revenue because of the increase in the number and the intensity of long stays. Therefore, the hospital payment system per stay that encourages an increase in the number and in the casemix of stays might provide incentives to also increase the number of ED visits. Our results provide a supply side explanation to the observed increase in the number of ED visits, supported by the effect of EDs on hospitals' revenue.

Chapter II

In the second chapter, we estimate the determinants of inappropriate ED visits, and compare the respective contributions of patients' characteristics and of out-patient care organization to ED visits inappropriateness. The survey we use (*Enquête Urgence*) presents the advantage of recording a direct measure of appropriateness of ED visits. This measure was completed by a physician for all patients who presented to an ED between 11 June 2013 at 8am and 12 June 2013 8am in France. Our data concerns 15,714 visits observed in 439 EDs. Detailed information is available on both patients' characteristics and on the characteristics of the health care system (availability of GPs, time of the visit, alternatives to EDs, among others). To examine the determinants of inappropriate ED visits, we consider a recursive two-equation model where the first equation describes patient decision to visit ED on self-referral, and the second explains the appropriateness of the visit, conditional on this decision. We use an Instrumental Variable (IV) estimator to deal with the non-exogeneity of the self-referral decision. We allow for fixed effects at the ED level in the estimation. We find that patients' decision to visit EDs on self-referral has a huge impact on the appropriateness score of the visits: 84% of its explained variance is due to this decision. But this decision is determined by both patients' characteristics and characteristics of the out-patient care system. Therefore, we use the reduced form of the two-equation model to estimate the respective contributions of patient's and system's characteristics to the inappropriateness of ED visits. We find that 72.7% of the explained score variability is due to patient characteristics and 27.1% to the management of out-patient care provision. Taken together, our results show that policies whose objective is to improve the efficiency of recourse to EDs must focus on patient decision to come on self-referral. They also suggest that policies aiming at increasing out-patient care supply have the potential to further substantial efficiency gains.

Chapter III

In the third chapter, we analyze the effect of a 2017 French reform that removed direct payments and cost-sharing for all the care consumed by pregnant women after 6 months of pregnancy. Since 96% of the French population hold a CHI that covers the cost-sharing, the main effect of the reform is the abolition of direct payments. Direct payments can deter care utilization because they impose a liquidity constraint on individuals' income. In 2000, they were already removed for low-income individuals, through the introduction of a free complementary health insurance (CHI) called "CMU-C" which ensures full insurance and no direct payments to beneficiaries. Since the sensitivity of care consumption to liquidity constraints is mostly a concern for low-income patients, it is legitimate to question the need for the 2017 reform. But because the maximum income to be eligible to the CMU-C is very low (70% of the French poverty level), there might still be individuals who are liquidity constrained by the price of a medical consultation. To address this question, we analyze the impact of the 2017 reform on the number of consultations of pregnant women. We rely on data from the EGB-S, which consists of a sample of the SNIIRAM database that contains exhaustive records of the care used by French individuals affiliated to the French National Health Insurance. Using a triple differences (DDD) estimator to assess the causal impact of the reform, we find that the abolition of direct payments for care consultations resulted in (i) an increase in the number of GP consultations, and (ii) a decrease in the number of midwife consultations. These results suggest that before the reform, pregnant women substituted midwives to GPs because midwife's consultations were cheaper. It provides empirical evidence of the presence of liquidity constraints for care in France. Then, we examine the possible spillover effects of the reform on the number of visits to the Emergency Department (ED). Since direct payments were not required in most EDs before the reform, pregnant women with liquidity constraints could substitute an ED visits to a GP consultation to avoid direct payments. We find no impact of the reform on the number of ED visits, suggesting that the absence of direct payments did not encourage liquidity constrained patients (here, pregnant women) to use EDs for non-urgent conditions. This paper is the very first to estimate the causal impact of the French *Tiers-Payant* reform on out-patient care consultations. It is also the first, to our knowledge, to provide empirical evidence of the existence of liquidity constraints and to assess their influence on access to medical consultations. This paper has several contributions to the literature. First, it contributes to a very scarce literature on the sensitivity of care consumption to direct payments. Second, it contributes to the literature on the determinants of an inappropriate use of EDs by providing evidence that liquidity constrained individuals do not substitute ED visits to GP consultations. Our results should be taken with caution and not generalized to all patients, since we estimate

an average effect on the treated (i.e., the population of pregnant women). We recommend that an experimentation is conducted to confirm these results in the general population.

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Chapter

1

What is the impact of emergency care on private hospitals' activity? Evidence from the French hospital industry

This chapter is co-authored with Brigitte Dormont (Université Paris-Dauphine, PSL).

1 Introduction

Since the late 1990s, the French healthcare system has faced a rapid increase in the number of visits to emergency departments (ED). In 1998, the number of visits to ED was about 11.3 million in France of which 2.3% took place in private-for-profit (PFP) hospitals [3]. Twenty years later in 2018, 21.8 million patients visited an ED. Among them, 13.8% were treated in a PFP hospital emergency room service [11]. An increase in ED visits is also observed in a majority of OECD countries [4] and many factors explaining this growth have been discussed in the literature [18, 7]. Emergency Departments are care facilities that are generally free from direct payments and accessible for everyone at any time (24/7), regardless the resources of patients. If most patients visit ED for conditions that are deemed "urgent" by doctors, a significant part of them also uses ED for conditions that do not represent an emergency situation [5, 4]. On the one hand, patients might substitute emergency care to primary care for financial reasons since the majority of EDs exempt their patients from direct payments, resulting in a misperception of gratuity. On the other hand, patients might substitute emergency care to primary care for non-financial reasons, as for instance the availability of these services at any time, or their convenience since complementary examinations can be carried out after a few hours of waiting (in opposition to delays of several weeks to have an appointment with a specialist in an outpatient care setting). All these reasons participate to an increase in the number of ED visits which is much more rapid than the increase in needs due to population aging. It is a source of concerns for many countries because at some point, the maximum capacity of ED is reached, and resources are lacking. The consequences of a supply shortage for emergency care is congestion, which is associated with higher waiting times, poorer outcomes (including increases in mortality rates), lower satisfaction for patients, and poorer working conditions for the ED staff [15, 18]. In 1989 and 1995, the lack of medical resources and the deterioration of working conditions for physicians in French EDs was reported at the French Senate [22] [23]. To solve these problems, the French government has created in 2001 conditions to increase the provision of emergency care in two ways. First, public funds were allowed to create new EDs and to modernize the existing structures. Second, a generous activity-based payment scheme was introduced for ED visits in PFP hospitals in order to encourage them to supply emergency care. As a result, the number of EDs raised from 616 to 750 between 2002 and 2011 [24], mostly due to openings in the private for profit sector. A French report pointed out that this reform conducted about a hundred PFP hospitals to apply for, and to receive the authorization to operate an ED [8].

Most of the literature analyzes the determinants of emergency care utilization from

the perspective of the demand (the patients). Very few research has been conducted to explore the influence of supply-side factors, as for hospital's financial incentives, on the rise of ED visits. One study conducted by the RAND on data from 60 US communities found that unscheduled ED visits were responsible for nearly all the growth in inpatient admissions observed between 2003 and 2009 [17]. It depicts the importance of the ED contribution to hospitals admissions at a national level. In this paper we contribute to this rare literature by showing that openings of EDs have an influence on hospitals' activity beyond ED visits. Specifically, we estimate the impact of ED openings (and closings) on the activity of private for profit (PFP) hospitals in France during years 2002-2012, when a payment reform triggered the creation of EDs among PFP hospitals. Several indicators are considered for hospital activity: number of admissions and its breakdown between long stays (at least one overnight) and day cases, bed occupancy rates and average length of stays for long stays, hospitals' revenues, in total, and revenues from long stays, or from day cases.

We use an administrative survey on French hospitals to build a panel of French private hospitals observed between 2002 and 2012, with information about the openings and closings of EDs. The estimation of fixed effects models show that the opening of an ED has a strong impact on the composition of hospitals' activity. While it has no impact on the total number of admissions, we find that it leads to a +14% increase in the number of long stays and to a break in the growth in day-cases that was prevailing before the ED opening. As a result, the proportion of long stays increases significantly (+12.6%), as well as the bed occupancy rate (+9%). On a shorter period, it was possible to estimate the impact of ED opening on hospitals' revenues. We find that a hospital total revenues increase by 6.5% after an ED opening. This increase is due to the rise in the number and in the complexity of long stays. Indeed, following an ED opening, we find that revenues due to the day-cases activity decline, while total revenues and revenues per stay increase for long stays, showing an increase in the case mix. To sum up, an ED opening creates the conditions for a change in the hospital activity: the stays are not more numerous, but proportion of long stays increases, and they are characterized by a higher case mix.

This paper is organized as follows. In the next section, we describe briefly the French hospital industry and the regulation of emergency care activity. Then we present the data in section 3. We present our empirical strategy in section 4, and results in section 5. We discuss the strengths and the limits of our work and conclude in section 6.

2 Emergency Departments and the French Hospital Industry

In France hospital care is covered by the universal social health insurance, whatever the hospital's ownership: public, private-for-profit (PFP) or private non-profit (PNP). Public hospitals carry out most admissions in France but PFP hospitals still achieve a sizeable portion. Indeed, 56.7% of total hospital stays in medical surgical and obstetrics' (MSO) departments take place in the public sector in 2012, 35.4% in the PFP sector and 7.9% in the PNP sector [10]. In the early 2000s, a prospective payment system per stay called "*Tarification à l'Activité*" (T2A) was introduced to finance the MSO activity. This prospective payment per stay was implemented to encourage efficiency gains. It was introduced in 2004 for public and PNP hospitals in replacement of a global budget, and in 2005 for PFP hospitals in replacement of a fee-for-service scheme. Prior to 2005, the funding of PFP hospitals was based on a fee-for-service system with reimbursements covering hospital stays and medical procedures [12]. Before and after the reform physicians are paid through a fee-for-services scheme in the private sector. Prospective payments per stay are known to generate incentives to increase the number of hospitalizations and care intensity [14, 19, 20]. Such reactions were stronger for public and PNP hospitals because they were previously funded by a global budget. The T2A reform had little impact on PFP hospitals' activity since they were already funded by an activity-based payment scheme. A French descriptive study found a noticeable change in the case mix concomitant with the introduction of the T2A, but no significant increase in the number of admissions or productivity of PFP hospitals [21].

French hospitals are subject to different rules as regard investments, human resources management and patient selection depending on their ownership type. In the public sector, the number of beds is defined by an administrative authority, and doctors, nurses and other employees are civil servants. In addition, public hospitals must guarantee a continuous access to care for all patients 24 hours a day and 7 days a week. On the contrary PFP hospitals are allowed to choose their patients for elective surgery and to specialize in a limited number of areas. Payments and rules for EDs are identical for public and PFP hospitals. EDs must be fully equipped to provide medical or surgical care to any patient requiring immediate care or resuscitation at any time. In France ED must welcome and treat without selection any individual presenting in need of care. EDs are highly accessible facilities since they are 24/7 open. Direct payments are not required in the vast majority of EDs though patients may be charged for out-of-pocket payments after a visit¹.

¹The cost-sharing for emergency care and for hospital care in general is 20% in France. Cost-sharing

Emergency care activity is subject to an authorization delivered by the regulator of care supply at the regional level. To apply for the creation of an ED, hospitals must be able to supply the following types of care: resuscitation, anesthesia, medical, surgical and obstetrics. The creation of an ED is granted if the hospital project is in line with the regulator objectives. Applying hospitals contract with the regional authority to define the objectives to be achieved by the future ED (number of visits, estimated expenditure for the NHI etc). The final decision of opening authorization for the opening of an ED is taken by the regional authority. A refusal or a closing decision may be motivated by one or more of the following reasons: (a) the application file is insufficient, (b) the hospital project is not compatible with the regional organization of care supply, (c) the healthcare needs of the population are met, (d) the hospital refuses to subscribe to some objectives of the contract set by the regulator. To sum up, the willingness to open an ED is initiated by the hospital through an application. But the final decision is quite exogenous and is taken by the regulator with respect to the care supply policy that is conducted in the region.

Before changes that occurred in 2001, PFP hospitals claimed higher payments for ED visits. They pointed out the insufficiency of the budget allocated to hospitals to cover the fixed cost of ED. In 2001, a more generous payment scheme was introduced, that triggered the development of emergency care activity within the PFP sector. It was made of two components. First, an annual lump sum that depends non-linearly on the total number of ED visits received during the year. Second, a fixed price per ED visit of about €25. In 2004, this payment system has replaced the global budget to fund ED in public and PNP hospitals when the T2A was introduced. Since 2005, private and public hospitals are financed with the same payment scheme. The payment received for an ED visit depends on patients' trajectories. If the patient is discharged after the visit and returns home, the hospital receives the two components of the ED payment: €25 plus the inclusion of the visit in the lump sum calculation. If the patient is admitted to hospitalization after the visit, the hospital receives the payment of the corresponding DRG. Note that the computation of DRG payments is influenced by the costs of emergency care provision in proportion to the share of entries through the ED.

for outpatient care (for instance a consultation with a general practitioner) is 30%.

3 Data

We use an unbalanced panel dataset of French PFP hospitals observed over 2002-2012 to analyze the impact of ED openings (*resp.* closings) on hospital activity. We combine two datasets: the *Statistique Annuelle des Etablissements de santé (SAE)* and the *Programme de Médicalisation des Systèmes d’Information (PMSI)*. The SAE is a yearly compulsory survey of all French hospitals conducted by the French Ministry of Health. We use this dataset to observe the openings and closings of EDs, as well as the number of ED visits by year, and to calculate the occupancy rate of beds by dividing the number of hospitalization days by the number of available bed-days. The PMSI is an administrative database measuring hospitals outputs in terms of stays in different DRGs. The French classification of admissions considers *Groupes Homogènes de Malades (GHM)*, that are inspired by the DRG classification. We observe the number of stays in medical, surgical, and obstetrics (MSO) services that occurred in each hospital per year. We focused on MSO admissions because it represents more than 90% of patients hospitalized from EDs [2] and the payment system is identical for all MSO admissions (as opposed to admissions in psychiatry or long-term care services for instance). In the total number of admissions, we distinguish stays with at least one night at the hospital from day-cases (without overnight). To simplify, we call hereafter stays with overnight “stays” or “long stays”, to be distinguished from day-cases.

We restricted our sample to non-missing observations on the variable of interests leading to the exclusion of 33 PFP hospitals² (200 observations). Small hospitals (with less than 5,000 admissions by year) were over-represented in the excluded observations and thus less frequently had an ED (see appendix 1.B table 1.B.1). We also excluded 10 hospitals (53 observations) that changed their ownership during the period. Because we specify hospital fixed-effects models with trends (see section 4) we selected hospitals observed for at least 4 consecutive years between 2002 and 2012. This led to the exclusion of 67 hospitals (262 observations). In total, the sample used for the econometric’s analysis is composed of 376 PFP hospitals (3,528 observations) observed for at least 4 consecutive years between 2002 and 2012. It covers 60% of the total number of admissions recorded in the PMSI by PFP hospitals during the 2002-2012 period. We focus the analysis on PFP hospitals because almost all the ED openings events took place in this sector following the ED payment reform of 2001. We observe 30 ED openings and 6 ED closings occurring

²We apply the same restrictions for the efficiency outcomes (bed occupancy rates and average length of stay). The missing values on these outcomes lead to the deletion of 8 additional hospitals to run the regression reported in table 1.4.

between 2002 and 2012³ (see appendix 1.A table 1.A.1).

Table 1.1: Hospital activity by ownership

Year	Public		PFP		PNP	
	2002	2012	2002	2012	2002	2012
Number of hospitals						
N	366	414	299	302	65	69
%	50.14%	52.74%	40.96%	38.47%	8.90%	8.79%
Hospital activity						
Number of admissions						
Mean	21,393	22,294	10,708	14,467	8,708	10,927
(SD)	(47,274)	(49,957)	(5,428)	(8,282)	(6,989)	(10,902)
Share of day-cases in ad-	26.80%	28.24%	36.40%	50.24%	32.04%	37.01%
missions						
Number of beds						
Mean	368	326	115	130	126	131
(SD)	(852)	(720)	(57)	(73)	(108)	(126)
Bed occupancy rate						
Mean	78.49%	82.71%	77.46%	62.71%	73.77%	77.88%
(SD)	(0.0865)	(0.0836)	(0.2673)	(0.1551)	(0.1157)	(0.1868)
Emergency care activity						
Number of EDs						
Share of hospitals with	92.35%	89.37%	24.41%	36.75%	40.00%	44.93%
ED						
Number of ED visits	10,626,806	14,209,924	915,617	2,065,351	454,805	708,990
(sum)						
- Share in total	88.58%	83.66%	7.63%	12.16%	3.79%	4.17%

Source: Author's calculation from a sample of 902 hospitals observed at least 4 consecutive years between 2002 and 2012. In all, 435 hospitals are public, 376 hospitals are private-for-profit (PFP), and 91 hospitals are private-non-profit (PNP).

Table 1.1 shows that the share of public hospitals holding an ED remained stable to close saturation (around 90%) between 2002 and 2012 while this share for PFP hospitals raised from 24% to 37%. Similarly, the share of ED visits that occurred in PFP hospitals increased from 7.7% in 2002 to 12.2% in 2012. One characteristic of PFP hospitals is their specialization in ambulatory care (i.e. day-cases). In 2012, 50% of PFP hospitals' activity was made of day-care admissions against 28% for public hospitals.

4 Method

We estimate hospital fixed-effects models to analyze the impact of ED opening or closing on hospital activity. The fixed-effects specification controls for hospitals heterogeneity related to time invariant unobserved characteristics that can be correlated with

³We observe less openings than what is stated in the French report from the *Cour des Comptes* [9] in 2002 because our data starts in 2002. Therefore, we can not observe the openings of ED that took place in 2001 or 2002. The openings we observe then correspond to a persistent effect of the reform. Our results might be downward biased if the impact of an opening was stronger for the first openers.

the decision to apply for an ED opening. The estimated specification is the following, where h and t stand for the hospital and year of observation ($t = 2002, \dots, 2012$):

$$\begin{aligned}
 Y_{ht} = & \beta_0 + \beta_1 X_{ht} + \lambda OPEN_{ht} + \eta CLOSE_{ht} + \gamma_1(t \times ED_h^{neverED}) \\
 & + \gamma_2(t \times ED_h^{alwaysED}) + \mu_1(t \times ED_h^{openers}) + \mu_2(t \times ED_h^{closers}) \quad (1.1) \\
 & + \mu'_1[(t - \tilde{t}_h) \times OPEN_{ht}] + \mu'_2[(t - \tilde{t}_h) \times CLOSE_{ht}] + \alpha_h + \epsilon_{ht}
 \end{aligned}$$

The outcome Y_{ht} represents the activity of hospital h in year t . It is observed through production indicators (the log of the total number of admissions, split into long stays and day-cases) and indicators of an efficient use of inputs (beds occupancy rates, average length of long stays). Regarding the impact of ED opening or closing, our specification allows for shocks on levels and trends of the outcomes. Impacts on levels are captured with dummy variables that switch from 0 to 1 with the opening (or closing) of an ED⁴.

Shocks on trends are specified by introducing specific time trends for hospitals that have an ED throughout the period ("always ED"), hospitals that never have an ED ("never ED"), hospitals that experience an ED opening (openers), and those that experience an ED closing (closers), together with variables allowing for the estimation of a trend change after ED opening (or closing). For an opening, for instance, this variable is equal to 0 before the opening at the date \tilde{t}_h , and is then equal to $t - \tilde{t}_h$.

In addition, our model include control variables at the hospital level denoted by X_{ht} . It includes hospital size⁵, the number of beds by MSO departments and the density of primary care physicians in the *département*⁶ of the hospital. Controlling for physician's density is important because general practitioners and specialists can act as gatekeepers for access to hospital care and ED. Moreover, many self-employed specialists are used to work in a close collaboration with one or more PFP hospitals, for which they contribute to patient recruitment⁷. We also include a dummy variable equal to 1 when the (T2A) payment reform is introduced in 2005 (for PFP hospitals) to control for the possible confounding effect induced by this reform.

⁴The dummy variables $OPEN_{ht}$ and $CLOSE_{ht}$ are always equal to zero for hospitals that have an ED throughout the period and hospitals that never have an ED.

⁵Hospital size is defined by the *Agence Technique de l'Information sur l'Hospitalisation (ATIH)* through the total number of admissions during a year. Small hospitals receive less than 5,000 admissions, medium hospitals receive more than 5,000 and less than 10,000 admissions and large hospitals receive more than 10,000 admissions per year. So hospital size is not a time-invariant characteristic of hospitals which is why it is included in the estimations.

⁶Administrative territorial division smaller than the region.

⁷It is also common practice for a physician to work both as an employee of a hospital and as a self-employed physician in its own practice dedicated to outpatient consultations. It gives them the opportunity to hospitalize their own patients in their affiliated hospital.

Finally, we control for shocks as mergers (or splits) and hospital creations (or closures) in the hospital's proximity. The creation (*resp.* closure) of a hospital k may reduce (*resp.* increase) the demand of a hospital h if they are relatively close. To control for these demand shocks we introduce a dummy equal to 1 for hospital h after a shock induced by hospital k located in the same *département*. Standard errors are clustered at the level of the region because the organization of care supply, including the decision to open or to close an ED, is taken by the regional authority, and regions encompass *départements*.

5 Results

Table 1.2 shows the average yearly growth rates of hospital outputs by hospital groups⁸. The total number of admissions increased for all groups during the period but more importantly for ED openers (+3.8%). Never-ED hospitals have a decrease in their number of long admissions (-1.9%), whereas their number of day-cases increases sharply (+16.1%). The three other groups experience a less rapid growth in day-cases (+6.2% and +7.9%, respectively, for always-ED and ED-openers) and a slow increase in long stays (+0.2% and +1.1%, respectively, for always-ED and ED-openers). Otherwise, Never-ED and Always-ED hospitals show opposite evolutions of their efficiency indicators: the bed occupancy rate is decreasing, and the LOS is increasing for the former, while the reverse is true for the latter. The bed occupancy rate of ED openers is decreasing by -1.1% yearly, but this does not preclude a possible improvement when the ED opens.

Tables 1.3 and 1.4 display the estimates of equation (1.1). Table 1.3 presents the effect of an ED opening (*resp.* closing) on the log of the number of admissions, the log of the number of long stays, the log of the number of day-cases, as well as the log of the share of long stays in the total number of admissions. Table 1.4 presents the estimated impact of an ED opening or closing on the efficient use of inputs.

5.1 Impact on the number of admissions

Results presented in Table 1.3 show that opening an ED is associated with a +14% increase in the number of long stays, conditionally on the number of beds. As for all hospitals, PFP hospitals are not allowed to select patients coming to the ED, so they must deal with a broader (and potentially more severe) range of conditions that can explain this increase. Yet in total, we do not find an increase in the total number of admissions following an ED opening. It suggests that PFP hospitals repositioned their

⁸Table 1.A.2 in appendix 1.A reports the means values of the outputs presented in table 1.2 for years 2002 and 2012, by hospital groups.

Table 1.2: Yearly growth rates for Private-for-Profit hospitals 2002-2012

	(1)	(2)	(3)	(4)
	Never ED	Always ED	Openers	Closers
	mean/sd	mean/sd	mean/sd	mean/sd
<i>Number of admissions</i>				
All admissions	1.60 (16.78)	2.31 (11.92)	3.83 (11.42)	1.46 (8.22)
Long stays	-1.95 (16.59)	0.16 (12.75)	1.06 (10.86)	0.65 (7.45)
Day-cases	16.14 (223.57)	6.18 (18.95)	7.97 (19.35)	4.31 (19.27)
<i>Efficient use of inputs</i>				
Beds occupancy rate	-1.15 (35.64)	2.27 (50.08)	-1.09 (10.97)	-2.02 (9.89)
Average length of long stays	0.07 (21.06)	-0.40 (10.14)	-0.25 (8.95)	-0.36 (13.65)
Observations	2,043	784	274	51
Number of hospitals	253	87	30	6

Source: Authors' calculation from a sample of 376 PFP hospitals observed at least 4 consecutive years between 2002 and 2012.

Notes: Average annual growth rates (%) are presented. Standard deviations in parentheses.

activity towards a higher proportion of long stays: in column 4 we see that this proportion increases by +12.6% after an ED opening. We do not find a significant impact of an ED opening on the level of day-cases, but the change on their trend goes in the same direction: the rapid growth of day-cases estimated before the opening (+5.3%) is stopped afterwards. The change in their trends is significant and equal to -4.4%, slowing the post-opening trend to zero (see tests at the bottom of table 1.3, third column, p-value=0.374).

We do not find any significant impact of ED closing, probably because of the small number of such event we observe in the data (6). There is no change in levels and trends associated to an ED closing. Results on the control variables show that the number of day-cases increased for PFP hospitals after the T2A payment reform which has created incentives to develop the number of admissions, and especially day-cases⁹ [6] [16]. Otherwise, the role of primary care physicians (GP and specialists) appears with a positive association between the density of physicians and the number of day-cases.

⁹Their payments were particularly generous and after 2009 some medical interventions were paid equally for an overnight stay and a day-case

Table 1.3: Impact of ED openings (*resp.* closings) on the log of admissions

	Total number of admissions b/se	Number of long stays b/se	Number of day-cases b/se	Proportion of long stays b/se
ED event				
OPEN	0.004 (0.032)	0.141** (0.067)	0.014 (0.064)	0.126** (0.057)
CLOSE	0.037 (0.056)	0.006 (0.036)	0.055 (0.146)	-0.031 (0.066)
Trends				
Never ED	-0.004 (0.002)	-0.029*** (0.005)	0.022*** (0.004)	-0.025*** (0.004)
Always ED	0.001 (0.004)	-0.012** (0.004)	0.015** (0.006)	-0.013*** (0.002)
Openers	0.028*** (0.007)	-0.051 (0.037)	0.053*** (0.013)	-0.081** (0.033)
Change in trend after opening	-0.030*** (0.006)	0.034 (0.038)	-0.044*** (0.011)	0.067* (0.035)
Closers	-0.014 (0.011)	-0.027*** (0.007)	-0.015 (0.036)	-0.012 (0.008)
Change in trend after closing	-0.005 (0.018)	0.015 (0.016)	-0.006 (0.056)	0.018 (0.018)
Controls				
<i>Hospital size</i>				
Small	ref.	ref.	ref.	ref.
Medium	0.318*** (0.036)	0.262*** (0.044)	0.372*** (0.104)	-0.037 (0.041)
Large	0.554*** (0.034)	0.418*** (0.044)	0.647*** (0.104)	-0.107** (0.042)
Number of beds	0.004*** (0.000)	0.005*** (0.000)	0.003** (0.001)	0.002*** (0.000)
Physicians density	0.026 (0.028)	-0.006 (0.085)	0.180** (0.085)	-0.038 (0.076)
T2A	0.051*** (0.007)	-0.011 (0.012)	0.179*** (0.036)	-0.063*** (0.012)
Constant	8.286*** (0.099)	7.789*** (0.270)	6.649*** (0.414)	-0.492* (0.281)
Observations	3,528	3,528	3,528	3,528
Number of hospitals	376	376	376	376
R. squared	0.96	0.96	0.91	0.84
Test : Openers+change in trend after opening=0				
F-stat	0.15	8.01	0.82	7.37
p-value	0.705	0.009	0.374	0.012
Test : Closers+change in trend after closing=0				
F-stat	3.79	1.21	0.65	0.17
p-value	0.064	0.283	0.429	0.687
Controls				
Hospital fixed-effects	Yes	Yes	Yes	Yes
Mergers or splits	Yes	Yes	Yes	Yes
Shocks of demand	Yes	Yes	Yes	Yes

Source: Authors' calculation from a sample of 376 PFP hospitals observed at least 4 consecutive years between 2002 and 2012. Notes: Log-linear fixed-effects regression. Coefficients are reported, standard errors clustered at the regional level in parentheses. Number of events : 30 ED openings, 6 ED closings. * p<.1, ** p<.05, *** p<.01

5.2 Impact on hospital efficiency

Table 1.4 presents the estimated impact of an ED opening (*resp.* closing) on the indicators of efficiency in the use of inputs: bed occupancy rate (column 1) and average length of long stays (column 2). Note that our indicator of LOS concerns only stays with overnight (named long stays), to prevent an influence of the proportion of day-cases on this measure. Throughout the 2002-2012 period, both Never and Always ED hospitals made efficiency gains by decreasing their average length for long stays at a similar pace (around -3% per year). Besides, their bed occupancy rate decreases, and this, more rapidly for Never ED (- 1.7%) than for Always ED (- 0.05%). This can be seen as the consequence of the decreasing trend in the number of long stays, which is more pronounced for Never ED than for Always ED hospitals (see Table 1.3). We find that opening an ED has sizeable impacts. It leads to a +8.8% in the bed occupancy rate. This efficiency gain, combined with the stopping in the growth in day-cases (Table 1.3), shows how openers dealt with the increase of long stays induced by the ED opening. Interestingly, we find also that an opening increases the length of long stays by +18.5%, suggesting that patients admitted after an ED visit have a higher degree of severity than patients with a planned hospitalization. So, an ED opening induces a higher proportion of long stays, and an increase in their severity. We find significant impacts of ED closing on the level and trends of the length of long stays: it increases by 21.3% with a closing, and its trend is reversed, from negative to positive, resulting in an increase in the LOS after ED closing (after closing the trend is equal to 5% and significantly different from 0), which appears as a real shock on the use of beds.

5.3 Impact on hospital revenues

To our knowledge, only two studies on US data examined the contribution of EDs to hospital revenues. A study on data from a single hospital in Western Massachusetts found that ED admissions were more profitable than non-ED admissions [13], and a US nationwide study conducted in 2009 confirmed that ED are profitable, with a profit margin of 7.8% by visit (calculated as the difference between ED revenues and ED costs divided by the hospital total revenue) [25]. As we do not observe costs in our data, we cannot analyze the impact of an ED opening (or closing) on hospitals' profitability. However, it is possible to evaluate their impacts on hospital revenue because this information is available from 2009. This analysis is necessarily restricted to years 2009 to 2012 because of the lack of information on revenue for the first years of the panel. This led to the deletion of 74 hospitals. Moreover, as most ED events occurred shortly after 2001, we can only examine the impacts on hospitals revenue for 9 hospitals (4 openers and 5 closers)

Table 1.4: Impact of ED openings (*resp.* closings) on efficiency in input use

	Bed occupancy rate	Average length of long stays
	b/se	b/se
ED event		
OPEN	0.088*** (0.026)	0.185*** (0.050)
CLOSE	0.030 (0.019)	0.213* (0.120)
Trends		
Never ED	-0.017*** (0.002)	-0.030*** (0.007)
Always ED	-0.005*** (0.002)	-0.034*** (0.011)
Openers	-0.023 (0.017)	-0.025 (0.027)
Change in trend after opening	0.011 (0.019)	-0.024 (0.036)
Closers	-0.009** (0.004)	-0.028* (0.016)
Change in trend after closing	-0.011 (0.008)	0.078** (0.038)
Observations	3,405	3,400
Number of hospitals	368	368
R. squared	0.61	0.85
Test : Openers+Change in trends after opening=0		
F-stat	10.23	4.17
p-value	0.004	0.052
Test : Closers+change in trend after closing=0		
F-stat	13.78	2.01
p-value	0.001	0.169
Controls		
Hospital fixed effects	Yes	Yes
Mergers or splits	Yes	Yes
Shocks of demand	Yes	Yes

Source: Authors' calculation from a sample of 368 PFP hospitals observed at least 4 consecutive years between 2002 and 2012. Notes: * $p < .1$, ** $p < .05$, *** $p < .01$. Linear fixed-effects regression. Coefficients are reported, standard errors clustered at the regional level in parentheses. Number of events : 30 ED openings, 6 ED closings.

over a sample of 302 remaining PFP hospitals (1,208 observations). Note that doctors' fees are not included in our variable of revenue. Hence it is mostly influenced by the DRG payment system.

Table 1.A.3 in appendix 1.A presents statistics on hospitals' revenues for each category, i.e. Never ED, Always ED, openers and closers. The revenue per admission is more than 3 times greater for long stays than for day-cases, a result consistent with figures given by a French report showing that in 2012, day-cases costs were in average 24% lower than the costs for a one-night hospitalization within the same DRG [1]. To investigate the impact of an ED opening (or closing) on hospital revenue, we estimate equation (1.1) on our restricted panel of 302 hospitals observed between 2009 and 2012. The dependent

variables are the log of revenue and the log of revenue per admission, computed for the total number of admissions, long stays and day-cases. Results in table 1.5 show significant changes in levels and trends following an ED opening for hospital revenue. This is true for total revenue, and for each of its components i.e., revenue from long stays and from day-cases. The dominant effect comes from long stays, with a 30% jump in level, and a positive change in the trend from -8.8% before opening to +3% after (but this post opening trend is not significant).

Table 1.5: Impact of ED openings (*resp.* closings) on hospital's revenues

	Total	Revenue	Day-cases	Total	Revenue per admission	Day-cases
	b/se	Long stays	b/se	b/se	Long stays	b/se
	b/se	b/se	b/se	b/se	b/se	b/se
ED event						
OPEN	0.065*** (0.014)	0.300*** (0.088)	-0.125* (0.063)	0.111*** (0.024)	0.090*** (0.018)	-0.021 (0.039)
CLOSE	0.046 (0.030)	0.113 (0.166)	0.011 (0.050)	0.046 (0.054)	0.041 (0.051)	0.026 (0.041)
Trends						
Never ED	0.017*** (0.004)	0.006 (0.007)	0.033*** (0.003)	0.013*** (0.002)	0.032*** (0.002)	-0.002 (0.006)
Always ED	0.027*** (0.002)	0.024*** (0.003)	0.042*** (0.004)	0.020*** (0.002)	0.037*** (0.002)	0.011*** (0.003)
Openers	0.009* (0.005)	-0.088** (0.036)	0.075*** (0.018)	-0.024** (0.011)	0.031*** (0.009)	0.004 (0.011)
Change in trend after opening	0.024* (0.014)	0.118*** (0.022)	-0.061*** (0.016)	0.045*** (0.007)	-0.015 (0.011)	0.012 (0.009)
Closers	0.088*** (0.023)	0.094 (0.091)	0.120*** (0.026)	0.036 (0.030)	0.039 (0.034)	0.048** (0.022)
Change in trend after closing	-0.082*** (0.026)	-0.075 (0.084)	-0.150*** (0.027)	-0.020 (0.028)	-0.029 (0.035)	-0.051** (0.023)
Observations	1,208	1,208	1,208	1,208	1,208	1,208
Number of hospitals	302	302	302	302	302	302
R. squared	0.99	0.99	0.96	0.97	0.97	0.68
Test : Openers+Change in trends after opening=0						
F-stat	7.03	1.51	15.29	9.67	19.17	4.68
p-value	0.0142	0.2315	0.0007	0.0049	0.0002	0.0411
Test : Closers+change in trend after closing=0						
F-stat	0.38	3.09	2.68	64.40	2.70	0.27
p-value	0.5449	0.0920	0.1151	0.0000	0.1138	0.6099
Controls						
Hospital fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Mergers or splits	Yes	Yes	Yes	Yes	Yes	Yes
Shocks of demand	Yes	Yes	Yes	Yes	Yes	Yes

Source: Authors' calculation from a sample of 302 PFP hospitals observed at least 4 consecutive years between 2009 and 2012. Notes: * p<.1, ** p<.05, *** p<.01. Log-linear fixed-effects regressions. Coefficients are reported (standard errors clustered at the regional level in parentheses). Number of events : 4 ED openings, 5 ED closings.

Looking at the impacts estimated on revenue per admission, we find that an opening induces a +9% increase in the revenue per admission for long stays, showing that ED opening has not only an impact on the proportion of long stays, but also on their case mix, with more intensive DRGs. The impact of an opening on the total revenue per admission (table 1.5, fourth column) is a significant increase in level (+11.1%) and trend (which is reversed from a decreasing trend (-2.4%) to a significantly increasing one (+2.1%))¹⁰.

¹⁰The p-value for the significance test of the post-opening trend for total revenue per admission is equal

To sum up: an opening induces more revenue per admission through a higher proportion of long stays, and more intensive long stays. Consequently, we find a positive impact of ED opening on total revenue, i.e., +6.5% in level and an acceleration of +2.4% of the already positive trend (table 1.5, first column), even if the total number of admissions is unchanged, as seen in table 1.3.

6 Discussion and conclusion

In this paper, we analyzed the consequences of ED opening and closing on hospitals' activity and revenue. We use data on the period following a 2001 reform that incentivized French hospitals - and especially private-for-profit (PFP) hospitals - to develop an emergency care activity. With the creation of a more generous payment system for ED visits in PFP hospitals and the allocation of public funds to encourage the openings of EDs and modernize the pre-existing structures, this reform resulted in the creation of a hundred EDs in PFP hospitals [8]. It offers the opportunity to study the impact of ED openings (*resp.* closings) on hospitals' activity and contributes to a rather scarce literature on the subject. Indeed, the literature on EDs generally focuses on the understanding of inappropriate recourse to ED. Here, we examine on the supply side if hospitals could have an interest in developing EDs, beyond the direct income coming from ED visits. We take advantage of a mandatory survey which gathers comprehensive information on hospital inputs to construct a database recording EDs openings and closings during the 2002-2012 period in France, as well as information on important confounding factors that must be controlled for, such as hospital creations, closings and absorptions that took place in hospitals' environment. Hospital activity is observed through the total number of admissions, split into what we call long stays (i.e., overnight stays) and day-cases.

We find that opening an ED increases the number of long stays by +14% and stops the previously rapid growth of day cases. Remarkably, ED opening does not lead to an increase in the total number of admissions but induces a change in the composition of a hospital activity through a greater proportion of long stays (+12.6%) and long stays with more intensive case-mix. The fact that the case-mix of long stays is becoming more complex is shown by the increase in revenue per long stay (+9%) estimated following an ED opening. In total, an ED opening induces more revenue per admission through a higher proportion of long stays, and more intensive long stays. Consequently, we find a positive impact of ED opening on total revenue, a jump of +6.5% and an acceleration of +2.4% of its positive trend, even if the total number of admissions is unchanged. These changes

to 0.0049, see bottom of table 1.5.

following an ED opening occur together with a +8.8% increase in the bed occupancy rate, showing an improved efficiency to take in charge these additional long stays. Because ED closings are rather rare events in our data, we don't obtain significant impacts, except on the length of long stays, that increases by 21.3% after a closing, with a change in trend equal to +7.8%.

This work has several limits. Our estimates cannot be strictly interpreted as showing causal impact. They can be affected by an endogeneity bias if the hospital's decision to apply for an authorization of ED opening is correlated with an unobserved transitory shock affecting the demand it faces. However, our specification includes hospital fixed effects that control for the endogeneity bias that might arise from the existence of unobserved time-invariant hospitals' characteristics correlated with the decision to open or to close an ED. Moreover, we have included regressors that control for the occurrence of shocks on demand around the hospital: hospitals mergers and splits, as well as creation or closing of a competing hospital in the same *département*. So, we can believe that our specification rules out as much as possible the eventuality of unobserved transitory shock on demand.

Another limitation is due to the few ED closings (6) that we observe during the period for PFP hospitals. This can explain that we find very few significant results on closings impact. Further research should be conducted to obtain findings on the impact of ED closings on hospital's activity.

Finally, our results concern PFP hospitals. We focused on PFP hospitals because they were the main respondents to the incentives given by the 2001 ED payment reform. Indeed, after this reform, most ED openings occurred in PFP hospitals since 80% of public hospitals were already supplying emergency care because of their mandates. In general, French PFP hospitals supply targeted care, mostly elective surgical procedures that can be profitable and performed in a day-care context. By opening an ED, a PFP hospital takes a step forward to participate in the public service. Our results show that it is not a bad deal: it contributes to a change in the hospital activity composition in favor of a higher proportion of stays with overnight, and of more intensive stays. These changes go with an increase in the bed occupancy rate and translate to higher revenues per stay, for an unchanged total number of admissions.

These results suggest that opening an ED is likely to be profitable to a PFP hospital. Of course, it would be interesting to observe costs to validate this conclusion. Unfortunately, reliable information on costs is rather sensitive in a competition context and hence particularly difficult to collect in the private sector.

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Appendix

1.A Additional statistics

Table 1.A.1: Number of ED openings and closings during the 2002-2012 period

	(1) Openings	(2) Closings
2002	0	0
2003	6	0
2004	7	0
2005	3	0
2006	5	0
2007	4	1
2008	1	0
2009	1	1
2010	1	1
2011	0	3
2012	2	0
Total	30	6
<i>N</i>	3528	3528

Number of events are presented. These events are observed for an unbalanced panel of 376 PFP hospitals. Each hospital is observed at least 4 consecutive years between 2002 and 2012.

Table 1.A.2: Averages of production, inputs and efficient use of inputs

	Never ED		Always ED		Openers		Closers	
	2002	2012	2002	2012	2002	2012	2002	2012
	mean/sd	mean/sd	mean/sd	mean/sd	mean/sd	mean/sd	mean/sd	mean/sd
Number of admissions								
All admissions	9,051.98 (4592.39)	11,468.12 (6529.19)	14,742.29 (5417.45)	19,260.91 (8221.00)	12,042.96 (5446.19)	18,992.33 (9809.64)	16,028.25 (2215.89)	21,236.20 (6810.32)
Long stays	5,742.16 (3115.88)	5,492.32 (3793.38)	9,430.54 (3857.50)	9,974.04 (4789.04)	7,790.22 (3723.00)	9,647.50 (6012.23)	9,271.25 (2794.10)	11,063.00 (5489.12)
Day-cases	3,309.82 (1974.55)	5,975.80 (3423.17)	5,311.74 (2409.41)	9,286.88 (3949.46)	4,252.74 (2224.20)	9,344.83 (4331.37)	6,757.00 (2773.36)	10,173.20 (4294.19)
Number of beds								
Medical	16.88 (23.81)	21.24 (26.24)	39.61 (29.79)	50.64 (32.89)	29.17 (26.52)	44.17 (35.00)	31.75 (28.22)	41.60 (43.75)
Surgical	65.05 (34.53)	69.23 (41.18)	102.74 (34.15)	105.83 (44.71)	86.78 (40.32)	105.77 (53.13)	86.25 (34.86)	108.20 (28.45)
Obstetrics	13.85 (20.10)	12.99 (21.20)	19.90 (19.88)	18.53 (21.72)	15.65 (19.21)	17.03 (27.70)	16.75 (20.84)	32.40 (23.99)
Efficiency								
Beds occupancy rate	0.76 (0.32)	0.58 (0.15)	0.80 (0.10)	0.70 (0.12)	0.80 (0.12)	0.70 (0.17)	0.88 (0.10)	0.67 (0.18)
Average length of long stays	4.80 (1.55)	4.39 (1.51)	5.28 (0.84)	4.73 (0.77)	5.20 (1.53)	4.69 (1.08)	4.78 (0.50)	4.09 (1.08)
Observations	202	186	70	81	23	30	4	5
Number of hospitals	253		87		30		6	

Source: Authors' calculation from a sample of 368 PFP hospitals observed at least 4 consecutive years between 2002 and 2012.

Note: Means are presented (standard deviation in parentheses).

Table 1.A.3: Hospital revenue

	Never ED		Always ED		Openers		Closers	
	2009 mean/sd	2012 mean/sd	2009 mean/sd	2012 mean/sd	2009 mean/sd	2012 mean/sd	2009 mean/sd	2012 mean/sd
Hospital revenue								
Total	10,665,539 (6708849)	11,613,528 (7888389)	18,689,406 (8698061)	20,977,309 (10098212)	12,753,146 (12871344)	15,250,985 (17006080)	18,587,542 (5566876)	23,281,211 (10784452)
Long stays	8,032,123 (5814305)	8,616,447 (6897599)	14,721,831 (7399959)	16,369,446 (8645205)	8,806,290 (10955937)	10,867,874 (14497346)	14,569,180 (6566542)	18,183,813 (11062190)
Day-cases	2,633,416 (1468017)	2,997,081 (1733451)	3,967,575 (1783282)	4,607,863 (2026088)	3,946,857 (1958057)	4,383,111 (2523753)	4,018,362 (1502591)	5,097,398 (2308151)
Number of admissions								
All admissions	11,047 (5998)	11,468 (6529)	18,413 (7906)	19,354 (8503)	14,018 (10894)	14,752 (12293)	18,299 (3002)	21,236 (6810)
Long stays	5,705 (3699)	5,492 (3793)	10,085 (4784)	10,035 (5011)	5,701 (6318)	5,893 (7245)	9,611 (3839)	11,063 (5489)
Day-cases	5,343 (2910)	5,976 (3423)	8,328 (3653)	9,319 (4022)	8,317 (4600)	8,860 (5057)	8,687 (3528)	10,173 (4294)
Hospital revenue per admissions								
All admissions	959 (223)	1,004 (284)	1,006 (166)	1,074 (195)	791 (214)	867 (285)	1,017 (251)	1,079 (224)
Long stays	1,388 (257)	1,536 (346)	1,449 (203)	1,624 (274)	1,282 (350)	1,540 (480)	1,489 (266)	1,571 (235)
Day-cases	485 (87)	495 (81)	476 (61)	494 (46)	484 (34)	494 (21)	467 (39)	500 (44)
Observations	186	186	107	107	4	4	5	5

Source: Authors' calculation from a sample of 368 PFP hospitals observed at least 4 consecutive years between 2002 and 2012.

Note: Means are presented (standard deviations in parentheses).

1.B Sample selection

Table 1.B.1: Difference in means of hospital's characteristics between samples of hospitals with and without missing values on the variables of interest

	(1) Econometric sample mean/sd	(2) Sample of missing values mean/sd	(3) Diff (1) - (2) b/t
Hospital size			
Small	0.10 (0.29)	0.75 (0.44)	-0.65*** (-20.769)
Intermediate	0.36 (0.48)	0.15 (0.36)	0.21*** (7.822)
Large	0.55 (0.50)	0.11 (0.31)	0.44*** (19.088)
Hospitals holding ED (%)	0.31 (0.46)	0.14 (0.34)	0.17*** (6.830)
Average length of stays	2.66 (1.25)	2.47 (1.24)	0.19 (1.310)
Beds occupancy rate	0.69 (0.18)	0.71 (0.18)	-0.02 (-1.083)
Number of ED visits	15661.14 (7430.04)	13992.00 (6221.58)	1669.14 (1.372)
Observations	3843	200	4043
Hospitals	453	33	486

Means (standard deviations in parentheses) are presented in column (1) and (2). Column (3) reports differences in means with the associated t-statistic in parentheses.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

1.C Full regressions

Table 1.C.1: Impact of ED openings (*resp.* closings) on efficiency in input use

	Bed occupancy rate	Average length of long stays
	b/se	b/se
ED event		
OPEN	0.088*** (0.026)	0.185*** (0.050)
CLOSE	0.030 (0.019)	0.213* (0.120)
Trends		
Never ED	-0.017*** (0.002)	-0.030*** (0.007)
Always ED	-0.005*** (0.002)	-0.034*** (0.011)
Openers	-0.023 (0.017)	-0.025 (0.027)
Change in trend after opening	0.011 (0.019)	-0.024 (0.036)
Closers	-0.009** (0.004)	-0.028* (0.016)
Change in trend after closing	-0.011 (0.008)	0.078** (0.038)
Controls		
<i>Hospital size</i>		
Small	ref.	ref.
Medium	0.050* (0.026)	-0.112 (0.140)
Large	0.087*** (0.023)	-0.341** (0.157)
Number of beds	-0.001*** (0.000)	0.004*** (0.001)
Physicians density	0.018 (0.040)	0.115 (0.112)
T2A	-0.042*** (0.008)	-0.129*** (0.036)
Constant	0.801*** (0.187)	4.217*** (0.485)
Observations	3,405	3,400
Number of hospitals	368	368
R. squared	0.61	0.85
Test : Openers+Change in trends after opening=0		
F-stat	10.23	4.17
p-value	0.004	0.052
Test : Pre-closing trend+Post-closing trend=0		
F-stat	13.78	2.01
p-value	0.001	0.169
Controls		
Hospital fixed effects	Yes	Yes
Mergers or splits	Yes	Yes
Shocks of demand	Yes	Yes

Source: Authors' calculation from a sample of 368 PFP hospitals observed at least 4 consecutive years between 2002 and 2012. Notes: * p<.1, ** p<.05, *** p<.01. Linear fixed-effects regression. Coefficients are reported, standard errors clustered at the regional level in parentheses. Number of events: 30 ED openings, 6 ED closings. Hospital size is defined through the number of total admissions (not only in MSO departments) : small hospitals receive less than 5,000 admissions, medium hospitals receive more than 5,000 and less than 10,000 admissions, large hospitals receive more than 10,000 admissions.

Table 1.C.2: Impact of ED openings (*resp.* closings) on hospital's revenues

	Total b/se	Revenue Long stays b/se	Day-cases b/se	Total b/se	Revenue per admission Long stays b/se	Day-cases b/se
ED event						
OPEN	0.065*** (0.014)	0.300*** (0.088)	-0.125* (0.063)	0.111*** (0.024)	0.090*** (0.018)	-0.021 (0.039)
CLOSE	0.046 (0.030)	0.113 (0.166)	0.011 (0.050)	0.046 (0.054)	0.041 (0.051)	0.026 (0.041)
Trends						
Never ED	0.017*** (0.004)	0.006 (0.007)	0.033*** (0.003)	0.013*** (0.002)	0.032*** (0.002)	-0.002 (0.006)
Always ED	0.027*** (0.002)	0.024*** (0.003)	0.042*** (0.004)	0.020*** (0.002)	0.037*** (0.002)	0.011*** (0.003)
Openers	0.009* (0.005)	-0.088** (0.036)	0.075*** (0.018)	-0.024** (0.011)	0.031*** (0.009)	0.004 (0.011)
Change in trend after opening	0.024* (0.014)	0.118*** (0.022)	-0.061*** (0.016)	0.045*** (0.007)	-0.015 (0.011)	0.012 (0.009)
Closers	0.088*** (0.023)	0.094 (0.091)	0.120*** (0.026)	0.036 (0.030)	0.039 (0.034)	0.048** (0.022)
Change in trend after closing	-0.082*** (0.026)	-0.075 (0.084)	-0.150*** (0.027)	-0.020 (0.028)	-0.029 (0.035)	-0.051** (0.023)
Controls						
<i>Hospital size</i>						
Small	ref.	ref.	ref.	ref.	ref.	ref.
Medium	0.275*** (0.071)	0.291*** (0.088)	0.210*** (0.063)	0.026 (0.028)	0.018 (0.028)	-0.009 (0.025)
Large	0.430*** (0.069)	0.427*** (0.089)	0.363*** (0.076)	0.018 (0.026)	0.007 (0.028)	-0.022 (0.030)
Number of beds	0.002*** (0.000)	0.003*** (0.001)	0.001* (0.000)	0.001** (0.000)	0.000 (0.000)	-0.000 (0.000)
Physicians density	0.017 (0.036)	-0.009 (0.035)	0.162*** (0.043)	-0.022 (0.024)	-0.031 (0.029)	0.103*** (0.028)
Constant	15.422*** (0.143)	14.991*** (0.180)	13.721*** (0.202)	6.768*** (0.110)	7.250*** (0.123)	5.811*** (0.096)
Observations	1,208	1,208	1,208	1,208	1,208	1,208
Number of hospitals	302	302	302	302	302	302
R. squared	0.99	0.99	0.96	0.97	0.97	0.68
Test : Openers+Change in trends after opening=0						
F-stat	7.03	1.51	15.29	9.67	19.17	4.68
p-value	0.0142	0.2315	0.0007	0.0049	0.0002	0.0411
Test : Closers+Change in trend after closing=0						
F-stat	0.38	3.09	2.68	64.40	2.70	0.27
p-value	0.5449	0.0920	0.1151	0.0000	0.1138	0.6099
Controls						
Hospital fixed-effects	Yes	Yes	Yes	Yes	Yes	Yes
Mergers or splits	Yes	Yes	Yes	Yes	Yes	Yes
Shocks of demand	Yes	Yes	Yes	Yes	Yes	Yes

Source: Authors' calculation from a sample of 302 PFP hospitals observed at least 4 consecutive years between 2009 and 2012. Notes: * p<.1, ** p<.05, *** p<.01. Log-linear fixed-effects regressions. Coefficients are reported (standard errors clustered at the regional level in parentheses). Number of events : 4 ED openings, 5 ED closings. Hospital size is defined through the total number of admissions: small hospitals receive less than 5,000 admissions, medium hospitals receive more than 5,000 and less than 10,000 admissions, large hospitals receive more than 10,000 admissions.

Chapter **2**

To which extent are patients responsible for inefficient emergency department visits?

This chapter is co-authored with Brigitte Dormont (Université Paris-Dauphine, PSL).

1 Introduction

In most OECD countries, the number of emergency department visits has been increasing for decades. This rise is much faster than the estimated increase in needs for urgent health care. Hence there is a growing concern in most countries about ED visits for "non-urgent" or "inappropriate" reasons, which are a source of inefficiency and put health care systems under pressure. In France, the annual number of emergency department (ED) visits was 10.1 million in 1996. It increased to 17 million in 2010 and continued to grow up to 21 million in 2018 [18]. An administrative report claimed that 20% of ED visits were inappropriate, leading to excessive health expenditure of €500 Million [11]. The cost borne by the French National Health Insurance (NHI) for an ED visit is €148 on average [12], which is much more than the €16.5 that are reimbursed for a GP consultation. From the regulator perspective, emergency room visits are deemed "inappropriate" if the patient needs are non-urgent conditions that could be treated by a general practitioner (GP) or a specialist consultation in a primary care setting more efficiently, i.e., at lower cost and equal risk. The goal of this paper is to examine the determinants of inappropriate ED visits, and to evaluate the comparative impacts of patient characteristics on one side, and of the health system organization on the other side. For that purpose, we use a survey that recorded exhaustively detailed information on all ED visits for 24 hours in France. Our sample contains information on 15,714 visits nested in 439 EDs. This dataset offers two advantages in comparison to the existing literature. First, it records a direct assessment of the appropriateness of the visit. This assessment is set at the exit of the ED by the physician who carried out the patient's examination. Second, it gathers for each visit the socio-demographic characteristics of the patient and the characteristics of the supply for care (health system organization) he or she is facing.

The literature analyzing the determinants of ED visits relies on administrative or survey data [39, 15, 13, 37, 28, 29, 45, 36, 9, 41, 32, 43]. It shows there are difficulties in the observation of avoidable ED visits [19, 40]. To overcome the lack of direct measure of appropriateness, papers often use a combination of indicators that are correlated with it: visit on self-referral, non-hospitalized ED visit, discharge without any doctor consultation or treatment, discharge without follow-up by a GP [39, 13, 37, 28]. Appropriateness is also assessed using clinical indicators coming from triage data [15, 41] or medical diagnosis [29, 45, 9]. The available literature provides evidence that patient and health system characteristics are associated with inefficient ED utilization. Concerning patients' characteristics, findings show that efficient use of ED increases with age and income, but the role of education is difficult to establish because available studies provide mixed results

[20, 22, 9, 13, 43]. As concerns the impact of the healthcare organization, Or and Penneau [37] found that cities where primary care services are highly accessible have lower non-hospitalized ED visits, and McHale et al. [28] found that inappropriate ED visits are more likely to occur during office hours (8am to 4pm). Similarly, reduction in ED visits is observed when primary care access is extended on evening and weekends [15, 49], which suggests that patients may substitute emergency care to primary care for accessibility motives. In the same way, barriers in access to primary care services are associated with higher ED utilization [48, 46, 41, 43]. The design of health insurance can also favor access to GP. In 2006, a reform implemented in the Massachusetts improved healthcare coverage for residents. It led to a decrease in the number of ED visits per capita from 5 to 8 percent. Significant impacts were found only for non-urgent visits and visits that occurred during opening hours of medical offices [29].

Overall, available results show that both patient and system characteristics influence recourse to ED for inappropriate reasons. On the patient side, policies can develop information to improve the use of ED or create penalties to discourage avoidable visits. On the supply side, the organization of access to care can be improved, with better access to GP (coverage, extension of opening time), creation of primary care platforms close to the ED, and improvement of the phone triage for ED. Instruments acting on the patient side are attractive for the regulator because they can be put in place easily, rapidly and with low cost (without thinking about revenues coming from penalties). However, they have shortcomings because low-income people or very deprived persons are generally not very responsive to information campaigns, and financial penalties can be detrimental to their access to ED, which can be the only source of care they know or can afford. For this reason, it is important to evaluate how much gains in efficiency can be expected from actions on the patient side, versus, on the system side. To our knowledge, no paper tries to compare the relative impacts of patient and system characteristics in explaining inefficient recourse to ED. This is mostly due to the lack of appropriate data: administrative data generally provide either poor information related to patient's socio-demographic characteristics [15, 37, 38], or poor information related to the health care system's characteristics [29, 45].

To examine the impact of patient characteristics in the appropriateness of recourse to ED, it is important to specify what refers to patient decision. In our framework, it is the decision to go to ED directly on self-referral, without consulting a doctor, phone service or another care provider. We consider a sequential two-equation model, where the first equation explains decision to come on self-referral, and where the second equation explains the visit appropriateness conditional on this decision. In the literature, only one paper adopts a structural approach, and this, in a framework different from ours [13].

Otherwise, most papers use the decision to come to the ED on self-referral as a proxy for inappropriateness [13, 28, 9, 38] when it is one of its determinants. Carret et al. [9] consider it is a determinant of appropriateness, but their results are exposed to biases because their estimation strategy does not take the non-exogeneity of the decision to come on self-referral into account. Other studies simply ignore this determinant of appropriateness so that estimation are exposed to an omitted variable bias [41, 33].

Our paper contributes to the literature on the determinants of inefficient use of ED in three ways. First, we have a direct and reliable observation of appropriateness because our survey design involves an assessment given by a doctor at the patient exit. Second, our database enables us to assess and compare the influences of patient and system characteristics on inappropriate recourse to ED. Third, we specify a two-equation model that makes it possible to distinguish what is due to patient or to health care system characteristics and to see if these influences are acting on the patient decision to come on self-referral. This model is consistently estimated by an instrumental variable method applied to a model with fixed effects related to EDs. Thanks to this specification, it is possible to better identify on which driver policy instruments should be targeted, and also if sizeable gains in efficiency can be expected from changes in the health care system organization.

Our findings show that 46.1% of ED visits are considered inappropriate and that this proportion rises to 55.9% when the patient came on self-referral. Interestingly, there is still a sizeable proportion of inappropriate visits (33.6%) for visits that received the advice of a GP or another care provider to go to the ED. These cases suggest there is a mismatch between the decision of the GP who decided to direct the patient to ED, and the final assessment of the doctor at the end of the ED visit. This discordance in assessments can arise because the GP is placed in an *ex ante* perspective, while the ED doctor formulates an *ex post* evaluation at the end of the visit. It can also come from differences in doctors' judgments relative to the ability of the primary care organization to respond to the patient's needs. Our estimates show that patient decision to come on self-referral has a sizeable negative influence on visit appropriateness, lowering the appropriateness score (0-10) by 3, value equal to its standard deviation. Characteristics of the health system organization, like patient's insurance and being on a GP's list have a strong influence on the decision to come on self-referral. Patients' socio-economic characteristics that influence their decision to come on self-referral, as for education and occupational status, are not significant anymore in the equation explaining the appropriateness grade of the visit, conditionally on this decision. We use our estimates to evaluate the respective contributions of patient and system characteristics to the explained variability of the visit

appropriateness score. We find that 72.7% of the explained score variability is due to patient characteristics and 27.1% to health care system organization. This later proportion is sizeable. It shows that improving the care supply organization is likely to provide gains in efficiency in the use of ED. This result is useful considering that policies on the patient side can not be very effective (information campaigns) [20, 7, 42] or can have deleterious impacts on access to care (financial incentives).

The paper is organized as follows. We present in section 2 the wide variety of policy interventions that were introduced in different health care systems worldwide to reduce inappropriate ED visits. Section 3 is dedicated to the presentation of the data and some descriptive statistics. The empirical strategy is reported in section 4 and results follow in section 5. We then propose a discussion and a conclusion in section 6.

2 How to promote appropriate use of ED

Many public policies have been implemented to reduce inappropriate ED utilization. They rely on the assumption that in some cases patients can substitute emergency care to primary care for financial and non-financial reasons. Indeed, EDs are often free from direct payments and generally more accessible than physicians' practices (24/7).

To eliminate financial motives to use ED instead of a primary care consultation, several countries have introduced direct payments for access to the ED. This extra payment can be charged for all visits (Portugal) or depend on the time of the visit (Finland), or concern self-referred patients (Ireland and Belgium), or visits with no hospitalization afterwards (France) [26, 14, 6, 1]. Available assessments show that the introduction of cost-sharing and/or co-payments at the ED successfully reduces the number of attendances without leading to an increase in mortality [20, 42, 23, 44]. Moreover, evidence from South-Korea suggest that the proportion of urgent ED visits increases with ED prices [25].

Regarding patient guidance, many countries have created in the 80s telephone-based platforms to answer patients in need of advice and screen them for access to the ED [6, 35]. The severity of patients' conditions is assessed online by physicians trained to emergency situations and patients are addressed to the most adequate healthcare facility. An ambulance can be sent to pick the patient up in the most urgent cases. Complementary policies try to improve access to primary care services [6, 47, 20]: UK, New-Zealand, Norway and Chile have created "walk-in centers" and "minor injury units" which are very accessible facilities, whose objective is to relieve the ED of patients with minor conditions. Other countries like Italy, Ireland, USA and Australia have targeted deprived populations

and created "community care centers" to prevent them to visit ED for inappropriate reasons. Though telephone-based platforms do not help reducing ED utilization, improving primary care access appears to be very effective [20], especially among non-urgent visits [15, 27, 49].

Other policies encourage a "streaming process", i.e., a triage of patients based on the urgency of their care needs evaluated when they arrive to the ED. In the UK, the Netherlands and Switzerland, a GP streams ED patients at their arrival and redirect those deemed inefficient to primary care services [34]. One study that evaluated the effect of a streaming policy found a 9% increase in primary care consultations of diverted patients, but no impact on ED utilization [16]. "Fast-tracks" can also be introduced within emergency room services, as in Canada, the UK and France, to redirect non-urgent patients to a simple GP consultation in a dedicated area. Evidence suggests they are effective in reducing congestion [30]. More recently in Japan and France, financial incentives have been created to encourage ED to redirect inefficient patients to primary care services [6, 24].

To sum up, there is a wide variety of public policies trying to improve the efficiency of ED utilization. There are a few empirical results about the effectiveness of some interventions, but nothing is known about their comparative effectiveness. Our paper can help choosing between available policy options by providing insights on the respective roles of individual behavior and access to primary care in inefficient recourses to ED.

3 Data

We use data from a French survey, "*Enquête urgence*" collected in 2013 by the French Ministry of Health (DREES). This survey recorded information at the patient-visit level for all ED visits that occurred over a 24-hour period from 11 June 2013 at 8am to 12 June 2013 at 8am. The date has been chosen to be representative of a "normal day", without any peak of demand because of winter flue, vacations or week-end. The advantage of this survey is that it provides two indicators of appropriateness completed by the ED physician at the end of each visit: (1) A grade ranging from 0 (inappropriate) to 10 (fully appropriate); (2) A qualitative assessment reporting whether the visit was necessary, divertible or delayable¹. The survey has also collected information on patient socio-economic characteristics, and on visit characteristics: time of the visit, distance between ED and patient's zip code, arrival on self-referral, exit through discharge to home, hospitalization or death. For each visit, we also observe if the patient is listed with a GP, and characteristics of

¹Divertible = treatment in primary care would be more efficient ; Delayable = ED attendances are clinically unnecessary. We thank Matthew Sutton for suggesting this compact terminology.

the visited ED: ownership type, presence of a MRI, number of physicians on duty. This information was completed with information at the level of patients' zip code: local accessibility of GP and nurses [5, 3] and availability of GPs out-of-office hours (OOH)². The indicator of local accessibility reflects the availability of primary care around patient's zip code. It is deemed better than the classical physician population ratio because it is robust to boundary effects (the area is defined by the distance – measured by time of access – around patient zip-code and not by the administrative definition of the municipality) and because it takes the labor duration of care providers into account. Last, we have included data on average income, unemployment and poverty rates measured at the patients' zip code level [4] [2].

3.1 The sample

Initially, the survey included 48,711 visits in 734 EDs. We deleted from our data patients whose visit cannot result from an autonomous decision (patients younger than 18 or admitted through a transfer from a nursing home or another institution). These deletions lead to a sample reduced to 28,744 visits in 590 EDs. Then, we removed visits with missing values for important variables, resulting in a sample with 16,778 visits in 569 EDs. Last, to perform reliable statistical inference at the ED level, we restricted our empirical analysis to EDs with at least 15 visits the day of the survey. Finally, our sample contains information on 15,714 visits observed in 439 EDs. As shown in the appendix, our sample selection does not imply important changes in our results.

3.2 Descriptive analysis

Table 2.1 shows patient's characteristics, that are representative of the population of ED users. Table 2.2 gives information on their access to primary care and to ED. Being registered on a GP list is important because the GP is a gatekeeper for access to specialists (with higher cost-sharing for patients who come without a referral by a GP) and is supposed to guide the patient for the decision to visit ED. In France, complementary health insurance (CHI) is judged necessary for access to care because the French social health insurance offers only a partial coverage of health expenditure (70% of out-patient care and 80% of hospital care). In 2013 (year of our survey) more than 95% of the French population is covered by a complementary health insurance (CHI). Among them, 4.9 million individuals (i.e., 7.4% of the French population) were covered by a public means-tested scheme, called CMU-C, which provides free complementary coverage to

²This indicator was built in collaboration with the Department of Statistics of the French Ministry of Health.

Table 2.1: Patient characteristics

Variables	Statistics	
	(1) Mean	(2) St. Dev
Age		
18-24	14.43	(35.14)
25-44	35.36	(47.81)
45-64	27.24	(44.52)
65-74	8.78	(28.30)
75+	14.19	(34.90)
Gender		
Male	51.47	(49.98)
Female	48.53	(49.98)
Occupation		
Employed	50.57	(50.00)
Unemployed	8.27	(27.55)
Retired	26.92	(44.36)
Other	14.24	(34.95)
Education		
No degree	24.20	(42.83)
High school	54.89	(49.76)
College and over	20.90	(40.66)
<i>Observed at the patient's zip code level</i>		
Unemployment rate	13.51	(4.65)
Median annual income €	20255.20	(3588.78)
Observations	15,714	

Source : Authors' calculations from 'Enquête Urgence', 2013, DREES, 15,714 observations. Means (standard deviations) are reported in column (1) ((2)).

low-income households [21]. To ensure access to care of CMU-C beneficiaries, physicians are not allowed to charge them with balance billings. In practice, CMU-C beneficiaries face some difficulties in access to specialist consultations, because they are less profitable than other patients [10, 17]. Hence the lack of complementary coverage or being covered by the CMU-C might be correlated with difficulties in access to primary care. In our sample, 7% of individuals are covered by the CMU-C and 5.71% have no CHI. Otherwise, the figures in Table 2.2 show that the distance between patients' zip code and the ED is 22km on average, with an important variability, and that 49% patients live in an area where GPs are available during the night and on week-ends, providing an alternative to the emergency room services.

Table 2.3 displays information on the appropriateness of ED visits. The score is on average equal to 6.5 with a standard deviation equal to 3.3 (score range = 0-10). Turning to the qualitative assessment, we find that physicians considered the emergency care was

Table 2.2: Access to primary care and to ED

Variables	Statistics	
	(1) Mean	(2) St. Dev
Patient is listed with a GP		
Yes	94.80	(22.20)
No	5.20	(22.20)
Complementary health insurance (CHI)		
Private	83.86	(36.80)
Public (CMU-C)	7.04	(25.58)
None	5.71	(23.20)
Doesn't know	3.40	(18.12)
Distance to ED (km)	22.45	(76.03)
Patient and ED are in the same <i>département</i>		
Yes	85.94	(34.76)
No	14.06	(34.76)
Hospital ownership		
Public	80.54	(39.59)
Private for profit (PFP)	13.43	(34.10)
Private non profit (PNP)	6.03	(23.81)
<i>Observed at the patient's zip code level</i>		
Accessibility indicator (APL) for 1000 inhab.		
Access to GP	0.67	(0.19)
Access to nurse	0.94	(0.56)
Availability of GPs out of office hours		
Yes	49.09	(49.99)
No	50.91	(49.99)
Observations	15,714	

Source : Authors' calculations from 'Enquête Urgence', 2013, DREES, 15,714 observations. Means (standard deviations) are reported in column (1) ((2)). Standard deviations are reported in column (2). APL=Accessibilité potentielle localisée. CMU-C: public means-tested free complementary coverage.

necessary for 54% of the visits, while they considered that 30% of them were divertible and 16% were delayable. Divertible means that the needs could have been handled by a GP or a specialist in an outpatient primary care setting; Delayable means that the patient could have waited at least one more day to be treated. Most patients (56%) decided to visit ED by themselves, without referral from a GP, a telephonic platform or any care provider in another setting. Visiting on self-referral is clearly correlated with a lack of appropriateness: only 44% of the visits are judged necessary when the patient came on self-referral whereas the proportion of necessary visits rises to 66% among referred patients. Interestingly, among patients who came to the ED following the referral of a health professional, there are still sizeable proportions of visits which are considered divertible (23%) or delayable (10%) by the doctor who provides the assessment at the end of the

ED visit.

Table 2.3: Appropriateness of the ED visit

	Statistics	
	(1) Mean	(2) St. Dev
<i>Assessments of appropriateness</i>		
Score (0-10)	6.46	(3.32)
Qualitative assessment		
Necessary	53.88	(49.85)
Divertible	30.01	(45.83)
Delayable	16.12	(36.77)
<i>Characteristics of the visit</i>		
Self-referral		
Yes	56.29	(49.60)
- Necessary	44.12	(49.66)
- Divertible	35.12	(47.74)
- Delayable	20.77	(40.57)
No	43.71	(49.60)
- Necessary	66.44	(47.22)
- Divertible	23.42	(42.36)
- Delayable	10.13	(30.18)
Time of the visit		
Midnight-4am	4.86	(21.51)
4am - 8am	3.98	(19.56)
8am - 12pm	27.08	(44.44)
12pm - 4pm	25.63	(43.66)
4pm - 8pm	23.32	(42.29)
8pm - midnight	15.11	(35.82)
Visit outcome		
Discharge : Home return	76.64	(42.31)
Hospitalization	21.72	(41.24)
Death	0.04	(1.95)
Observations	15,714	

Source : Authors' calculations from 'Enquête Urgence', 2013, DREES, 15,714 observations. Patients self-referred to the ED if they did not receive the advice to go to an ED by a health provider including physicians, pharmacists or medical rescue services.

Regarding divertible visits, this discordance can come from differences in doctors' judgment or knowledge relative to primary care availability (e.g., the GP knows there is no skillful doctor available, whereas the doctor at ED believes there are some). Regarding delayable visits (the less frequent for referred patients), the discrepancy can arise because the GP is placed in an ex-ante perspective, while the ED doctor formulates an ex post evaluation. Otherwise, we observe that most ED visits (76%) take place between 8am

and 8pm, when alternatives to emergency care should be available. After the visit, 76.6% of patients returned home and 21.7% were admitted to hospitalization.

4 Empirical Strategy

Our survey provides information at the individual level (patient), at the level of the emergency department, and at the level of the individual's zip code. For each visit i , at the emergency department (ED) h we observe X_i , i.e., a range of variables describing patient's characteristics (socioeconomic situation, coverage, and access to care) and Q_h that describes the characteristics of the emergency department. In addition, we have information at the individual's zip code level $z(i)$ concerning the local organization of care provision, as well as average income and unemployment levels. These variables are denoted $W_{z(i)}$. Our database has a nested structure, with individual visits observed in EDs³. Notice however that observations relative to EDs and patients' zip codes $z(i)$ are not nested: there are visits in one ED of patients coming from different zip codes and patients living in an area with the same zip code can visit different EDs⁴.

Our purpose is to understand the determinants of appropriate ED visits, and to evaluate the role of individual decision to come directly on self-referral, without any assessment by a GP or by the phone triage. Consider $y_{i,h,z}$ the appropriateness score of the visit to ED h by patient i living in location z , and $d_{i,h,z}$ a dichotomic variable equal to 1 if patient i came on self-referral. We describe the patient's trajectory by a recursive two-equations model, where the decision to come on self-referral is explained by a linear equation (2.1) with ED specific effects ν_h , and where the appropriateness of the visit is explained by the decision to come on self-referral and other regressors in equation (2.2) with ED specific effects μ_h :

$$d_{i,h,z} = \phi_i a + X_i' b + W_{z(i)}' c + \nu_h + e_{i,h,z} \quad (2.1)$$

$$y_{i,h,z} = d_{i,h,z} \alpha + X_i' \beta + W_{z(i)}' \delta + \mu_h + \epsilon_{i,h,z} \quad (2.2)$$

In the above equation, $e_{i,h,z}$ and $\epsilon_{i,h,z}$ are random disturbances. ED specific effects ν_h and μ_h can be specified as fixed or random. Based on Hausman tests that led to a rejection of random effect hypothesis, we consider that ν_h and μ_h are fixed, which implies that the impacts of ED characteristics Q_h cannot be identified, at this stage of the estima-

³On average, we observe 44 visits par ED (median=40), with standard error equal to 19.

⁴The average number of zip codes per ED is 18 (median=17), and the average number of ED per zip code is 3 (median=2).

tion. We introduce Q_h later, in the correlated random effect approach explained below. Decision to visit on self-referral is a regressor of the score y . It is likely to explain the appropriateness of the visit since no medical expert contributed to the decision to visit ED. However, it is probably non exogenous, because unobserved heterogeneity that influences the decision to come on self-referral can be correlated to unobserved determinants of visit appropriateness. We decided to implement an instrumental variable (IV) method to obtain consistent estimates of equation (2.2). A relevant instrument must be correlated with $d_{i,h,z}$ and uncorrelated with $\epsilon_{i,h,z}$. We chose to use the distance ϕ_i from patient home location to ED, which is likely to influence the score only through its influence on the decision to come on self-referral. Indeed, it can be motivated by the cost of access to ED relative to the cost of access to GP. This includes transportation cost (money and time) and the opportunity cost of time of access to GP or ED. As regards monetary costs, the difference is tenuous, except that no cash-in-advance is required for ED visits. Otherwise, there are co-payments for both ED visit and GP consultation which are fully covered by complementary health insurance.

In this paper, we want to (i) examine the determinants of inappropriate ED visits, and especially the role of the patient decision to come on self-referral; (ii) identify among them what can be linked to patient characteristics and what can be attributed to a deficiency in the organization of care provision.

(i) To understand the determinants of inappropriate ED visits, we first estimate the recursive model formed by equations (2.1) and (2.2). Equation (2.1) is estimated by fixed effect OLS, allowing for clusters at the ED level. It serves at a first stage for the instrumental variable estimation of equation (2.2), which includes ED fixed effects and clusters at the ED level.

(ii) To evaluate the magnitudes, among the determinants of inappropriate ED visits, of the influence of patient characteristics on one side, and of the health care system organization on the other side, we divide each group of regressors into patient characteristics and system characteristics. Consider for example variables X , one has $X_i' = [X_i'^p | X_i'^s]$, where the exponents p and s refer to *patient* and *system*. Our purpose is to split the variance explained by our equations into the variance explained by *patient* variables and the variance explained by *system* variables. For instance, distance to ED and education are variables relative to patients, while time of the visit and the existence of primary care accessible during the night are considered system variables.

The ED fixed effects of equations (2.1) and (2.2) cannot be directly split into patient versus system characteristics. To solve this difficulty, we transform our specifications into correlated random effects (CRE) models, i.e., specifications *à la Mundlak* (1978), where the correlations between random specific effects and regressors are specified as a linear combination of the averages of the regressors at the ED level and of ED characteristics Q_h . (See appendix 2.A for details on the specifications).

5 Results

5.1 The role of decision to come on self-referral on visit appropriateness

The estimates are reported in table 2.4. In our recursive model, equation (2.1) explains the decision to come on self-referral and equation (2.2) explains the score of appropriateness, conditional on the type of coming. Other results are displayed in the online appendix 2.E to show the robustness of the findings to the choices of specification and variables. As stated in the previous section, the specifications allow for fixed effects at the ED level. The variability of the explained variables can be split into two components, one reflecting average differences between EDs, the other measuring differences between patients within each ED (within-ED variance). The within-ED component dominates greatly the variability of our explained variables: it represents 92% of the variability of the decision to come on self-referral and 87% of the score variability. So, in our data on the use and access to EDs, differences between patients dominate the information recorded, and are much more important than average variations between EDs.

Statistics provided at the bottom of table 2.4, column (2), validate the use of an instrumental variable estimator for equation (2.2): the Hausman test rejects the exogeneity of the decision to come on self-referral (p-value = 0.0487)⁵. The value of the Fischer statistic for the test of significance of the excluded instrument in the first stage regression (distance between patient's home and ED in equation (2.1)) shows that the instrument is not weak (F-stat = 40.15). We find that the decision to visit ED on self-referral has a sizeable negative impact: it reduces the appropriateness score by -3, which amounts to one standard deviation of the score (table 2.3). This result is easily understandable because patients have no medical expertise to evaluate their needs of urgent care at the

⁵With the alternative indicator of appropriateness (dichotomic variable "the visit was necessary"), the Hausman test rejects the exogeneity of the decision to come on self-referral as well (p-value = 0.0102, see appendix 2.B, table 2.B.1).

ED, and their judgment can be influenced by anxiety due to personal health problems. Estimates displayed in column (1) show the determinants of patient's decision to come on self-referral.

Table 2.4: Determinants of appropriate ED visits

	(1) Self-referral (OLS)		(2) Appropriate score (2SLS)	
	coef.	se	coef.	se
	<i>First stage</i>		<i>Second stage</i>	
Distance				
< 10km	0.064***	(0.010)	-	
> 10km	ref.		-	
Self-referral				
Yes	-		-3.071***	(1.018)
No	ref.		ref.	
Age				
[18;24[	ref.		ref.	
[25;44[	-0.059***	(0.012)	0.299***	(0.109)
[45;64[	-0.152***	(0.013)	0.529***	(0.176)
[65;74[	-0.210***	(0.024)	0.641**	(0.254)
75+	-0.350***	(0.022)	0.787**	(0.384)
Gender				
Male	ref.		ref.	
Female	-0.022***	(0.007)	-0.499***	(0.056)
Occupation				
Employed	ref.		ref.	
Unemployed	-0.038***	(0.014)	-0.164	(0.114)
Retired	-0.090***	(0.018)	0.051	(0.158)
Other	-0.041***	(0.012)	0.011	(0.095)
Education				
No degree	ref.		ref.	
High school	-0.019*	(0.011)	0.003	(0.070)
College	-0.034**	(0.013)	0.071	(0.090)
Comp. health insurance				
Private	ref.		ref.	
Public (CMU-C)	0.035**	(0.016)	-0.211*	(0.111)
None	0.023	(0.016)	-0.274**	(0.121)
Doesn't know	-0.045**	(0.021)	0.026	(0.144)
Time of the visit				
[midnight;4am[	ref.		ref.	
[4am;8am[	0.058**	(0.026)	-0.126	(0.187)
[8am;noon[	-0.039*	(0.020)	-0.590***	(0.147)
[noon;4pm[	-0.077***	(0.020)	-0.576***	(0.160)
[4pm;8pm[	-0.105***	(0.020)	-0.452***	(0.173)
[8pm;midnight[	0.005	(0.021)	-0.261*	(0.143)
The patient has a GP				
Yes	-0.105***	(0.015)	-0.025	(0.159)
No	ref.		ref.	
Variables at the patient's zip code level				
Indicator of local accessibility				
to				
GP	-0.010	(0.029)	-0.053	(0.202)
Nurse	0.007	(0.011)	-0.053	(0.089)

Continued on next page

Table 2.4 – *Continued from previous page*

	(1) Self-referral (OLS)		(2) Appropriate score (2SLS)	
	coef.	se	coef.	se
Availability of GP OOH				
Yes	-0.012	(0.014)	0.062	(0.097)
No	ref.		ref.	
Patient and ED in same <i>dé-</i> <i>partement</i>				
Yes	-0.023*	(0.012)	-0.073	(0.078)
No	ref.		ref.	
Zip code annual income				
> €20,000 per capita	0.029**	(0.012)	0.082	(0.092)
< €20,000 per capita	ref.		ref.	
Unemployment rate	ref.		ref.	
< 10%	-0.036**	(0.016)	0.151	(0.122)
10% to 15%	-0.051***	(0.013)	-0.018	(0.107)
>15%	ref.		ref.	
Observations	15,714		15714	
Number of ED	439		439	
R-squared	0.168		0.125	
ED Fixed Effects	Yes		Yes	
Tests on instruments				
F-stat			40.15	
Hausman test (p-value)			0.0487	

Sources: Authors' calculations from *Enquête Urgence* database.

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. This table presents the coefficients (standard errors (se) in parentheses) of the principal 2SLS analysis. The sample used is made of ED containing at least 15 observations on adult patients (+18) who did not come to ED through transfer or a referral from an institution or a health facility (eg nursing home, hospital, residence for disabled individuals etc.)

All variables describing patient characteristics are significant: distance to ED, age, gender, occupation, and education. Patients living close to ED are more likely to come on self-referral, which can be interpreted in terms of access costs. Otherwise, decision to come on self-referral is a decreasing function of age, and less likely for women. Educated people, and people who are unemployed or retired are less likely to come on self-referral. The roles of education and aging might reflect better information acquired by studies or experience on the role of ED in care supply. The impact of occupation obeys to another mechanism; it suggests that going directly to ED (on self-referral) is less time-consuming than consulting first a doctor. The impact of unemployment rate in the patient's zip code goes in the same direction.

Characteristics describing the organization of the health care system also have significant impacts on the decision to come on self-referral: being listed with a GP prevent such decision (coefficient = -0.105). Coming on self-referral is less frequent during the day (between 8 am and 8 pm) when GPs are accessible. Conversely, being a beneficiary

of the free means-tested complementary coverage (CMU-C) is positively associated with the decision to come on self-referral. This can be seen as an outcome of the difficulties in access to specialist consultations faced by this population because it is forbidden to charge them with balance billing. Otherwise, variables describing care supply in the patient's zip-code are not significant, particularly local accessibility indicators for GPs and nurses and the dichotomic variable indicating availability of GPs out of office hours. The impacts of these variables might be captured by the ED fixed effects⁶.

Turning to the analysis of the determinants of visit appropriateness (Table 2.4, column (2)), we have in mind that the estimated impacts of variables measure direct effects that influence the score on top of indirect effects that work through their impact on the decision to come on self-referral. Finding opposite signs for one regressor in equations (2.1) and (2.2) means that the direct impact of the variable goes in the same direction, i.e., reinforces its indirect impact that works through self-referral coming (because coming on self-referral has a negative effect on the score).

The estimations show that age has a direct positive (and monotonic) impact on the appropriateness of recourse to ED, which reinforces the negative impact of age on the coming on self-referral. It is the same for the impact of health insurance, where estimates show that being a beneficiary of the CMU-C deteriorates the appropriateness of ED visit, as it encourages the decision to come on self-referral. The discriminations against CMU-C beneficiaries who are less profitable patients make them come to ED instead of consulting a specialist in ambulatory care where they have problems to get an appointment. Because of these well-know problems, GPs might address them to ED, even if their health problem could be fixed by a specialist. Regarding people without complementary insurance, we find similarly a positive (but not significant) impact on the decision to come on self-referral, and a significant negative impact on the appropriateness. People with limited coverage can prefer going to ED, where there is no cash in advance to pay for care services, and where they guess (wrongly) that they are free.

Interestingly, socioeconomic variables have no significant influence on the appropriateness score, conditionally on the decision to come on self-referral. Occupation and education only have an influence on this decision. In other words, there is no socioeconomic bias in the way GPs decide to refer people to ED. This result is of importance for guidelines that can be given to primary care doctors to improve referrals to ED. It is not visible in previous studies on ED, because they estimate a specification equivalent to a reduced form, where the role of the individual decision regarding the coming to ED

⁶When we express the fixed effects as a linear function of variables averaged at the ED level (Mundlak approach) we find that GP accessibility has a significant negative significant influence on the decision to come on self-referral (see table 2.D.1 in the online appendix 2.D).

cannot be disentangled. Looking at the estimation of the reduced form, we see that retired people and educated people have more relevant ED visits (table 2.C.1 in the appendix 2.C). The estimates of table 2.4 show that it is exclusively due to the decision to come on self-referral.

We obtain noticeable results regarding the time slots of the visit. Daytime slots (8am – noon; noon-4pm; 4pm-8pm) have coefficients of the same sign in equations (2.1) and (2.2), which means that their influence on appropriateness work in opposite directions (self-referral has a negative coefficient in equation (2.2)). During the day, patients are less likely to come on self-referral because doctor practices are open, and because many visits are divertible the score decreases by 0.5 point on average. The impact found for the slot 4am-8am illustrates the interest of our structural specification. Overlooking the structural form means either that one risks estimation bias by neglecting the possible non-exogeneity of self-referral, or that one estimates the reduced form. The estimates of the reduced form provided in Table 2.C.1 in the online appendix 2.C show that visits occurring during the slot 4am-8am are less appropriate, a result which is particularly difficult to interpret. Using the structural specification enables us to observe what is due to the self-referral decision: in Table 2.4, we see that the negative impact of 4am-8am is uniquely due to the self-referral decision, and that 4am-8am is not significant in equation (2.2)⁷.

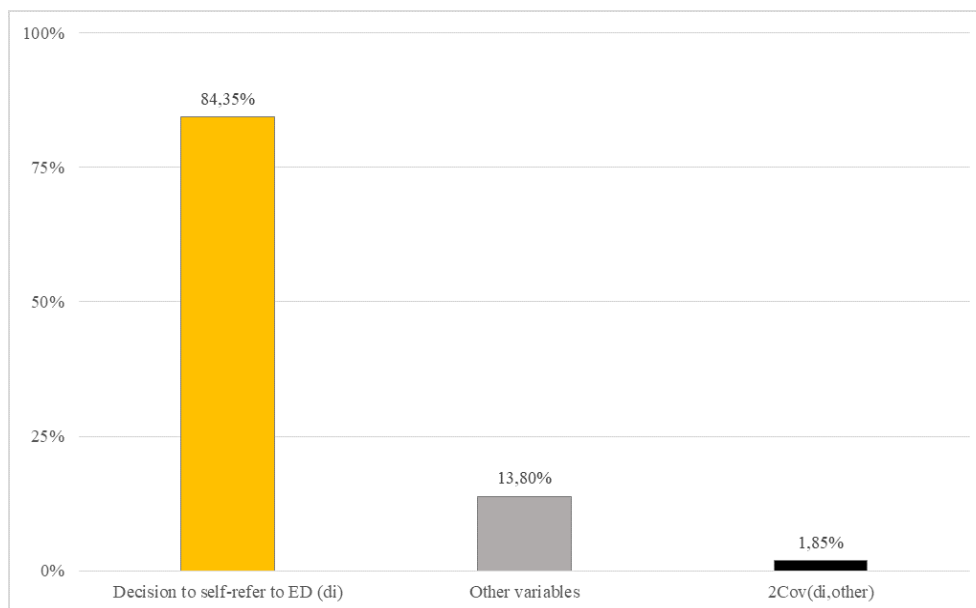
Finally, patients listed to a GP are less likely to come on self-referral, with an important impact of -0.10. This has no impact on the score, conditional of the coming mode, which is quite logical.

5.2 The respective impacts of patient and system characteristics

We now use our estimates to provide insights about the roles of patient and system characteristics in explaining the inefficient use of ED. As explained in our empirical strategy (section 4, with details and formulas in the appendix 2.A), we can split the explained variance of our dependent variables into what results from patient characteristics, and what refers to characteristics of the health care system. Of course, these two groups of variables can be correlated: we provide the values of twice the covariance between patient and system characteristics. As explained in our empirical strategy, this analysis is implemented on a correlated random effects specification [31] that enables us to explain ED fixed effects as functions of patient and system variables, averaged at the ED level. The estimated impacts of the determinants analyzed above are similar on this specification.

⁷Similar illustration can be drawn from results obtained for the time slot 4pm-8pm, using estimates in Table 2.B.1 and 2.C.1 (the latter is in the online appendix 2.C).

Figure 2.1: Breakdown of the explained variance of the appropriate score between patient and system determinants



Sources: Author's calculation from *Enquête Urgence*.

Notes: 100% = explained variability. Results are obtained by performing the breakdown presented in equation (2.7) on the estimates of an IV estimation of model (2.2) using a Mundlak's CRE (Correlated Random Effect) specification.

Lecture: 84% of the explained variance of the patient's visit score of appropriateness is explained by the decision to visit ED with or without referring to a health professional.

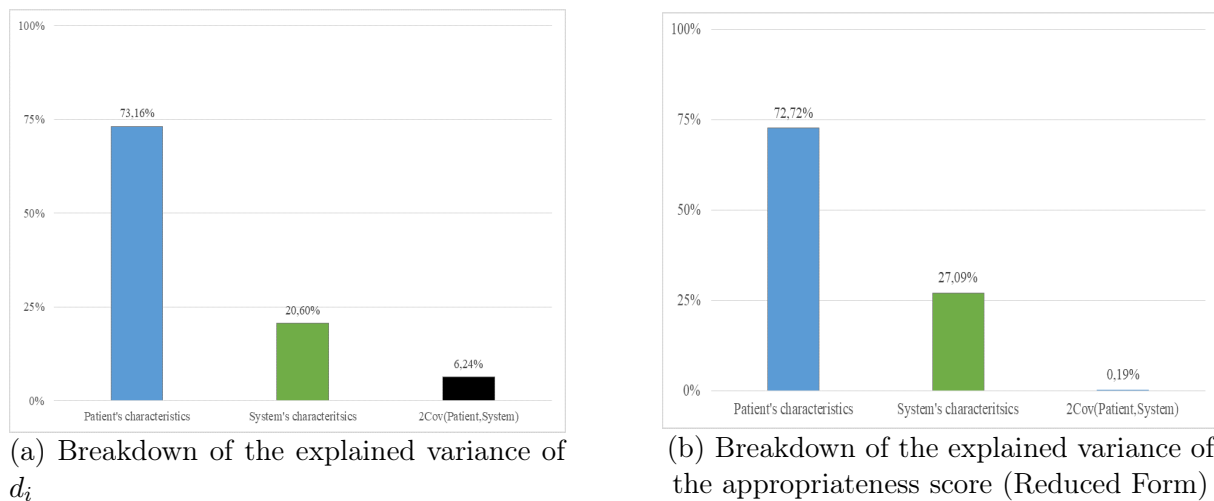
Patient variables are the following: distance to ED, age, gender, occupation, and education, that are observed at the patient level; unemployment rate and average income observed at the patient's zip-code level. System variables are comp. health insurance (CHI), time of the visit, patient listed or not with a GP, indicators of local accessibility of GPs and nurses, local availability of GP out of office hours, dichotomic variable indicating if patient and ED are located in the same *département*, and other variables observed at the ED level, which are listed at the bottom of table 2.D.1 in online appendix 2.D.

Before splitting the explained variance into its patient and system components, we first follow the structure of our model to quantify the contribution of the decision to come on self-referral in the explained variance of the score (equation (2.2)). Figure 2.1 shows how important is the influence of the referral type on the explanation of the appropriateness score: 84.3% of the explained variance is due to this decision. Otherwise, 13.8% is due to the other regressors and the covariance is tiny. However, patients' decisions are influenced by the organization of the health care system they face: determinants of the decision to come on self-referral comprise patient and system characteristics. The breakdown of the explained variance of the decision to come on self-referral (equation (2.1)) is given in Figure 2.2a. It shows that the contribution of patient characteristics is predominant: it

amounts to 73.2% of the explained variance, whereas system characteristics contribute to 20.6%.

Last but not least, we can integrate equations (2.1) and (2.2) in the reduced form to evaluate the contributions of patient and system characteristics to the explanation of visit appropriateness, while considering, in this evaluation, the impact of patient decision to come on self-referral. Results are given in Figure 2.2b. We find that patient and system characteristics explain, respectively, 72.7% and 27.1% of the explained variance of the appropriateness score. So, the portion of the variance that is explained by system organization is far from negligible, more than one fourth of the score variability. Another interesting result is that the covariance between the contributions of patient and system characteristics is almost negligible: twice this covariance contributes to 0.2% of the explained variance. These two results shows that serious gains in efficiency can be expected from changes in system organization.

Figure 2.2: Breakdown of the explained variance between patient and system determinants



Sources: Author's calculation from *Enquête Urgence*.

Notes: 100% = explained variability. Results of figure 2.2a are obtained by performing the breakdown presented in equation (2.6) on the estimates of a CREM (Correlated Random Effect Model) of equation (2.4) by GLS (Generalized Least Squares). Results of figure 2.2b are obtained by performing similar breakdown as the one presented in equation (2.6) on \hat{y}_i variance. Estimates of \hat{y}_i are obtained through a GLS (Generalized Least Squares) estimation of model (2.2) reduced form with a Mundlak's CRE (Correlated Random Effect). Lecture: 1/5 of the explained variance of the patient's decision to self-refer to ED is explained by system related characteristics. 27% of the explained variance of the patient's visit score of appropriateness is explained by system related characteristics.

5.3 Robustness

Complementary analyses showed the robustness of our results. As explained in our data section 3, a qualitative assessment of the visit can be used to define a binary variable stating whether the visit was necessary or not (the alternatives being divertible or delayable). As shown in Table 2.B.1 of the online appendix 2.B, similar results are obtained if we use this indicator instead of the score of appropriateness. We used a Linear Probability Models (LPM) to estimate models explaining dichotomic variables such as “the patient came on self-referral”, or “the visit was necessary”. Indeed, the Probit estimator is not consistent when there are fixed effects with a limited number of observations because of the “incidental parameter problem” [8]. Linear Probability Models lead to unbiased estimates. There are concerns for the consistency of statistics used for the tests, but they are fixed by the use of robust standard errors (that we do) and a large sample size (like ours). As a check, we estimated Probit models without fixed effects and verified that we obtain similar results with LPM without fixed effects. Finally, we restricted our sample to ED with at least 15 observations to obtain consistent estimates of the effect of invariant ED characteristics in the CRE model. This does not impact our results, as shown in table 2.E.1 in online appendix 2.E.

6 Conclusion

In this paper we examine the determinants of inappropriate ED visits, taking advantage of a survey that provides a direct assessment by a doctor on the visit relevance, and gathers information on patients’ socio-economic characteristics and on the health care organization they face. We use a specification that enables us (i) to evaluate the role of patient decision to come to ED directly on self-referral and (ii) to assess the respective impacts of patient versus system determinants on visit inappropriateness. We find that patient decision to visit ED on self-referral has a huge impact on visit appropriateness score: 84% of its explained variance is due to this individual decision. This decision is influenced not only by personal characteristics, but also by the organization of care supply in the patient’s area. Our estimates show that 20% of the explained variance of this patient decision is due to what we call “system characteristics”, among which patient’s insurance, whether the patient is or not listed with a GP, and GP’s opening hours. Using our whole model to estimate the respective contributions of patient and system characteristics to the explained variability of the appropriateness score, we find that 72.7% of the explained score variability is due to patient characteristics and 27.1% to the health system organization.

Two other interesting results are obtained. On a methodological point of view, we show that the decision to come on self-referral is a non-exogenous regressor of the visit appropriateness. Overlooking this problem leads to a bias that understates the impact of this decision on the appropriateness score. Otherwise, we find that socioeconomic patient characteristics have no influence on the visit appropriateness, conditionally on the decision to come on self-referral. In other words, there is no socioeconomic bias in the way GPs decide to refer people to ED. This result of importance was not visible in previous studies on ED, because they considered specifications where the role of the individual decision regarding the coming to ED cannot be disentangled.

Taken together, our results show that policies intended to improve the efficiency of recourse to ED must focus on the patient's decision to come on self-referral. They show also that substantial gains in efficiency can be expected from changes affecting the health care supply. Indeed, patients' decisions being influenced by the system organization, more than a fourth of the appropriateness score explained variance is due to system characteristics. This result is of importance to the regulator aware of the small impact of information campaigns, and who prefers to avoid introducing financial penalties that can jeopardize access to care for deprived people.

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Appendix

2.A Breakdowns

The two-equation model is:

$$d_{i,h,z} = \phi_i a + X_i' b + W_{z(i)}' c + \nu_h + e_{i,h,z} \quad (2.1)$$

$$y_{i,h,z} = d_{i,h,z} \alpha + X_i' \beta + W_{z(i)}' \delta + \mu_h + \epsilon_{i,h,z} \quad (2.2)$$

Referring to Mundlak (1978) [31], we transform these equations into correlated random effects (CRE) models.

As concerns decision to come on self-referral (equation (2.1)), we have:

$$\nu_h = \bar{\phi}_h \Pi_1 + \bar{X}_h' \Pi_2 + Q_h' \gamma + u_h \quad (2.3)$$

, where u_h is a random variable, and where $\bar{\phi}_h$ is the ED average of ϕ_i (the distance to ED of all individual visits to ED h).

Replacing ν_h in equation (2.1) by its expression in equation (2.3), and putting together all regressors of type p (patient) and s (system), one obtains:

$$d_{i,h,z} = G_{i,h,z}^{\prime p} \theta_p + G_{i,h,z}^{\prime s} \theta_s + u_h + e_{i,h,z} \quad (2.4)$$

We estimate this random effect model by GLS, and obtain (from now on and for the sake of simplicity, we omit subscripts h and z):

$$\hat{d}_i = \hat{d}_i^p + \hat{d}_i^s \quad (2.5)$$

, where $\hat{d}_i^p = G_i^{\prime p} \hat{\theta}_p$ is the part of the decision to come on self-referral that is explained by patient characteristics and $\hat{d}_i^s = G_i^{\prime s} \hat{\theta}_s$ is the part of this very decision that is explained by system characteristics.

From equation (2.5) we can write:

$$V(\hat{d}_i) = V(\hat{d}_i^p) + V(\hat{d}_i^s) + 2Cov(\hat{d}_i^p, \hat{d}_i^s) \quad (2.6)$$

This enables us to quantify the contribution of patient and system variables in the explained variance $V(\hat{d}_i)$ for decision to visit ED and for the appropriateness score of the visit as well $V(\hat{y}_i)$ (equation (2.2)). For the visit score, we use the reduced form⁸ to

⁸The reduced form results from the combination of equations (2.1) and (2.2):

avoid implementing our breakdown on a two-step estimation (the IV estimator), apply a Mundlak specification to explain ED effects, and then explain the score by groups of patient and system characteristics (as shown above for decision $d_{i,h,z}$ in equations (2.3) and (2.4))⁹. Last, it seemed interesting to us to quantify, in equation (2.2), the contribution, to the explained variance of y , of patient's decision to visit on self-referral. We performed an IV estimation of model (2.2) and used Mundlak's CRE specification. Then we split the explained variability of the score into the variability due to self-referral decision, and the rest explained by the other regressors:

$$V(\hat{y}_i) = V(\hat{d}_i) + V(\widehat{other}_i) + 2Cov(\hat{d}_i, \widehat{other}_i) \quad (2.7)$$

$y_{i,h,z} = \phi_i a \alpha + X'_i (b \alpha + \beta) + W'_{z(i)} (c \alpha + \delta) + (\nu_h \alpha + \mu_h) + (e_{i,h,z} \alpha + \epsilon_{i,h,z})$

⁹In any case, our models are estimated by the GLS estimator, which implies that the estimated residuals are not uncorrelated with the predicted variable. The correlations are however very small, and we give their values in the results presented hereafter.

2.B Results of OLS regressions

Table 2.B.1: Determinants of appropriate ED visits - OLS

	(1) Appropriate score (OLS)		(2) ED visit was necessary (LPM)		(3) ED visit was necessary (2SLS)	
	coef.	se	coef.	se	coef.	se
Self-referral						
Yes	-1.119***	(0.061)	-0.174***	(0.009)	-0.552***	(0.157)
No	ref.		ref.		ref.	
Age						
[18;24[	ref.		ref.		ref.	
[25;44[	0.415***	(0.089)	0.065***	(0.013)	0.042**	(0.017)
[45;64[	0.825***	(0.087)	0.122***	(0.013)	0.064**	(0.027)
[65;74[	1.051***	(0.152)	0.178***	(0.023)	0.099**	(0.039)
75+	1.473***	(0.150)	0.239***	(0.023)	0.106*	(0.059)
Gender						
Male	ref.		ref.		ref.	
Female	-0.459***	(0.051)	-0.069***	(0.008)	-0.077***	(0.009)
Occupation						
Employed	ref.		ref.		ref.	
Unemployed	-0.092	(0.103)	0.009	(0.016)	-0.005	(0.018)
Retired	0.228*	(0.123)	0.040**	(0.019)	0.006	(0.024)
Other	0.091	(0.082)	0.042***	(0.013)	0.027*	(0.015)
Education						
No degree	ref.		ref.		ref.	
High school	0.042	(0.064)	-0.005	(0.010)	-0.012	(0.011)
College and more	0.137*	(0.080)	0.005	(0.013)	-0.007	(0.014)
Comp. health insurance						
Private	ref.		ref.		ref.	
Public (CMU-C)	-0.281***	(0.098)	-0.062***	(0.017)	-0.049**	(0.019)
None	-0.320***	(0.113)	-0.039**	(0.017)	-0.030	(0.019)
Doesn't know	0.117	(0.134)	0.016	(0.022)	-0.001	(0.024)
Time of the visit						
[midnight;4am[	ref.		ref.		ref.	
[4am;8am[	-0.241	(0.171)	-0.048*	(0.027)	-0.026	(0.030)
[8am;noon[	-0.509***	(0.132)	-0.098***	(0.020)	-0.113***	(0.022)
[noon;4pm[	-0.423***	(0.129)	-0.075***	(0.021)	-0.105***	(0.026)
[4pm;8pm[	-0.245*	(0.131)	-0.046**	(0.020)	-0.086***	(0.027)
[8pm;midnight[	-0.268**	(0.133)	-0.047**	(0.021)	-0.046*	(0.024)
The patient has a GP						
Yes	0.183	(0.116)	0.030*	(0.017)	-0.010	(0.024)
No	ref.		ref.		ref.	
Variables at the patient's zip code level						
Indicator of local accessibility						
GP	-0.087	(0.192)	0.004	(0.030)	0.011	(0.032)
Nurse	-0.063	(0.085)	-0.014	(0.017)	-0.012	(0.017)
Availability of GP OOH						
Yes	0.075	(0.093)	0.017	(0.015)	0.015	(0.016)
No	ref.		ref.		ref.	
Patient and ED are from the same <i>département</i>						
Yes	-0.089	(0.074)	-0.015	(0.011)	-0.012	(0.012)
No	ref.		ref.		ref.	
Zip code annual income						

Continued on next page

Table 2.B.1 – *Continued from previous page*

	(1) Appropriate score (OLS)		(2) ED visit was necessary (LPM)		(3) ED visit was necessary (2SLS)	
	coef.	se	coef.	se	coef.	se
> €20k per capita	0.001	(0.074)	-0.011	(0.012)	0.005	(0.014)
< €20k per capita	ref.		ref.		ref.	
Unemployment rate						
< 10%	0.272***	(0.091)	0.026*	(0.016)	0.003	(0.020)
10% to 15%	0.116	(0.074)	0.010	(0.012)	-0.016	(0.017)
> 15%	ref.		ref.		ref.	
N	15,714		15,714		15,714	
Number of ED	439		439		439	
ED Fixed Effects	Yes		Yes		Yes	
R-squared	0.196		0.154		0.036	
Tests on instruments						
F-stat					47.43	
Hausman test (p-value)					0.0102	

Sources: Authors' calculations from *Enquête Urgence* database.

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. This table presents the coefficients (standard errors (se) in parentheses) of OLS regression on the score of appropriate use, and of LPM (Linear Probability Model) and 2SLS regressions on the qualitative assessment of appropriateness (dichotomic variable equald to 1 if the ED visit was necessary). The sample used is made of ED containing at least 15 observations on adult patients (+18) who did not come to ED through transfer or a referral from an institution or a health facility (eg nursing home, hospital, residence for disabled individuals etc.)

2.C Results of the reduced form

Table 2.C.1: Determinants of appropriate ED visits - Reduced Form

	(1) Appropriate score (OLS)		(2) ED visit was necessary (LPM)	
	coef.	se	coef.	se
Distance				
<10km	-0.198***	(0.065)	-0.036***	(0.010)
>10km	ref.		ref.	
Age				
[18;24[	ref.		ref.	
[25;44[	0.481***	(0.089)	0.075***	(0.013)
[45;64[	0.996***	(0.089)	0.148***	(0.014)
[65;74[	1.285***	(0.155)	0.215***	(0.023)
[75+]	1.864***	(0.154)	0.300***	(0.023)
Gender				
Male	ref.		ref.	
Female	-0.431***	(0.053)	-0.064***	(0.009)
Occupation				
Employed	ref.		ref.	
Unemployed	-0.047	(0.104)	0.016	(0.016)
Retired	0.328***	(0.126)	0.056***	(0.019)
Other	0.138	(0.084)	0.050***	(0.013)
Education				
No degree	ref.		ref.	
High school	0.063	(0.065)	-0.002	(0.010)
College and more	0.177**	(0.082)	0.012	(0.013)
Comp. health insurance				
Private	ref.		ref.	
Public (CMU-C)	-0.318***	(0.098)	-0.068***	(0.017)
None	-0.344***	(0.113)	-0.043**	(0.017)
Doesn't know	0.165	(0.138)	0.024	(0.023)
Time of the visit				
midnight;4am	ref.		ref.	
[4am;8am[	-0.305*	(0.173)	-0.058**	(0.027)
[8am;noon[	-0.470***	(0.132)	-0.092***	(0.020)
[noon;4pm[	-0.339***	(0.128)	-0.062***	(0.021)
[4pm;8pm[	-0.131	(0.132)	-0.028	(0.020)
[8pm;midnight[	-0.275**	(0.133)	-0.048**	(0.021)
The patient has a GP				
Yes	0.298**	(0.118)	0.048***	(0.018)
No	ref.		ref.	
Variables at the patient's zip code level				
Indicator of local accessibility				
GP	-0.023	(0.194)	0.016	(0.030)
Nurse	-0.074	(0.086)	-0.016	(0.017)
Availability of GP OOH				
Yes	0.098	(0.094)	0.021	(0.015)
No	ref.		ref.	
Patient and ED are from the same <i>département</i>				
Yes	-0.003	(0.080)	0.000	(0.012)
No	ref.		ref.	
Zip code annual income				

Continued on next page

Table 2.C.1 – *Continued from previous page*

	(1)		(2)	
	Appropriate score (OLS)		ED visit was necessary (LPM)	
	coef.	se	coef.	se
> €20,000 per capita	-0.006	(0.076)	-0.011	(0.012)
< €20,000 per capita	ref.		ref.	
Unemployment rate	ref.		ref.	
< 10%	0.261***	(0.097)	0.023	(0.016)
10% to 15%	0.138*	(0.077)	0.012	(0.013)
> 15%	ref.		ref.	
N	15,714		15,714	
Number of ED	439		439	
ED Fixed Effects	Yes		Yes	
R-square	0.174		0.130	

Sources: Authors' calculations from *Enquête Urgence* database.

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. This table presents the coefficients (standard errors (se) in parentheses) of the reduced form. OLS and LPM (Linear Probability Model) regressions are estimated. The sample used is made of ED containing at least 15 observations on adult patients (+18) who did not come to ED through transfer or a referral from an institution or a health facility (eg nursing home, hospital, residence for disabled individuals etc.)

2.D Results of the Mundlak's CREM specification

Note: Coefficients reported in table 2.D.1 are from equation (2.3): $\nu_h = \bar{\phi}_h \Pi_1 + \bar{X}'_h \Pi_2 + Q'_h \gamma + u_h$. They are obtained by the estimation of the reduced form of equation (2.2) as a correlated random effects model (CREM) following Mundlak (1978) [31]. To see the results of the coefficients associated with variables observed at the patient's level, the reader should refer to the coefficients reported in table 2.C.1 since the estimation of equation (2.2) by fixed effects model and CREM produces both consistent estimates.

Table 2.D.1: Correlation between ED fixed effects and regressors averaged at the ED level

	(1) Self-referral (LPM) coef. se		(2) Appropriate score (OLS) coef. se		(3) ED visit was necessary (LPM) coef. se	
Averages of the regressors at the ED level						
Distance						
< 10km	0.045	(0.039)	-0.178	(0.365)	-0.022	(0.042)
> 10km	ref.		ref.		ref.	
Age						
[18;24[	ref.		ref.		ref.	
[25;44[	-0.203**	(0.087)	1.156	(0.980)	0.090	(0.114)
[45;64[	-0.101	(0.087)	-0.030	(0.989)	-0.026	(0.121)
[65;74[	-0.140	(0.151)	-1.348	(1.713)	-0.195	(0.216)
75+	-0.109	(0.147)	-2.368	(1.588)	-0.334*	(0.200)
Gender						
Male	ref.		ref.		ref.	
Female	-0.018	(0.052)	1.035*	(0.610)	0.111	(0.069)
Occupation						
Employed	ref.		ref.		ref.	
Unemployed	-0.111	(0.106)	1.800	(1.224)	0.171	(0.150)
Retired	-0.233*	(0.122)	2.855**	(1.389)	0.263	(0.170)
Other	-0.058	(0.085)	1.218	(0.871)	0.132	(0.105)
Education						
No degree	ref.		ref.		ref.	
High school	0.032	(0.062)	-0.592	(0.618)	-0.074	(0.078)
College and more	0.008	(0.080)	-0.864	(0.781)	-0.027	(0.092)
Comp. Health Insurance						
Private	ref.		ref.		ref.	
Public (CMU-C)	0.040	(0.119)	-0.155	(1.154)	0.176	(0.135)
None	-0.021	(0.099)	-0.747	(1.063)	0.012	(0.138)
Doesn't know	0.060	(0.073)	-2.016**	(0.973)	-0.104	(0.096)
Time of the visit						
[midnight;4am[	ref.		ref.		ref.	
[4am;8am[	0.124	(0.211)	-3.188	(2.245)	-0.141	(0.260)
[8am;noon[	0.216*	(0.130)	-1.242	(1.434)	0.134	(0.169)
[noon;4pm[	0.181	(0.126)	-2.466*	(1.390)	-0.108	(0.168)
[4pm;8pm[0.232*	(0.139)	-2.048	(1.498)	0.051	(0.183)
[8pm;midnight[0.077	(0.153)	-0.943	(1.772)	0.140	(0.206)

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Table 2.D.1 – *Continued from previous page*

	(1)		(2)		(3)	
	Self-referral (LPM)		Appropriate score (OLS)		ED visit was necessary (LPM)	
	coef.	se	coef.	se	coef.	se
The patient has a GP						
Yes	-0.164	(0.109)	-0.093	(1.140)	0.127	(0.132)
No	ref.		ref.		ref.	
Variables at the patient's zip code level						
Indicator of local accessibility						
GP	-0.171**	(0.069)	-1.168*	(0.689)	-0.132	(0.088)
Nurse	0.019	(0.019)	0.224	(0.168)	0.030	(0.024)
Availability of GP OOH						
Yes	-0.006	(0.019)	-0.146	(0.180)	-0.020	(0.023)
No	ref.		ref.		ref.	
Patient and ED in same <i>département</i>						
Yes	0.013	(0.039)	-0.303	(0.408)	0.031	(0.055)
No	ref.		ref.		ref.	
Zip code annual income						
> €20,000 per capita	-0.013	(0.029)	0.256	(0.274)	-0.012	(0.035)
< €20,000 per capita	ref.		ref.		ref.	
Unemployment rate						
< 10%	-0.055	(0.042)	-0.107	(0.390)	0.026	(0.048)
10% to 15%	0.012	(0.030)	-0.367	(0.300)	0.010	(0.034)
> 15%	ref.		ref.		ref.	
ED characteristics Q_h						
Hospital ownership						
Public	ref.		ref.		ref.	
PFP	0.018	(0.019)	1.058***	(0.209)	0.135***	(0.027)
PNP	-0.005	(0.026)	0.285	(0.259)	0.042	(0.030)
Fast-tracks						
Yes	-0.010	(0.011)	-0.108	(0.119)	-0.011	(0.014)
No	ref.		ref.		ref.	
Direct access in specialized units						
Yes	0.027	(0.018)	0.247	(0.190)	0.028	(0.023)
No	ref.		ref.		ref.	
Register desk						
Yes	0.022	(0.018)	-0.020	(0.181)	0.010	(0.021)
No	ref.		ref.		ref.	
Register desk 24/24						
Yes	-0.018	(0.012)	-0.005	(0.133)	0.006	(0.016)
No	ref.		ref.		ref.	
MRI						
Yes	-0.056***	(0.016)	-0.154	(0.157)	-0.053**	(0.021)
No	ref.		ref.		ref.	
Number of medical staff						
Physicians	0.002	(0.005)	0.035	(0.059)	0.010	(0.007)
Nurses' managers	-0.024*	(0.013)	0.138	(0.153)	-0.000	(0.019)
Nurses	-0.011**	(0.005)	0.072	(0.059)	0.011	(0.007)
Nursing assistants	-0.006	(0.005)	0.002	(0.052)	-0.004	(0.006)
Total number of visits	0.000	(0.000)	-0.005*	(0.003)	-0.001*	(0.000)
GP density in the ED <i>département</i>						
Per 1000 inhab.	-0.021	(0.023)	0.210	(0.234)	0.001	(0.032)

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Table 2.D.1 – *Continued from previous page*

	(1) Self-referral (LPM)		(2) Appropriate score (OLS)		(3) ED visit was necessary (LPM)	
	coef.	se	coef.	se	coef.	se
Observations	15,714		15,714		15,714	
Number of ED	439		439		439	
R-squared	0.168		0.174		0.130	

Sources: Authors' calculations from *Enquête Urgence* database.

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. This table presents the coefficients (standard errors (se) in parentheses) of Correlated Random Effects Models (CREM) estimated on the reduced form of equation (2.2). Column 1 reports First Stage estimates. Since CREM results are equivalent to the results of the Fixed Effect model for the coefficients of the variables measured at the individual level, we only report results for variables observed at the ED level in this table (see breakdown methodology presented in equation(2.3)). The sample used is made of ED containing at least 15 observations on adult patients (+18) who did not come to ED through transfer or a referral from an institution or a health facility (eg nursing home, hospital, residence for disabled individuals etc.).

Variables observed at the ED level: averages of patient's and system's characteristics at the ED level, ownership, fast-track (yes/no), direct access to hospital departments (yes/no; e.g. for cardiology), registered desk 24/7 (yes/no), MRI (yes/no), number of physicians, number of health manager, number of nurses, number of care assistants, total number of visits the day of the survey, GP density at the ED zip code level.

2.E Robustness of estimates to sample selection

Table 2.E.1: Determinants of appropriate ED visits

	(1) Self-referral (OLS)		(2) Appropriate score (2SLS)	
	coef.	se	coef.	se
	<i>First stage</i>		<i>Second stage</i>	
Distance				
< 10km	0.067***	(0.010)	-	
> 10km		ref.	-	
Self-referral				
Yes		-	-3.340***	(0.951)
No		-		ref.
Age				
18;24		ref.		ref.
[25;44[	-0.063***	(0.012)	0.273**	(0.107)
[45;64[	-0.152***	(0.012)	0.482***	(0.166)
[65;74[	-0.210***	(0.023)	0.578**	(0.244)
75+	-0.349***	(0.021)	0.684*	(0.361)
Gender				
Male		ref.		ref.
Female	-0.020***	(0.007)	-0.487***	(0.054)
Occupation				
Employed		ref.		ref.
Unemployed	-0.037***	(0.014)	-0.201*	(0.112)
Retired	-0.094***	(0.017)	-0.005	(0.153)
Other	-0.044***	(0.011)	-0.033	(0.093)
Education				
No degree		ref.		ref.
High school	-0.021**	(0.010)	0.010	(0.069)
College	-0.033**	(0.013)	0.055	(0.087)
Comp. health insurance				
Private		ref.		ref.
Public (CMU-C)	0.031**	(0.016)	-0.217**	(0.108)
None	0.032**	(0.016)	-0.233*	(0.120)
Doesn't know	-0.035*	(0.021)	0.011	(0.137)
Time of the visit				
[midnight;4am[		ref.		ref.
[4am;8am[	0.062**	(0.025)	-0.060	(0.185)
[8am;noon[	-0.041**	(0.019)	-0.602***	(0.145)
[noon;4pm[	-0.079***	(0.019)	-0.570***	(0.157)
[4pm;8pm[	-0.106***	(0.020)	-0.449***	(0.170)
[8pm;midnight[	0.000	(0.020)	-0.211	(0.141)
The patient has a GP				
Yes	-0.107***	(0.015)	-0.079	(0.154)
No		ref.		ref.
Variables at the patient's zip code level				
Indicator of local accessibility to				
GP	-0.025	(0.028)	-0.035	(0.197)
Nurse	0.006	(0.011)	-0.052	(0.088)
Availability of GP OOH				
Yes	-0.006	(0.013)	0.084	(0.095)
No		ref.		ref.

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Table 2.E.1 – *Continued from previous page*

	(1) Self-referral (OLS)		(2) Appropriate score (2SLS)	
	coef.	se	coef.	se
<i>Patient and ED in same département</i>				
Yes	-0.026**	(0.012)	-0.091	(0.077)
No		ref.		ref.
<i>Zip code annual income</i>				
> €20,000 per capita	0.026**	(0.012)	0.078	(0.089)
< €20,000 per capita		ref.		ref.
<i>Unemployment rate</i>				
< 10%	-0.037**	(0.016)	0.121	(0.119)
10% and 15%	-0.052***	(0.012)	-0.053	(0.105)
> 15%		ref.		ref.
Observations		16,778		16,764
Number of ED		569		555
R-squared		0.173		0.109
ED Fixed Effects		Yes		Yes
Tests on instruments				
F-stat			55.77	
Hausman test (p-value)			0.0150	

Sources: Authors' calculations from *Enquête Urgence* database.

Notes: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. This table presents the coefficients (standard errors (se) in parentheses) of the 2SLS analysis on a sample of ED containing at least 2 observations. Sample characteristics on other criteria (adult patients (+18) who did not come to ED through transfer or a referral from an institution or a health facility (eg nursing home, hospital, residence for disabled individuals etc.)) is unchanged in comparison with the main sample analysis.

Chapter **3**

Does the abolition of direct payments for consultations reduce emergency room visits? Evidence from a French natural experiment.

1 Introduction

The World Health Organization (WHO) describes direct payments as the most inequitable form of funding [37]. Since the 1978 Alma Ata conference [47], it shows that the risk of catastrophic health care expenditure (spending more than 40% of income for health care) increases with the share of direct payments in total health care expenditure. However more than 100 million of households faced catastrophic health care expenditure in 2008 worldwide [37]. The presence of direct payments for care products and services increases the probability of care renouncement. And the lower the income, the higher this probability. Following WHO recommendations, many developing countries have gradually removed direct payments for a specific set of services and/or targeted populations [39]. Direct payments can also prevent access to care in developed countries. But evidence on the effect of direct payments' exemption on care consumption is lacking in these countries. Most of the reforms that aim at increasing financial access to primary care in European countries ensured free care by removing copayments. For instance, copayments for GP consultations were removed in Sweden in 2002 for children and adolescents aged 7-19 [31], in Norway in 2010 for adolescents aged 12 to 15, and in Ireland in 2015 for children under 6 years, and individuals aged 70 and older [32, 46].

The effect of direct payments should not be confused with the effect of insurance coverage. In France, direct payment is the main source of payment for out-patient care. The price of a medical consultation (for instance €25 for a consultation with a GP) is fully paid by patients. These payments impose a liquidity constraint on individuals' income that can deter care utilization. Thus, liquidity constraints induced by direct payments are a concern for out-patient consultations. This effect should be distinguished from the price sensitivity of care consumption, i.e., the sensitivity to copayments. In France, a National Health Insurance (NHI) covers 70% of out-patient care and 80% of inpatient care expenditure but unlike out-patient care, direct payments are not required for inpatient care. On top of that, 96% of the French population is covered by a complementary health insurance (CHI) [3] that reimburses the remaining share of expenditure. These two insurances (the French NHI and the private CHI chosen by patients) reimburse afterwards the price of the consultation to patients.

In 2017 a French reform removed direct payments for two specific populations¹: (1) pregnant women for all the care consumed (on top of the prenatal care recommended by the French NHI guidelines) between the first day of the 6th month of pregnancy and the 12th day following birth delivery, and (2) individuals suffering from long-term diseases (LTD) for all the care services used in relation to their disease. In addition, the reform

¹This reform is known as the "*Tiers-Payant*" reform in France.

removed the cost-sharing for the care consumed by pregnant women². Note that pregnant women were already exempt from direct payments and cost-sharing for the prenatal care recommended by NHI guidelines (see appendix 3.H). So the reform affected the care consumed by pregnant women *on top* of the recommended care. Since 2017, the cost of all out-patient care consumed after 6 months of pregnancy is zero. Note that the abolition of cost-sharing did not increase the reimbursements of pregnant women who were covered by a private CHI, like 96% of the French population. For this reason, we think that the main impact of the reform is the abolition of direct payments. This reform was not the first to remove direct payments for specific populations (see appendix 3.G for details on payment exemptions). In particular, direct payments (and cost-sharing) were removed for low-income households in 2000. This was made through the introduction of a free complementary health insurance (CHI) managed by the French NHI called "CMU-C"³. This CHI provides full insurance to the beneficiaries and prohibits direct payments for all the care consumed. So the risk to forgo or delay care consumption because of the presence of direct payments is limited by the existence of the CMU-C since 2000. Therefore, it is legitimate to question the need for the 2017 "Tiers-Payant" reform, which extended the exemption of direct payments to pregnant women and LTD patients who were not CMU-C beneficiaries. The annual income to be eligible to the CMU-C should not exceed €8,723 for a single individual in 2017⁴, which corresponds to 70% of the poverty line value in France in 2017 [18]. We wonder if some individuals above the CMU-C eligibility threshold are still liquidity constrained by direct payments for care.

Thus, we investigate in this paper the following questions. First, we analyze if the abolition of direct payments resulted in an increase in the care consultations of pregnant women. Second, if any impact is found, we examine the possible spillover effects of the reform on ED visits. Since direct payments are not required for ED visits, the reform could have resulted in a decrease in ED visits if EDs were used as substitutes to GP or specialists consultations before the reform to avoid the payment of a consultation. We investigate the impact of the reform on two outcomes: (i) the care consumed by pregnant women (consultations and ED visits), and (ii) the probability of pre-term births. We propose a triple difference (DDD) estimator to assess the causal impact of the reform on the care consumption of French pregnant women between July 2014 and June 2018.

This paper is organized as follows. The next section 2 details the reform and the

²Care consumed by LTD patients in relation to their disease was already covered at 100% by the French NHI before the reform.

³Couverture Maladie Universelle Complémentaire.

⁴Source: <https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000034316282>

context of its implementation. Section 3 discusses the sensitivity of care consumption to price and direct payments. Since the reform led to a change in both the level of direct payments and the level of cost-sharing, this section will discuss the mechanisms through which these changes can affect care consumption. Then, section 4 explains the extent to which the incentive to substitute out-patient care for EDs was removed by the reform. The following section 5 presents the data and section 6 the empirical strategy. Results are reported in section 7. The robustness of the results is tested in section 8. Section 9 concludes this paper.

2 The reform

The objective of the 2017 "Tiers-Payant" reform is to improve access to out-patient care by removing liquidity constraints, i.e., direct payments for care. Originally, all individuals insured by the French NHI should have been affected by a withdrawal of direct payments. But in France, care is covered by two insurances: the French NHI, and private insurance companies that cover the copayments. Organizing a general exemption of direct payments was too complicated to implement in the French system where many private insurance companies reimburse a share of consultation fees. Therefore, this project was abandoned. Instead of a general withdrawal of direct payments, the French government targeted two specific populations: pregnant women and individuals suffering from long-term diseases (LTD)⁵. The 1st of January 2017, direct payments were removed for: (i) all the care consumed by pregnant women on top of the care recommended by the NHI guidelines, between the 6th month of pregnancy and the 12th day after the birth delivery ; (ii) all care and services used by LTD patients, in relation to their disease. In addition, the reform ensured full coverage (balance billings excluded⁶) for the care consumed by pregnant women after 6 month of pregnancy. This change of coverage did not affect pregnant women who were covered by a CHI because their copayments were reimbursed before the reform, as for the 96% of the French population who has a CHI. For this reason, we believe that the main impact of the reform for pregnant women is the abolition of direct

⁵Long before the reform, the French Social Security has established a list of 30 long-term diseases (LTD) for which care expenditure are covered at 100% by the NHI. It concerns for instance patients suffering from cancer, diabetes, or heart failure. The exhaustive list of LTD covered by the French NHI is available from <https://www.ameli.fr/assure/droits-demarches/maladie-accident-hospitalisation/affection-longue-duree-ald/affection-longue-duree-ald>.

⁶In France, liberal physicians are free to chose between two sectors of practice. Either they affiliate to sector 1. In this case the price of the consultations is regulated and physicians cannot charge patients with balance billings. In return, they benefit from tax reductions [10]. Or they affiliate to sector 2. In this case they are free to set prices and charge patients with balance billings, but they pay more taxes. The French NHI only covers the regulated price of a consultation (€25 for a GP consultation). Balance billings can be covered by a complementary health insurance (CHI). In 2013, 6.8% of GPs and 26% of overall physicians were liberal physicians affiliated to sector 2 [19].

payments. LTD patients were not concerned by this change in coverage because they were already exempted from cost-sharing long before the reform for the care used in relation to their disease. All recommended medical examinations carried out during a pregnancy episode (see table 3.H.1 in appendix 3.H) were already exempt from direct payments before the reform, and covered for 100% by the French NHI. These examinations concern mainly prenatal consultations (with a gynecologist, a midwife or a GP) and childbirth preparation sessions. So the reform removed direct payments for all the care consumed by pregnant women which is not recommended by the NHI guidelines, after 6 months of pregnancy. Putting differently, the reform targeted all the care consumed in addition to the recommended prenatal care.

Before 2017, the absence of direct payments was not a right for pregnant women and LTD patients. The French Ministry of Health estimated that pregnant women advanced an average of €640 during a pregnancy episode and that patients with diabetes (one of the LTD disease listed by the French NHI) had to pay an average of €1,100 per year for their care through direct payments before the reform [2]. But since the 1st of July 2016, it was possible for physicians to already exempt these patients from direct payment on a voluntary basis. In the following of this paper, we will control the estimations for the increase in the number of physicians removing direct payments before the reform, i.e., from mid-2016. By allowing the possibility to adapt before the reform, the French government objective was to encourage physicians to test and introduce smoothly direct payment exemptions. In fact, physicians were reluctant to this reform as they feared cash flow problems due to long payment delays from the French NHI. To reassure physicians, the French NHI has committed to pay a €1 penalty each time a payment took more than 7 days to be paid. The French NHI paid a total of €640K of penalties to physicians for the last half of 2016, and a total of €150K for the first half of 2017.

To sum up, we are interested in this paper in analyzing the impact of the 2017 "Tiers-Payant" reform on the care consumption of pregnant women. The main shock induced by the reform is the abolition of direct payments for the care used after 6 month of pregnancy (and before day+12 after the birth delivery) in addition to the prenatal care recommended by the NHI guidelines that was already exempt from direct payments before the reform. In the following of this paper, we will refer to pregnancy episodes after 6 months (and before day+12 after the birth delivery) as the "treatment" period. We will also use the terminology "control" period or "pre-treatment" period to refer to pregnancy episodes before 6 months. Timelines of the reform are reported in appendix 3.A.

3 The sensitivity of health care consumption to price and liquidity

Care consumption can be influenced by changes in both the level of direct payments and cost-sharing. But the sensitivity of care consumption to the level of insurance coverage and the level of direct payments can differ.

3.1 The price elasticity of care consumption

From an economic perspective, price sensitivity refers to the way the demand is affected by a change in the price of a product. For "normal" goods, demand decreases with price. On the health care market, most prices are not set freely by care providers. In a majority of countries, health expenditure are partially covered by a regulated health insurance system. The system can either rely on private health insurance companies (like in Switzerland), or on a national (public) health insurance (like in France). In all, the prices of medical consultations (resp. medicines) are defined by a contract between the insurance company or the regulator, and the physicians (resp. the pharmaceutical industry). In practice, the "price sensitivity" of care consumption depends on the level of cost-sharing, i.e., the share of the price paid by the patient after reimbursement by the insurance⁷.

Available empirical evidence suggests that health care consumption is price sensitive. Results from the famous RAND experiment show that general practitioners' (GP) utilization decreases with the level of cost-sharing [30]. A study analyzing the effect of a strong reduction in patients' cost-sharing at age 70 in Japan also found evidence that care consumption is price sensitive. Both out-patient care and inpatient care increase with more generous insurance coverage [41]. Similarly, several high-income countries have removed copayments for GP consultations in the past decades, ensuring free care to patients. Results of the evaluations suggest that GP utilization is price sensitive. In 2015, Ireland withdrew a €52.50 copayment for GP consultations of children aged 6 or less. It was followed by a 28.7% increase in the number of consultations [32]. Similar results were found in Sweden where copayments fell from \$10 to \$0 for GP consultation of adolescents below 19 in 2001. The overall number of GP consultations increased by 9% [31]. In 2010, Norway abolished copayment of €17.50 for a GP consultation for adolescents between 12 and 15 years old. It resulted in an increase in the number of GP consultations of 13.8% for males and 22.1% for females [34]. In a companion study Landsem and Magnussem (2014) exploit the discontinuity induced by the reform at the age of 16. They found a 10% to 15% decrease in GP consultations at the age of 16 when copayments are reintroduced

⁷The remaining price paid by the patient is often denoted by the term "out-of-pocket expenditure".

[27].

3.2 The sensitivity of care consumption to liquidity constraints

The life-cycle theory of consumption developed by Modigliani and Brumberg in the 1950s [13] considers that the consumption of individuals is determined by their lifetime expected income. The implication of this theory is that individuals borrow money during their young life, then accumulate savings during their active life and eventually sells their assets and consume through dissavings during retirement⁸. Among others, this theory was criticized on the ground that the introduction of liquidity constraints⁹ in the model would imply important changes on consumption behaviors [48]. In particular, liquidity constraints could prevent individuals to borrow money and invest in assets to smooth consumption when income is low [12]. In this case individuals are constrained in their capacity to consume by their available income. But since this constraint decreases with income, it is mostly a concern for low-income individuals. The sensitivity of consumption to liquidity constraints was empirically confirmed by using the unemployment rate as a proxy for the prevalence of liquidity constraints [20]. Now, the liquidity sensitivity of consumption to liquidity constraints is well established in the literature. Results from a recent paper show that low-income consumers purchase more goods on paydays [33]. This result suggests that liquidity constrained individuals delay consumption to a moment when they are less constrained (for instance on payday)¹⁰. Transposing this mechanism to health care consumption implies that the existence of direct payments for care might lead to the same behaviours. On one hand liquidity constrained individuals may either delay or forgo care consumption in the presence of direct payments. On the other hand they may substitute to a cheaper care accessible without direct payments. For now, the sensitivity of health care consumption to liquidity constraints has received little attention in the literature.

We found one recent study that evaluates the role of liquidity constraints on the care consumption of Medicare beneficiaries [22]. In this paper, the authors use quasi-random variations in the time of the month when pensions are paid by Social Security to its beneficiaries¹¹. They find that the number of drug scripts increases by 11 percent on payday. Importantly, results show that "important" medical drug prescriptions (meaning that non-adherence to prescription can lead to severe short-term health consequences, e.g.,

⁸One of the life-cycle theory hypothesis is that individuals do not wish to leave inheritance [5].

⁹The literature also uses the terminology "borrowing constraints"

¹⁰Liquidity constraints may also lead to forgo consumption, or to purchase less expensive substitutes if competition exists on the market.

¹¹The day when social security paychecks are paid to recipients is pre-determined by the recipients' date of birth. So depending on their day of birth, two individuals of same age can receive their paychecks on two different weeks.

blood thinners) are also sensitive to direct payments. Also, some Medicare recipients are enrolled in a federal government program that subsidizes the purchase of private health insurance, and can partly cover copayments, depending on their income. The authors are able to distinguish between recipients with full coverage (no copayments), partial coverage (subsidized copayments) and no coverage (no-subsidized copayments). They found no increase in drug scripts on payday for individuals facing no copayments. To our knowledge, this study is the first to provide empirical evidence of the sensitivity of health care consumption to direct payments (and so liquidity constraints).

3.3 The sensitivity of care consumption in France

In France, the National Health Insurance (NHI) covers part of the healthcare expenditure of French residents. In 2017, 77.8% of healthcare expenditure in France was covered by the French NHI [3]. Out-patient care (for instance a consultation with a GP) is covered at 70% by the French NHI. The percentage reimbursed for hospital care (including emergency care) is 80%, and direct payments are not required for inpatient care. The remaining share of expenditures is to be paid by patients or their complementary health insurance (CHI) afterwards. In France, 96% of the population is covered by a CHI [3] but level of coverage are of course heterogeneous. Even after the reform, some care doesn't belong to the benefit package, and remain not reimbursed by the French NHI, as for instance ineffective medicines, alternative treatments (like osteopathy), or consultations with a psychologist. Medical consultations of pregnant women are undertaken by a GP, a gynecologist or a midwife, and are covered by both the French NHI and a CHI. So, as we explained in section 2, there is no change in coverage for 96% of patients following the reform. The main impact of the reform, if any, should rely on the liquidity mechanism arising from the removal of direct payments.

One specificity of the French system is that direct payments are required for the majority of out-patient care consultations. Patients must pay directly (out-of-pocket) 100% of the price of a medical consultation¹², which is reimbursed afterwards for 70% by the French NHI. The 30% cost-sharing is also reimbursed after the consultation by the patient's CHI if any. In France, the price of a GP consultation is €25, the price of a gynecological consultation is €30 and the price of a consultation with a midwife is €23 (it increased to €25 in 2019)¹³. After 2019, the price of a midwife consultation increased to €25 but this

¹²This is not the case for hospital care.

¹³If the GP or the gynecologist is affiliated to sector 2, the regulated price can be increased by balance billings that are not covered by the NHI. All the regulated prices for physicians are available on the NHI website at the following address: <https://www.ameli.fr/medecin/exercice-liberal/remuneration/consultations-actes/tarifs>.

change is out of our period of analysis (2014-2018). These prices include a fixed contribution of €1 that must be paid by patients (or their CHI). In the absence of the reform, patients have to pay the full price of the consultation. Later, the French NHI reimburses the patients for 70% of the consultation price minus the fixed contribution, i.e., €16.8 for a GP consultation, €20.3 for a gynecological consultation and €15.4 for a consultation with a midwife. The copayment (€8.2 for a GP consultation, €9.7 for a gynecological consultation and €7.6 for a consultation with a midwife) might also be reimbursed after the consultation by the patient CHI if he holds one. After the 2017 reform (that acts from the 6th month of pregnancy to the 12th day after the birth delivery), physicians are not allowed to claim pregnant women any payment for the consultation. Since the reform also ensures full insurance to pregnant women (although it changed nothing for those who are covered by a CHI), the full price of the consultation is then paid by the French NHI to the physician after the consultation.

To our knowledge, only one study, dating back to 2000, has investigated the sensitivity of health care consumption (and health expenditure) to direct payments in France [17]. It was also the year (2000) when a free CHI "CMU-C" was implemented to remove direct payments and offer full insurance to low-income individuals who are likely to be liquidity constrained. The question we address in this paper is whether the rest of the population, i.e., people who are not eligible to the CMU-C, are exposed to liquidity constraints because of direct payments for care or not. This issue has not been studied yet. Some elements support the hypothesis that there are still individuals who are liquidity constrained by the price of a medical consultation. First, in 2013, the proportion of the French population who reported foregoing care at least once in the past 12 months for financial reasons was estimated between 21% and 33% [28]. Second, the maximum income to be eligible for the CMU-C is very low, far below the poverty level, as mentioned in the introduction of this paper¹⁴. So there are people with very low income who are not eligible for the CMU-C. These people might be subject to liquidity constraints. This paper contributes to explore the influence of liquidity constraints (i.e., the impact of direct payment exemption) on out-patient care consumption.

4 EDs as substitutes to out-patient care

Price elasticity or the sensitivity to liquidity constraints are generally influenced by the existence of substitute goods and services. If some pregnant women were subject to liquidity constraints, it was possible for them to visit an ED. In fact, EDs are highly

¹⁴The income eligibility threshold for the CMU-C corresponds to 70% of the poverty line.

accessible facilities (opened 24/7) and no direct payment is claimed after a visit in the vast majority of them. Moreover, every patient presenting to an ED is treated without discrimination. These services are able to deal with situations ranging from the mildest conditions to life-threatening conditions that requires immediate resuscitation. These characteristics make the ED a good candidate to be used as a substitute to out-patient care. Because ED visits are exempt from direct payments in most EDs, a common fallacy among patients is that emergency care is free. In a 2013 survey on ED users conducted by the French Ministry of Health, one of the possible answer to the question "why did you come to the emergency room?" was "because cash advance is not required"¹⁵ [15]. In reality EDs are not free, and patients receive at home a bill for the 20% copayment. The price of any admission to a French ED in 2017 was €25.32. [25]. This price is increased at least by the price of a medical consultation (€25, plus possible extra fees during the night and on week-end) and by the price of medical diagnostic procedures if any. So the lowest price for an ED visit in France is €50¹⁶. 80% of this price is reimbursed by the NHI. In comparison the regulated price of a GP visit is €25 of which 70% is reimbursed by the NHI. Thus, from the patient point of view, a GP visit is theoretically preferable to an ED visit. However, because 96% of patients are fully covered by the NHI (70%) and a CHI (30%), they are not sensitive to the price of consultations or visits. Conversely, they can be sensitive to the fact that direct payments are not requested in most EDs, contrary to GPs in ambulatory care setting. This can be a motive to substitute a GP or a specialist consultation to an ED visit. Because the cost of an ED visit is much higher for the regulator than the cost of an out-patient consultation, such a substitution would raise an efficiency issue. In fact, the average cost of an ED visit for the French NHI is about €148 [11] while a GP consultation costs 70% of €25. The indirect effect of the 2017 reform was to make this substitution unattractive by removing direct payments for medical consultations.

Empirical evidence of substitution between EDs and out-patient care has been found in several countries. Several papers find a negative correlation between accessibility to primary care services and ED utilization [44], [40], [35], [36]. In England, an experimentation was conducted to ensure the opening of GP practices every day of the week. A study of the experimentation's effects found that it decreased the number of ED visits

¹⁵This was answered by less than 3% of the patients surveyed [9] but it is likely that patients under-report this reason to come to the ED because of social desirability bias [26].

¹⁶The provisional report on the social security accounts for September 2021 states that the average copayment for a non-hospitalized ED visit was €20.3 in 2019. Since the copayment is 20% of the total price, it suggests that the price for a non-hospitalized ED visit is €101.5 in average. This report is available from <https://www.securite-sociale.fr/files/live/sites/SSFR/files/medias/CCSS/2021/Rapport%20CCSS-Septembre2021.pdf>

by 9.9%[\[16\]](#). But results are mixed regarding the substitution between EDs and GP for financial reasons. Again, the respective effects of the level of cost-sharing and the presence of direct payments must be separated to analyze the results of the literature.

Concerning the effect of insurance coverage, evidence from the 2006 Massachusetts health insurance reform show that the introduction of new or better coverage for out-patient care decreased the number of ED visits per capita by 5.2% to 8.4% [\[29\]](#). This result support the existence of a substitution between EDs and out-patient care because of the level of cost-sharing for out-patient consultations¹⁷. Opposite results have been found in the Oregon Health Experiment (which expanded Medicaid eligibility). Evidence of a complementarity between emergency care and out-patient care was found among the population of low-income and uninsured individuals [\[43\]](#). Finally, one study examined the indirect impact of the abolition of copayments for GP consultations of children under 6 in Ireland in 2015, and found no impact on ED overall utilization [\[46\]](#). But they found that the proportion of patients coming to the EDs following the referral of a GP increased by more than 2 pp. These results do not support the existence of a substitution between EDs and out-patient care because of the presence of copayments.

To our knowledge, the pure effect of liquidity constraints for out-patient care on ED visits has not been investigated yet. In this paper, we contribute to this literature by using administrative data on French individuals' care consumption to analyze the impact of the 2017 "Tiers-Payant" reform whose main effect was to remove direct payments for out-patient care consultations. Two research questions are addressed in this study. First, we analyze the impact of removing liquidity constraints (through direct payments exemption) on the care consultations of pregnant women. Second, if any impact on care consultation, we examine the possible spillover effects of the reform on ED visits, if EDs are substitutes to out-patient care.

5 Data

We use data hosted by the National Health Data System (SNDS) whose objective is to promote access to French health databases for research, study and evaluation purposes [\[42\]](#). The SNDS is managed by the French National Health Insurance (NHI), the *Caisse Nationale d'Assurance Maladie des Travailleurs Salariés (CNAMTS)* [\[4\]](#). The SNDS was created in 2016 [\[1\]](#) and contains two main data sources: data on hospital activity coming

¹⁷Putting differently, this result suggest that the respective demands for emergency care and out-patient care have negative cross-price elasticities.

from the *Programme de Médicalisation des Systèmes d'Information (PMSI)* and data on out-patient care from the *Système National d'Information Inter-Régimes de l'Assurance Maladie (SNIIRAM)*. The matching of these two databases is performed by the SNDS. Access to these data is limited but possible upon submission of an access request file justified by a research project. The data used in this paper was obtained following this long process which involves many stages. On top of that, the "normal" delay in accessing the data has been increased by the administrative disruption associated with the Covid crisis. In all, we applied for access to the data in January 2019, and we eventually got access to it in September 2020. Since these data are somewhat complicated to handle, access is granted on condition that a several days training dedicated to the understanding of the data is completed. Moreover, several safeguards (personal cards with encrypted password, ban on data exports) are supervised by a SNDS data center in order to ensure the security and the privacy of personal health related data.

We use data from the "*Echantillon Généraliste de Bénéficiaires Simplifié*" (EGB-S) which consists of a 1/97th sample of the SNIIRAM data. These data record the care consumption of individuals affiliated to the French NHI¹⁸. The SNIIRAM consists of an exhaustive administrative dataset that aims to track all the reimbursements paid by the NHI to French beneficiaries. As big data requires large storage capacities, the SNIIRAM is only available for 2 years (plus the current year), which offers limited potential for panel data analysis on care pathways. In addition, since the purpose of these data is to record information about health care reimbursements, non-users (i.e., individuals covered by the NHI who do not consume any care during a year) are not included in the data. The EGB-S was created to overcome these limitations. This sample is representative of the age and gender distribution of the beneficiaries. It allows to observe care users and non-users for a period of 20 years from present. For these reasons, the EGB-S is preferred to other databases for longitudinal analyses.

5.1 The identification of pregnancy episodes

We identify pregnancy episodes on the basis of their outcome: the birth delivery. To do so, we use PMSI data as part of the EGB-S database. The PMSI is a comprehensive dataset measuring hospital outputs in a medical approach. It is supplied by a French classification of diseases - the *Groupe Homogene de Malades (GHM)* - inspired by the DRG's classification. We follow an algorithm developed by Blotiere et al. in 2018 [8] to select hospital admissions resulting in a birth delivery. But since the French GHM classification changed in 2012, the algorithm reported in the publication is obsolete for the period we study (2014-2018). Therefore we adapted the algorithm to the new clas-

¹⁸Since 2016, these data record the care consumption of 95.6% of the French population.

sification based on the methodology proposed by the *Agence Technique d'Information sur l'Hospitalisation (ATIH)*¹⁹. For sake of comparability we select pregnancy episodes resulting in single live-births. Live births represent 73.9% of total pregnancy episodes in France and twin pregnancies represent 1.7% of live births [8]. Single live-births are identified among birth deliveries with a gestational age greater than 22 weeks of amenorrhea in order to distinguish viable births from stillbirths and abortions (elective, therapeutic or spontaneous). In administrative hospital databases, medical conditions that require hospitalizations are classified through the French GHM classification of diseases and assigned to a Principal Diagnosis, with possible report about Associated Diagnoses. To identify pregnancy episodes we select principal diagnosis code *O.80.0* which designs uncomplicated birth deliveries. We also select associated diagnoses starting with the *Z.37* code which refers to the birth delivery outcome. Since we do not want to miss birth deliveries occurring outside of the hospital, we also select hospitalizations with the associated diagnosis *Z39.00*. Finally, we select hospitalizations that report the performance of a birth delivery medical procedure in order not to miss deliveries that occurred during a hospitalization for an other diagnosis than the ones pre-cited. It also allows us to accurately date the birth delivery by using the date of the performance of the delivery procedure instead of the starting date of hospitalization. Once the date of birth delivery is precisely identified, we use information about the gestational age (delay in days or weeks since the last menstrual period) to calculate the starting date of pregnancy retrospectively. It is essential to know pregnancies' starting dates and birth delivery dates to construct a pre-treatment period (before 6 month) and a treatment period (after 6 month) to identify the time when women are exempted from direct payments. All dates are available at the daily level in the data, which enables us to reconstruct periods of payment exemptions very precisely for each pregnancy episode. Knowing the starting and ending dates of pregnancies, we generate all the days from the beginning of the pregnancy to the 12th day after birth delivery to obtain a daily panel of observations for each pregnancy episode.

We identify 36,696 single live-births deliveries during the 2014-2018 period using the algorithm. We excluded 844 pregnancy episodes with missing gestational age and 66 with a gestational age lower than 6 months. We also dropped 57 hospitalizations with a principal diagnosis and/or an associated diagnosis designing a birth delivery but reporting no delivery procedure. Finally we deleted 10 observations because the delay between two pregnancy episodes of the same woman was lower than 9 months. This selection provides a sample of 35,719 birth deliveries to be linked with data on care consumption. More

¹⁹We thank Pierre-Olivier Blotiere from the CNAMTS for his help in the adaptation of the algorithm to the new classification of diseases.

details on the identification and selection process for pregnancy episodes can be found in appendix 3.B.

5.2 Sample design

After having identified pregnancy episodes, we use historical data on individuals' affiliations to the French NHI from the EGB-S sample. We use this information to design a sample of pregnant women whose care consumption is observed continuously during their pregnancy episode taking place between the 1st of July 2014 and the 30th of June 2018.

We exclude 93 pregnancy episodes who leave the EGB-S sample during their pregnancy (for instance because they move to a foreign country, or because they switch to another NHI plan which is not included in the EGB-S). Also, selecting observations between the 1st of July 2014 and the 30th of June 2014 (for balance purpose of the panel between pre and post treatment periods) leads to the exclusion of 3,364 pregnancies²⁰. At this stage of the selection process we observe 32,262 pregnancy episodes for 27,861 women between mid-2014 and mid-2018. We attribute out-patient care consultations and ED visits to each pregnancy episodes at the day when the care was consumed. Then we aggregate data at the week-of-pregnancy level for the purpose of an "event-study" analysis. We center weeks of pregnancy on the first week of the treatment period, so that weeks of pregnancies are measured as the distance to the beginning of the treatment, i.e., of the direct payment abolition period (at 6 months of pregnancy)²¹. The advantage of this dataset is the comprehensiveness of the care consumption during pregnancy episodes, that enables to run a panel analysis. However, data contain very few information on socio-demographic characteristics of women. We only observe age, gender, whether women are affiliated to the CMU-C or not, and their place of residence (city and *département*)²². To compensate for this lack of data, We add data on physician's density at the pregnant women's *département* level. It will control for the provision of care around women's places of residence in further analysis. Unfortunately, information on women's places of residence is missing for a large part of the panel. Deleting observations with missing values results in the exclusion of 12,704 pregnancy episodes. We exclude women whose age is lower than 18 years at the

²⁰The direct payment abolition reform impacted pregnant women over 6 months of pregnancy until day 12 after the birth delivery (see section 2 for details). Since pregnant women are identified on the basis of the birth delivery, treatment period is over-represented at the beginning of the first year of the panel (2014). Conversely, pre-treatment period is under-represented in the end of the last year of the panel (2018). To avoid this issue, we start the panel on the 1st of July 2014 and ends it on the 30th of June 2018.

²¹In the sample used for the analysis, the average number of weeks of pregnancy observed are 24.5 (standard deviation=4.6) during the control period and 9.9 (standard deviation=2.9) during the treatment period.

²²The *département* is a French administrative division of the territory smaller than the region.

date of birth delivery leading to 168 pregnancy episodes deletions. We also exclude the birth delivery period since out-patient consultations and ED visits occurring during this period are very unlikely to be sensitive to liquidity constraints²³. This exclusion leads to the loss of 264 pregnancy episodes. Because we want to ensure the robustness of a panel data analysis that introduces individuals' and time fixed effects, we only keep pregnancy episodes observed at least 4 consecutive weeks (317 pregnancy episodes excluded). The final sample used in this study contains 18,809 pregnancy episodes belonging to 16,811 women observed between the 1st of July 2014 and the 30th of June 2018. The total number of observations is 604,070.

6 Empirical strategy and method

In this paper, we examine (i) the existence of liquidity constraints for care consumption in France; (ii) the existence of a substitution between ED visits and out-patient care to avoid the payment of a consultation. To do so, we analyze the effects of the direct payment abolition reform of 2017 ("Tiers-Payant") on (a) the number of out-patient care consultations, and (b) the number of ED visits of pregnant women between 2014 and 2018. If some pregnant women were liquidity constrained by the price of a medical consultation before the reform, we should observe an increase in the number of out-patient care consultations. Also, if these women were using EDs as substitutes to out-patient care, the reform should decrease the number of ED visits. In order to test for these two hypotheses, we implement a difference-in-difference-in-differences strategy, or triple differences (DDD). In what follows, we detail the triple difference estimator and its identifying assumption. This estimator is rather intuitive since it can be computed as the difference between two difference-in-differences (DD) estimators.

6.1 Identification of the reform impact

The "Tiers-Payant" reform was introduced on the 1st January 2017 in France. It removed direct payments for all the care consumed by pregnant women between the 6th month of pregnancy and the 12th day after the birth delivery. Since care recommended by the NHI was already exempted from direct payments before the reform (see table 3.H.1 in appendix 3.H), it only affected the care that is consumed on top of the recommended care. For a given pregnancy episode p of a pregnant woman i , two periods are observed: a control period ($T = 0$) before 6 months of pregnancy, and a treatment period ($T = 1$) after 6 months of pregnancy (and until day +12 after birth delivery). There is no treatment before the 1st of January 2017, whatever the stage of pregnancy. Let us introduce

²³Excluded period start from the week before the week of the birth delivery.

a dummy variable $Post_{2017} = 1$ if care is consumed on a year $t \geq 2017$ posterior to the reform, and $Post_{2017} = 0$ otherwise. In addition, the population of pregnant women can be subdivided into two groups of French NHI beneficiaries: a group that benefits from a free public CHI (CMU-C) which ensures no direct payments and no cost-sharing for all care consumed before and after the 2017 reform and at any time during the pregnancy (and not only during the pregnancy), and a group that does not benefit from the free CHI CMU-C. In other words, pregnant women who benefit from the "CMU-C" are always untreated, and remain unaffected by the reform since direct payments and cost-sharing were already removed for all the care they consumed before 2017. Therefore we create a third dummy variable $\mathbb{1}_{g=1}$ to designate the group of women who were affected by the reform after 2017. Thus CMU-C beneficiaries are denoted by $g = 0$ and other pregnant women who do not benefit from the public CHI are denoted by $g = 1$.

Let us use the potential outcomes framework as introduced in the Rubin causal model²⁴. Consider Y_{1igt} the potential outcome of a pregnant woman i who belongs to the group g of beneficiaries at time t if treated by the reform. Conversely, consider Y_{0igt} the potential outcome of a same pregnant woman i belonging to the group g of beneficiaries at time t if not treated by the reform. Thus Y_{0igt} is the counterfactual of Y_{1igt} and represents in the context of this paper the care that would have been consumed by a pregnant woman i in the absence of the direct abolition payment policy. We call it "potential" outcomes because we cannot observe Y_{1igt} and Y_{0igt} simultaneously. It might seem convenient to propose a difference-in-differences strategy and compare the differences in care consumption during the treatment period and the control period, before and after the reform. But one can reasonably doubt about the consistency of the DD estimator²⁵. Estimates would be biased if some structural changes occurred concomitantly with the reform (for instance in the medical guidelines regarding the follow-up of pregnancies at hospital). To eliminate this source of bias, we propose a triple-differences estimator to assess the causal impact of the reform on the following outcomes: (i) Medical consultations (GP, gynecology, midwifery) and (ii) ED visits. We compare the differential - before *vs* after the reform - in the outcomes of (affected) group $g = 1$ and (unaffected) group $g = 0$ during the treatment period to the differential in the outcomes of group $g = 1$ and group $g = 0$ in the control period. Note that using CMU-C beneficiaries ($g=0/1$) to build a DDD estimator comes down to suppose that CMU-C beneficiaries have access to the same quality of care than other patients, which is a reasonable assumption for France.

²⁴For a modern presentation of this model, see Angrist and Pischke's book [6].

²⁵This estimator relies on the following assumption called the "common trend assumption" which might not hold in practice: $(E[Y_{0it}|T = 1, Post_{2017} = 1] - E[Y_{0it}|T = 1, Post_{2017} = 0]) = (E[Y_{0it}|T = 0, Post_{2017} = 1] - E[Y_{0it}|T = 0, Post_{2017} = 0])$

So we can define δ as the "true" causal average treatment effect on the treated of the reform :

$$\begin{aligned}\delta &= E[Y_{1igt} - Y_{0igt}|T = 1, g = 1, Post = 1] \\ &= \delta_1 - \delta_0\end{aligned}\tag{3.1}$$

Where $\delta_1 = E[Y_{1igt}|T = 1, g = 1, Post = 1]$ designs the potential outcome of a treated woman affected by the reform, and $\delta_0 = E[Y_{0igt}|T = 1, g = 1, Post = 1]$ denotes what would have been observed for the same woman in the absence of the reform.

The DDD estimator implemented to assess the causal impact of the reform is:

$$\begin{aligned}\hat{\beta} &= \{([E(Y_{1igt}|T = 1, g = 1, Post = 1)] - [E(Y_{0igt}|T = 1, g = 1, Post = 0)]) \\ &\quad - ([E(Y_{0igt}|T = 0, g = 1, Post = 1)] - [E(Y_{0igt}|T = 0, g = 1, Post = 0)])\} \\ &\quad - \\ &\quad \{([E(Y_{0igt}|T = 1, g = 0, Post = 1)] - [E(Y_{0igt}|T = 1, g = 0, Post = 0)]) \\ &\quad - ([E(Y_{0igt}|T = 0, g = 0, Post = 1)] - [E(Y_{0igt}|T = 0, g = 0, Post = 0)])\}\end{aligned}\tag{3.2}$$

$\hat{\beta}$ is a consistent estimator of the "true" effect of the reform δ if the following assumption is verified:

$$\begin{aligned}&\{([E(Y_{0igt}|T = 1, g = 1, Post = 1)] - [E(Y_{0igt}|T = 1, g = 1, Post = 0)]) \\ &\quad - ([E(Y_{0igt}|T = 0, g = 1, Post = 1)] - [E(Y_{0igt}|T = 0, g = 1, Post = 0)])\} \\ &\quad = \\ &\quad \{([E(Y_{0igt}|T = 1, g = 0, Post = 1)] - [E(Y_{0igt}|T = 1, g = 0, Post = 0)]) \\ &\quad - ([E(Y_{0igt}|T = 0, g = 0, Post = 1)] - [E(Y_{0igt}|T = 0, g = 0, Post = 0)])\}\end{aligned}\tag{3.3}$$

The DDD estimator does not rely on the assumption of "parallel trends" in the outcomes of the untreated and the treated in the absence of treatment. The DDD assumption presented in equation (3.3) supposes that the differential in the outcomes of group $g = 1$ and group $g = 0$ in the treatment period would have evolved similarly to the differential in the outcomes of group $g = 1$ and group $g = 0$ in the control period, in the absence

Table 3.1: Number of consultations and ED visits depending on whether pregnant women were affected by the reform or not

	(1) All	(2) Before 2017		(4) After 2017		(5)
		Before 6 month	After 6 month	Before 6 month	After 6 month	
	Sum	Sum	Sum	Sum	Sum	Sum
<i>Public CHI (CMU-C): No</i>						
GP consultations						
Total	49,252	25,310	6,888	13,393	3,661	
Out-patient care outside hospital	44,183	23,118	5,849	12,101	3,115	
Hospital out-patient care	5,069	2,192	1,039	1,292	5,46	
Gynecological consultations						
Total	58,255	24,322	13,975	12,695	7,263	
Out-patient care outside hospital	41,643	18,640	8,797	9,693	4,513	
Hospital out-patient care	16,612	5,682	5,178	3,002	2,750	
Midwife consultations						
Total	41,153	9,939	14,838	7,180	9,196	
Out-patient care outside hospital	9,191	3,415	1,745	2,754	1,277	
Hospital out-patient care	31,962	6,524	13,093	4,426	7,919	
Emergency Department visits						
Total	7,462	3,453	1,217	2,091	701	
Hospitalized	914	260	311	146	197	
Non-hospitalized	6,548	3,193	906	1,945	504	
<i>Public CHI (CMU-C): Yes</i>						
GP consultations						
Total	18,095	9,272	2,528	4,951	1,344	
Out-patient care outside hospital	16,026	8,320	2,100	4,432	1,174	
Hospital out-patient care	2,069	952	428	519	170	
Gynecological consultations						
Total	12,716	5,086	3,018	2,849	1,763	
Out-patient care outside hospital	7,841	3,354	1,607	1,892	988	
Hospital out-patient care	4,875	1,732	1,411	957	775	
Midwife consultations						
Total	11,871	3,179	3,903	2,078	2,711	
Out-patient care outside hospital	2,201	870	337	687	307	
Hospital out-patient care	9,670	2,309	3,566	1,391	2,404	
Emergency Department visits						
Total	3,304	1,580	549	886	289	
Hospitalized	443	130	147	75	91	
Non-hospitalized	2,861	1,450	402	811	198	
CMU-C: No						
N	475,282	219,957	90,606	116,547	48,172	
Pregnancies	14,830	11,015	9,485	5,603	5,123	
Women	13,228	10,422	9,125	5,553	5,083	
CMU-C: Yes						
N	128,788	59,221	23,118	32,447	14,002	
Pregnancies	3,979	2,939	2,455	1,561	1,491	
Women	3,583	2,751	2,345	1,542	1,476	

Sources: Author's calculations from the EGB-S database.

Notes: Beneficiaries of the CMU-C were unaffected by the reform. Conversely, pregnant women who are not beneficiaries of the CMU-C were affected by the reform. Column 1 reports the total number of consultations and ED visits in the sample for the whole period of observation (mid-2014 to mid-2018). Column 2 (*resp.* 4) reports consultations and visits consumed during the control period (before 6 months of pregnancy) before (*resp.* after) the reform (2017). Column 3 (*resp.* 5) reports consultations and visits consumed during the treatment period (after 6 months of pregnancy) before (*resp.* after) the reform.

of the reform. In practice, this assumption cannot be tested since we do not observe the potential outcomes of a woman if treated and if not treated by the reform at the same time. But it is possible to propose a "visual check" of trends in treatment period and control period in groups $g = 0$ and $g = 1$ before the reform in order to assess whether the evolution is similar or not. Also, we will propose an "event-study" analysis where the event is not exactly a period of time but a pregnancy week. It will enable to partially test for the DDD assumption by estimating whether the differential in the outcomes of groups $g = 1$ and $g = 0$ evolved similarly during the control period (before 6 months of pregnancy) after the reform.

Table 3.2: Differences in means for pregnancy characteristics and care consumption between affected (no CMU-C) and unaffected women (CMU-C).

	(1) All	(2) Before 2017	(3) After 2017	(5) Before 2017	(6) After 2017
		Before 6 months	After 6 months	Before 6 months	After 6 months
	diff.	diff.	diff.	diff.	diff.
Pregnancy characteristics					
Mother's age	1.972***	2.026***	2.111***	1.894***	1.696***
Pregnancy duration (in weeks)	0.095***	0.053***	-0.026	0.237***	0.142***
N. of observed pregnancy weeks	-0.097***	0.083***	-0.304***	-0.303***	0.164***
GP consultations					
Total	-0.037***	-0.041***	-0.033***	-0.038***	-0.02***
Out-patient care outside hospital	-0.031***	-0.035***	-0.026***	-0.033***	-0.019***
Sector 1	-0.035***	-0.039***	-0.028***	-0.036***	-0.022***
Sector 2	0.002***	0.002***	0.002***	0.001***	0.002***
Hospital out-patient care	-0.005***	-0.006***	-0.007***	-0.005***	-0.001
Gynecological consultations					
Total	0.024***	0.025***	0.024***	0.021***	0.025***
Out-patient care outside hospital	0.027***	0.028***	0.028***	0.025***	0.023***
Sector 1	0.004***	0.005***	0.002	0.005***	0.001
Sector 2	0.023***	0.023***	0.026***	0.02***	0.022***
Hospital out-patient care	-0.003***	-0.003***	-0.004**	-0.004***	0.002
Midwife consultations					
Total	-0.006***	-0.008***	-0.005	-0.002	-0.003
Out-patient care outside hospital	0.002***	0.001	0.005***	0.002**	0.005***
Hospital out-patient care	-0.008***	-0.009***	-0.01***	-0.005***	-0.007*
Emergency Department visits					
Total	-0.01***	-0.011***	-0.01***	-0.009***	-0.006***
Hospitalized	-0.002***	-0.001***	-0.003***	-0.001***	-0.002***
Non-hospitalized	-0.008***	-0.01***	-0.007***	-0.008***	-0.004***
CMU-C: No					
N	475,282	219,957	90,606	116,547	48,172
Pregnancies	14,830	11,015	9,485	5,603	5,123
Women	13,228	10,422	9,125	5,553	5,083
CMU-C: Yes					
N	128,788	59,221	23,118	32,447	14,002
Pregnancies	3,979	2,939	2,455	1,561	1,491
Women	3,583	2,751	2,345	1,542	1,476

Sources: Author's calculations from the EGB-S database.

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. This table reports the difference in means of care consumption between pregnant women in group $g = 1$ (not beneficiaries of the CMU-C) and pregnant women in group $g = 0$ (beneficiaries of the CMU-C). The p-value associated with the test of equality in means is reported next to the value of difference through the following legend: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Column (1) reports differences in means for the whole sample. Columns (2) and (3) reports differences in means for the pre-reform period, while columns (5) and (6) reports same statistics for the post-reform period. For each of these periods, differences in means are estimated for the control period of pregnancy (before 6 months) when direct payments are not exempted (columns (2) and (5)), and for the treatment period (after 6 months) when direct payments are exempted (columns (3) and (6)).

Of 18,809 pregnancy episodes experienced by 16,811 women, 3,979 belong to 3,583 women who benefit from the free CHI "CMU-C" during their pregnancy (see table 3.C.1). In this paper, we are interested in several outcomes. First, the out-patient care consul-

tations of pregnant women which includes GP consultations, gynecology consultations and midwife consultations. Second, the ED visits of pregnant women. A distinction is made between hospitalized and non-hospitalized ED visits because substitutes to outpatient consultations are more likely to be non-hospitalized ED visits. All outcomes are measured at the week of pregnancy level. Table 3.D.1 reports the total number of consultations and ED visits observed in the sample, by treatment period before and after the reform. Table 3.1 presents the same statistics depending on the group of beneficiaries (CMU-C or not). One can see that 67,347 GP consultations are observed between mid-2014 and mid-2018 in the sample. Of these consultations, 49,952 were consumed by pregnant women in the affected group $g = 1$, and 18,095 by women in unaffected group $g = 0$ (CMU-C beneficiaries).

The majority of ED visits are non-hospitalized visits because in our sample many hospitalized ED visits correspond to the admission of pregnant women who are about to give birth. Since we excluded the period of the birth delivery, we also excluded the majority of hospitalized ED visits. Interestingly, the majority of hospitalized ED visits take place after 6 months of pregnancy while the majority of non-hospitalized ED visits take place before 6 months of pregnancy. In all, 10,766 ED visits are observed, of which 3,304 are made by CMU-C beneficiaries.

Table 3.D.2 show weekly means of care consumption outcomes by treatment period (and the associated difference in means), before and after the reform. The average age of mothers in the sample is 30, with a standard deviation of 5. The average duration of a pregnancy episode is 37 weeks (8 months and a half). In average, it corresponds to the number of weeks we observe in the data. The average number of GP consultations remained stable before and after the reform in both periods. In all, the average number of GP consultations is 0.1 per week, but the number of consultations decreases during the pregnancy (the weekly mean is 0.12 before 6 months and 0.07 after 6 months). The average number of gynecology consultations is 0.11 per week. A 0.01 increase in mean is observed in the treatment period after the reform. Midwife consultations increased in both treatment and control periods after the reform. There were 0.06 consultations per week during the control period and 0.20 consultations per week during the treatment period after 2017. Turning to emergency care, the overall probability to have an ED visit during a week of pregnancy is 2.4%.

Table 3.2 now reports differences in means of care consumption between pregnant women affected by the reform (non CMU-C) and pregnant women unaffected by the reform (CMU-C). The difference in the average number of consultations per week (and its significance at the 95% confidence interval) is calculated for the whole sample and by treatment periods, before and after the reform. The differences reported show that

women who are not covered by the CMU-C (group $g = 0$) are 2 years older in average. They have less GP consultations than CMU-C beneficiaries, except for consultations with a GP who is allowed to charge patients with balance billings (sector 2). In contrast, they use more gynecological consultation than CMU-C beneficiaries. Also, women affiliated to the CMU-C use more emergency care than other women in average. These results are consistent with previous findings showing that CMU-C beneficiaries have higher health expenditure than the rest of the population because they are in poorer health [38, 24].

We present the trends in care consumption of pregnant women by pregnancy weeks and by group of beneficiaries for (i) primary care consultations (figures 3.E.1, 3.E.2, 3.E.3) and (ii) emergency care (figure 3.F.1). It shows the comparability of care consumption trends (regardless the outcome that is picked) between pregnant women affiliated to a public CHI (figures on the right-side) and pregnant women who are not (figures on the left-side). The trends before *versus* after the reform in both the control and treatment periods are very similar, except for GP consultations and midwife consultations. A decrease in the number of GP consultations is observed after the reform in the treatment period for beneficiaries of the CMU-C. Also, it seems that the number of consultations with a midwife slightly increased after the reform in both groups. But this increase is mainly observed during the treatment period for CMU-C beneficiaries.

6.2 Estimation of the reform impact

To estimate the impact of the direct payment reform abolition, we first implement an analysis similar to an event-study analysis where the event is not a time period but a pregnancy week. An event-study analysis allows to estimate the (possible) heterogeneity of the reform impact over time, which here corresponds to the impact of the direct payment abolition reform by weeks of pregnancy, for the group of affected women (no CMU-C), in comparison with the group of unaffected women (CMU-C). This specification has several advantages.

First, it enables us to control for the evolution of the pregnancy episode by looking at the (possible) heterogeneous effects of the reform over weeks of pregnancy. Second, it also allows to track the care consumption of pregnant women in affected and unaffected groups of beneficiaries (CMU-C or not) over weeks of pregnancy and to compare the differential effects. Third, it gives a test of the identifying assumption of the triple difference estimator by comparing the significance of the pre-reform trends between affected and unaffected pregnancy episodes. The model estimates the impact of the reform on care consumption across 38 weeks of pregnancy and two groups of pregnant women.

We denote Y_{ipgwq} the care consumption (primary care or emergency care) of a pregnant woman i belonging to group g observed each week w of a quarter q during a pregnancy

episode p . We assign to each week of pregnancy an event-time w ranging from -26 to 11 (38 weeks of pregnancy maximum), with week -2 before the abolition of direct payments as reference pregnancy-week event. We assigned week -2 since the identification of starting date of pregnancy - and thus of the 6th month of pregnancy - can be subject to small variations because of unobserved variations in the date of conception. By choosing week -2 as reference pregnancy-week event, we ensure the reference to be in the control period.

We estimate the following regression by Ordinary Least Square (OLS):

$$\begin{aligned}
 Y_{ipgwq} = & \left\{ \sum_{w=-26}^{-3} \delta_{w,post,cmu:no}^0 (\mathbb{1}_{g=1} \cdot Post_{2017}) + \sum_{w=-1}^{11} \delta_{w,post,cmu:no}^1 (\mathbb{1}_{g=1} \cdot Post_{2017}) \right\} \\
 & + \sum_{w=-26}^{-3} \delta_{w,cmu:no}^0 (\mathbb{1}_{g=1}) + \sum_{w=-1}^{11} \delta_{w,cmu:no}^1 (\mathbb{1}_{g=1}) + \sum_{w=-26}^{-3} \delta_{w,post}^0 (Post_{2017}) \quad (3.4) \\
 & + \sum_{w=-1}^{11} \delta_{w,post}^1 (Post_{2017}) + \delta_w + bW'_{ipgwq} + \alpha_i + \gamma_q + e_{ipgwq}
 \end{aligned}$$

Here, $\mathbb{1}_{g=1}$ is a binary indicator equal to one if the woman is not covered by the CMU-C, and $Post_{2017}$ is a binary variable equal to one after 2017, 0 otherwise. So the interaction between these two variables ($\mathbb{1}_{g=1} \cdot Post_{2017}$) is equal to one for pregnant women who are not beneficiaries of the CMU-C after the reform.

Equation (3.4) specifies an event-study analysis, so the impact of being affected by the reform is estimated by week of pregnancy. We introduce pregnancy week dummies δ_w which control for the trend in care consumption of unaffected women (CMU-C) before the reform. The coefficients of interest in this event-study are the $\delta_{w,post,cmu:no}^1$ since they estimate, by week of pregnancy, the impact of the reform on affected pregnant women (non-beneficiaries of the CMU-C) in the treatment period (after 6 month of pregnancy). Coefficients $\delta_{w,post,cmu:no}^0$ estimate the differential in care consumption between non CMU-C and CMU-C beneficiaries during the control period, after 2017, by pregnancy week. Then, variable $\mathbb{1}_{g=1}$ interacted with pregnancy week dummies controls for the differential trend in outcomes between non CMU-C and CMU-C beneficiaries before the reform, and variable $Post_{2017}$ interacted with pregnancy week dummies control for the post-reform trend in the outcomes of CMU-C beneficiaries.

W'_{ipgwq} control for a set of covariates including the age of pregnant women, medical density in women's *département* of residence and the number of observed weeks of the pregnancy episode. Individual's fixed effects α_i are introduced, as well as control for quarterly macroeconomic shocks γ_q . Standard errors are clustered at the pregnant woman level to correct for heteroskedasticity between two pregnancies.

We finally estimate an average treatment effect on women affected by the reform:

$$\begin{aligned}
 Y_{ipgwq} = & \beta(T_w \cdot \mathbb{1}_{g=1} \cdot Post_{2017}) + b_1 Post_{2017} + b_2 T_w + b_3 \mathbb{1}_{g=1} \\
 & + b_4(Post_{2017} \cdot T_w) + b_5(T_w \cdot \mathbb{1}_{g=1}) + b_6(Post_{2017} \cdot \mathbb{1}_{g=1}) \\
 & + b_7 Post_{2016} + b_8(Post_{2016} \cdot \mathbb{1}_{g=1}) + b_9(T_w \cdot \mathbb{1}_{g=1} \cdot Post_{2016}) \\
 & + b_{10} W'_{ipgwq} + \alpha_i + \delta_w + \gamma_q + e_{ipgwq}
 \end{aligned} \tag{3.5}$$

In the above equation, β is the parameter of interest. The triple interaction of variables T (the treatment period, i.e., after the 6th month of pregnancy), $\mathbb{1}_{g=1}$ (affected women who are not beneficiaries of the CMU-C) and $Post_{2017}$ (dummy for the post-reform period) corresponds to the triple difference estimator. The associated coefficient β measures the estimated average effect of the reform on the number of medical consultations and ED visits of a pregnant woman affected by the reform. The model introduces all the interactions terms that form the DDD estimator. In addition, we control for pre-reform confounding factors that could arise from the possibility allowed by the French government to abolish direct payments for pregnant women and LTD patients since the 1st of July 2016 on a voluntary basis. The same controls as for the event-study analysis are introduced in the variable W'_{ipgwq} .

7 Results

7.1 On primary care consultations

Results of the estimation of equation (3.4) by OLS on the number of out-patient care consultations are reported in several graphs. Figures 3.1 to 3.3 report the results of the event-study analysis. It provides a visualisation of the impact of removing direct payments on the care consumed by pregnant women who are not beneficiaries of the CMU-C (i.e., affected by the reform), by weeks of pregnancy. The event-study estimates as many impacts of the reform as the number of weeks (38). The average number of out-patient consultation by weeks of pregnancy is 0.1 (see table 3.D.2). In these graphs, weeks of pregnancy are displayed on the x-axis. They are expressed as the delay since the first week of the 6th month of pregnancy, when direct payments are removed. So negative values of the x-axis represent pregnancy weeks in the control period (before 6 months) and positive values represent pregnancy weeks in the treatment period (after 6 months). Since the reform impacted the care consumed after 6 months of pregnancy, the coeffi-

coefficients of interest are those on the right of the vertical bar (i.e., coefficients $\delta_{w,post,cmu:no}^1$ in equation (3.4)). They are displayed with their associated confidence intervals so that one can easily assess if a coefficient is significant or not. A significant coefficient is interpreted as a significant difference in the number of consultations between non CMU-C and CMU-C beneficiaries after the reform, in comparison with the difference in the number of consultations between those two groups before the reform, for a given week of pregnancy. So if the reform had an impact, a significant coefficient should be observed during the treatment period, when consultations are exempt from direct payments.

Figure 3.1 presents the results on the number of GP consultations. Figure 3.2 shows the impact of the reform on the number of gynecological consultations. Figure 3.3 reports estimates of the reform impact on the number of midwife consultations. Among them, the sub-figures report the impact of the reform for out-patient consultations taking place outside a hospital (sub-figures (b)) and out-patient consultations taking place within a hospital (sub-figures (c)). Sub-figures (a) presents the impact of the triple difference estimation by weeks of pregnancy on the total number of out-patient consultations. Results show no significant impact of the direct payment abolition reform on the total number of GP consultations, except for weeks 4 and 6. But there is no clear increasing trend. Also, we find no effect of the reform on the number of GP consultations delivered outside hospital in general practices (sub-figure 3.1b). However, we find an increase in the number of GP consultations taking place at hospital (sub-figure 3.1c) of affected pregnant women after 6 months of pregnancy, following the reform. We find no impact of the reform on the number of gynecological consultations, by weeks of pregnancy (figure 3.2a). We obtain similar results for midwife consultations (figure 3.3a).

In order to estimate an average effect of the reform, we differentiate only two periods: the control period (before 6 months of pregnancy) and the treatment period (after 6 months). This model is estimated by equation 3.5. Results of the triple difference estimation reported in table 3.3 reveal a positive impact of the abolition of direct payments on the number of GP consultations. In other words, the number of GP consultations of affected pregnant women that took place at hospital increased after the reform. In all, the exemption of direct payments for GP consultations led to an increase of 0.016 consultations per week by pregnant woman. Putting differently, this result suggests an increase of 6.4 GP visits per month of pregnancy for 100 pregnant women. The effect is small but significant (it corresponds to 1/20 standard deviation of the total number of GP consultations per pregnancy week, (see table 3.D.2)). It suggests that it concerns only a small proportion of pregnant women. It is not surprising since only a part of the

population is subject to liquidity constraints.

Table 3.3: Triple difference estimates of the reform impact on the number of medical consultations of pregnant women

	(1)	(2)	(3)
	Total consultations	Outpatient consultations outside hospital	Hospital outpatient consultations
Outcome A: General Practitioner (GP) consultations			
Average Treatment Effect on the Treated	0.016436** (0.00824)	0.008596 (0.00775)	0.00784*** (0.00277)
R-Square	0.1075	0.1095	0.0807
Outcome B: Gynecological consultations			
Average Treatment Effect on the Treated	-0.0071 (0.00816)	-0.00454 (0.00677)	-0.00256 (0.00471)
R-Square	0.087	0.1095	0.0952
Outcome C: Midwife consultations			
Average Treatment Effect on the Treated	-0.02059*** (0.00735)	-0.00541 (0.00339)	-0.01518** (0.00657)
R-Square	0.1466	0.1247	0.1536
Number of observations	604,070	604,070	604,070
Number of pregnancies	18,809	18,809	18,809
Number of women	16,811	16,811	16,811

Sources: Author's calculations from the EGB-S database.

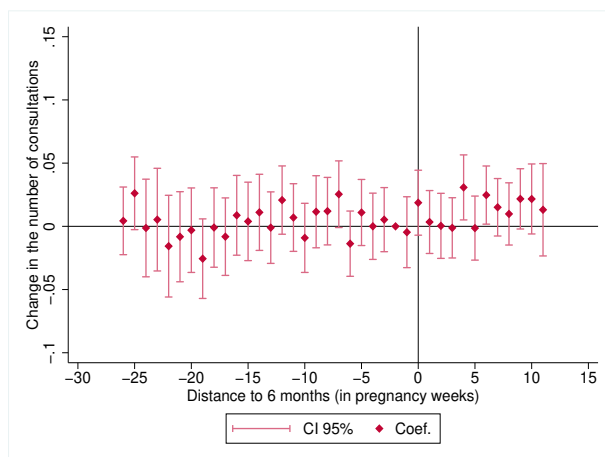
Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. This table reports the coefficient (standard errors in parentheses) of the triple difference estimator, measuring the impact of the direct payment abolition reform on the number of out-patient consultations of pregnant women affected by the reform (who are not beneficiaries of the CMU-C). An average treatment effect on the treated (ATE/T) is thus estimated. Standard errors are clustered at the individual level to account for possible heterogeneity in the unobserved characteristics of pregnant women between pregnancy episodes. Fixed effects models are estimated by OLS regressions. Regressions control for individual (pregnant woman) fixed effects as well as for specific effects by pregnancy weeks.

If we assume that 5% of the French population is liquidity constrained, it means that the reform would have resulted in an increase of 1.28 GP consultations per month. On the contrary, the abolition of direct payments for care did not significantly change the number of gynecological consultations of pregnant women. The fact that mandatory prenatal consultations were already exempt from direct payments before the reform (see appendix 3.H) might explain the absence of effect on gynecological consultations. Surprisingly, a decrease in the number of out-patient consultations with a midwife at the hospital is found for affected pregnant women following the reform. This decrease is not estimated for out-patient consultations taking place outside of the hospital.

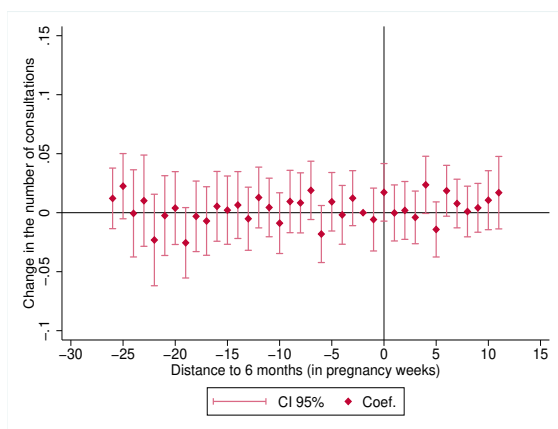
In all, we observe an increase in the number of GP consultations, and a decrease in the number of midwife consultations of pregnant women following the direct payment exemption reform. Both of these results are found for consultations taking place at hospital. It suggests that pregnant women substituted midwife consultations to GP consultations before the reform since their price was lower (€23 for a midwife consultation *versus* €25

for a consultation with a GP). After the reform, the incentive to substitute was removed since direct payments were abolished for both types of consultations.

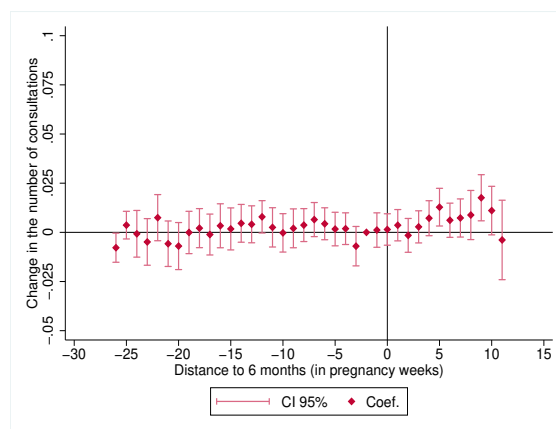
Figure 3.1: Event-study analysis of the reform impact on the number of GP consultations by weeks of pregnancy



(a) Total GP consultations



(b) Outpatient GP consultations

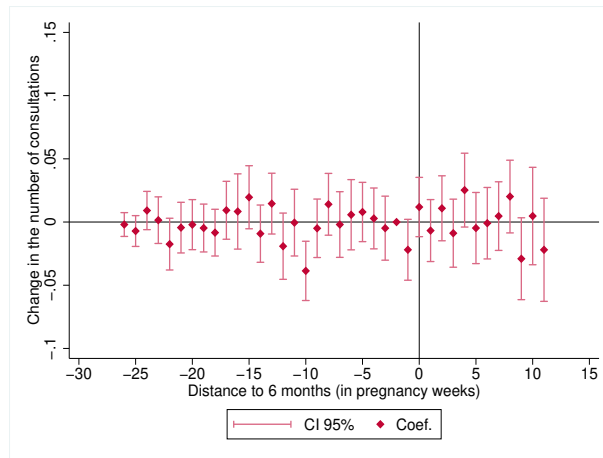


(c) Hospital outpatient GP consultations

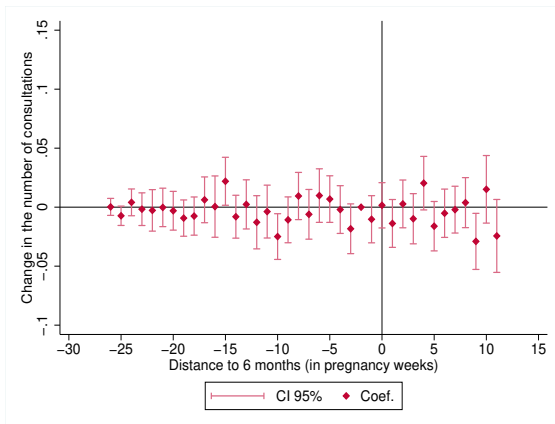
Sources: Author's calculation from EGB-S.

Notes: Coefficients of the estimation of the 2017 reform impact on affected pregnant women (non beneficiaries of the CMU-C) by weeks of pregnancy, and their associated confidence intervals (CI) are reported on this graph. Results are obtained from the estimate of equation (3.4) by OLS. Standard errors are clustered at the individual (pregnant woman) level. Weeks of pregnancy are displayed on the x-axis as a distance (in weeks) from the first week of the 6th month of pregnancy (week=0).

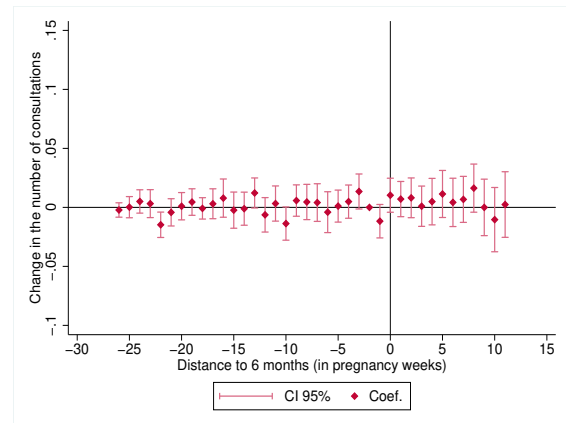
Figure 3.2: Event-study analysis of the reform impact on the number of gynecological consultations by weeks of pregnancy



(a) Total gynecological consultations



(b) Outpatient gynecological consultations

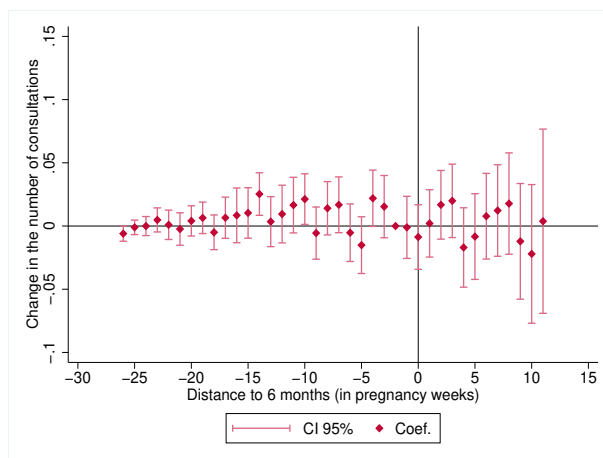


(c) Hospital outpatient gynecological consultations

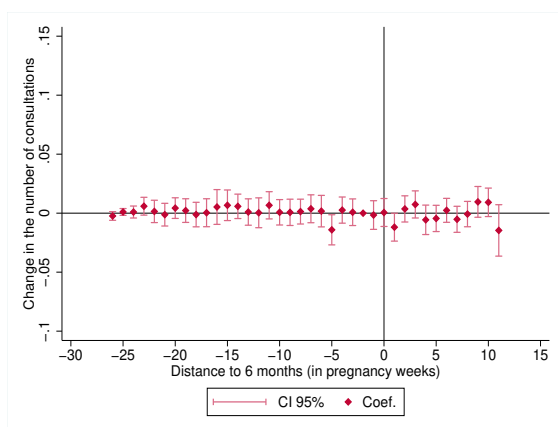
Sources: Author's calculation from EGB-S.

Notes: Coefficients of the estimation of the 2017 reform impact on affected pregnant women (non beneficiaries of the CMU-C) by weeks of pregnancy, and their associated confidence intervals (CI) are reported on this graph. Results are obtained from the estimate of equation (3.4) by OLS. Standard errors are clustered at the individual (pregnant woman) level. Weeks of pregnancy are displayed on the x-axis as a distance (in weeks) from the first week of the 6th month of pregnancy (week=0).

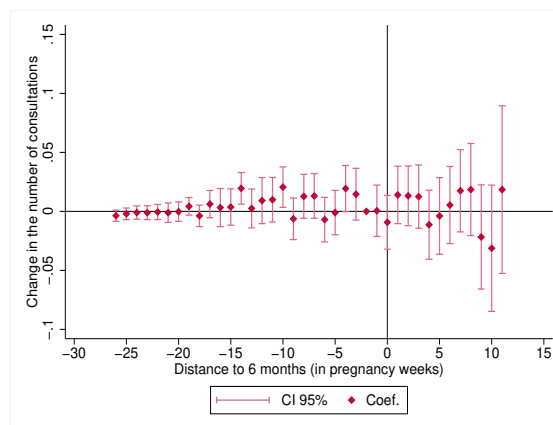
Figure 3.3: Event-study analysis of the reform impact on the number of midwife consultations by weeks of pregnancy



(a) Total midwife consultations



(b) Outpatient midwife consultations



(c) Hospital outpatient midwife consultations

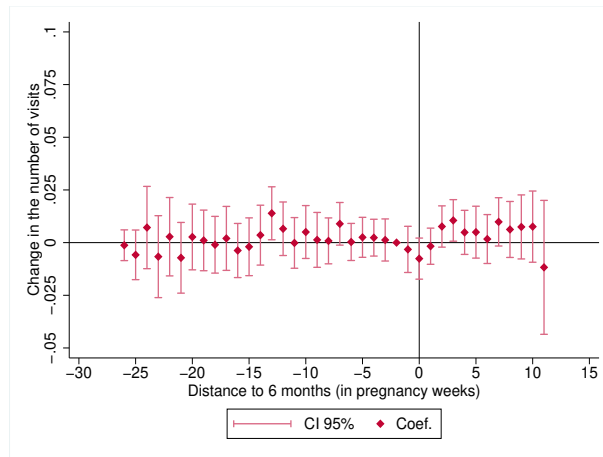
Sources: Author's calculation from EGB-S.

Notes: Coefficients of the estimation of the 2017 reform impact on affected pregnant women (non beneficiaries of the CMU-C) by weeks of pregnancy, and their associated confidence intervals (CI) are reported on this graph. Results are obtained from the estimate of equation (3.4) by OLS. Standard errors are clustered at the individual (pregnant woman) level. Weeks of pregnancy are displayed on the x-axis as a distance (in weeks) from the first week of the 6th month of pregnancy (week=0).

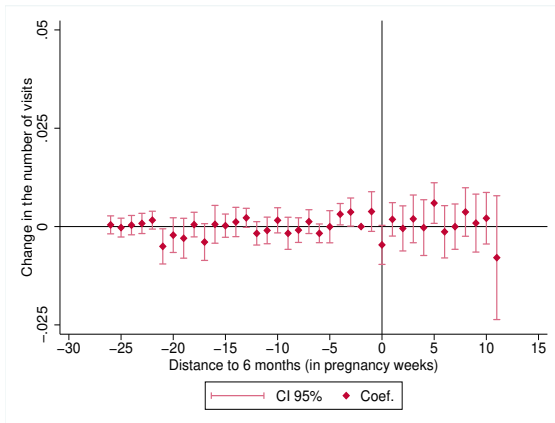
7.2 On emergency care

Results of the estimation of the reform impact by weeks of pregnancy on ED visits are reported in figure 3.4. We found no evidence of a change in the trend of ED visits of affected pregnant women after the reform during the treatment period. Also, the differential trends in ED visits between affected (no CMU-C) and unaffected (CMU-C beneficiaries) pregnant women is not significant which suggests no impact of the DDD estimator.

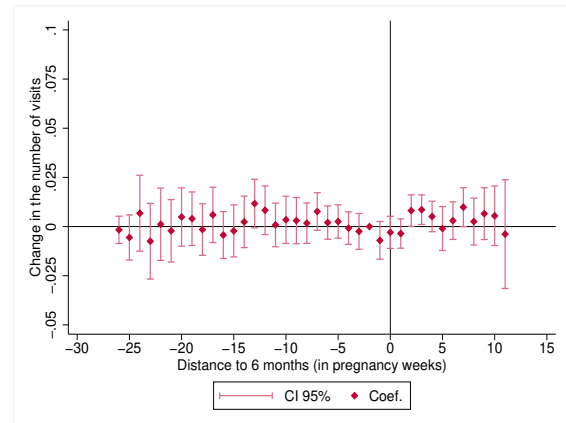
Figure 3.4: Event-study analysis of the reform impact on the number of ED visits by weeks of pregnancy



(a) Total ED visits



(b) Hospitalized ED visits



(c) Non-hospitalized ED visits

Sources: Author's calculation from EGB-S.

Notes: Coefficients of the estimation of the 2017 reform impact on affected pregnant women (non beneficiaries of the CMU-C) by weeks of pregnancy, and their associated confidence intervals (CI) are reported on this graph. Results are obtained from the estimate of equation (3.4) by OLS. Standard errors are clustered at the individual (pregnant woman) level. Weeks of pregnancy are displayed on the x-axis as a distance (in weeks) from the first week of the 6th month of pregnancy (week=0).

Results of the estimation of the average effect of the reform are reported in table 3.4. We find no significant impact of the reform on the number of ED visits, neither on hospitalized visits, nor on non-hospitalized. This result suggests that EDs were not used as substitutes to out-patient care consultations by liquidity constrained pregnant women to avoid the payment of a consultation before the reform.

Table 3.4: Triple difference estimates of the reform impact on the number of ED visits of pregnant women

	(1) Total	(2) Hospitalized	(3) Non-hospitalized
Average Treatment Effect on the Treated	0.000023 (0.00352)	0.001033 (0.00121)	-0.00101 (0.00329)
R-Square	0.071	0.0427	0.0686
Number of observations	604,070	604,070	604,070
Number of pregnancies	18,809	18,809	18,809
Number of women	16,811	16,811	16,811

Sources: Author's calculations from the EGB-S database.

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. This table reports the coefficient (standard errors in parentheses) of the triple difference estimator, measuring the impact of the direct payment abolition reform on the number of ED visits of pregnant women affected by the reform (who are not beneficiaries of the free CHI CMU-C). An average treatment effect on the treated (ATET) is thus estimated. Standard errors are clustered at the individual level to account for possible heterogeneity in the unobserved characteristics of pregnant women between pregnancy episodes. Fixed effects models are estimated by OLS regressions. Regressions control for individual (mother) fixed effects as well as for time (weeks of pregnancy) fixed effects.

7.3 On pre-term births

As an additional result, we estimate the impact of the direct payment abolition reform on the probability of pre-term births. A premature birth delivery is an undesirable event because the life of the new born child is threatened by the fact that the organs did not have enough time to develop. This can lead to long-term consequences for the child's health involving disabilities. In France, in average, there are 50,000 pre-term births each year [23]. A multiple of mechanisms are involved in a pre-term birth, including medical factors for which a treatment can be implemented [21]. It has been established that care utilization during the pregnancy was associated with a lower probability of pre-term births [7, 14, 45]. Therefore, it is of interest to study the potential effect of the "Tiers-Payant" reform on the probability of pre-term births occurrence. One could expect a decrease in this probability through two mechanisms. First, we found that the reform increased access to GPs at hospital, and decreased the use of midwife consultations. These changes

in GP and midwife utilization can affect pre-term births. Second, the abolition of direct payments could have an indirect impact on pre-term births through an increase in the disposable income of pregnant women. This paper considers an impact of the reform on three types of out-patient care (GP, gynecological and midwifery). But the additional disposable income ensured by the reform can be used to consume other types of care, or other goods. For instance, the nutritional status of pregnant women is associated with premature births [21], suggesting that improving food quality could influence pre-term births. Therefore, an indirect influence of the reform on women’s consumption could lead to a decrease in the risk of premature births.

In order to test these hypotheses, we keep only one observation by pregnancy episode. Thus, the sample used for this analysis contains 18,809 pregnancy episodes and 16,811 women. For each pregnancy episode, we define a binary indicator of a pre-term birth equals to one if the pregnancy episode duration is lower than 240 days (8 months), 0 otherwise. There are 749 pre-term births identified among 18,809 birth deliveries (4.0% of the sample²⁶ (see table 3.I.1 in appendix 3.I)). We set the value of variables that varies during the pregnancy at the date of birth delivery, and we sum the number of out-patient consultations used during the pregnancy.

We estimate the impact of the reform on the probability that a pregnancy episode results in a pre-term birth using a Difference-in-Differences (DD) estimator. It consists in estimating whether the difference in the number of pre-term births between affected women (not CMU-C) and unaffected women (beneficiaries of the CMU-C) after the reform is significantly different from the difference in the number of pre-term births between affected and unaffected women before the reform. This is implemented by the estimation of equation (3.6) by OLS:

$$Y_{ipq} = b_1(\mathbb{1}_{g=1} \cdot Post_{2017}) + b_2\mathbb{1}_{g=1} + b_3Post_{2017} + b_4X'_{ipq} + \alpha_i + \mu_q + \epsilon_{ipq} \quad (3.6)$$

Where Y_{ipq} denotes the outcome of a mother i , during a pregnancy episode p that took place on a quarter q . We estimate this regression on two outcomes: the indicator of a pre-term birth and the duration of a pregnancy episode p in days. $\mathbb{1}_{g=1}$ is a binary indicator that equals to one if a pregnant woman is not a beneficiary of the CMU-C, 0 otherwise. Indicator $Post_{2017}$ equals to one after the reform, 0 before. Controls in variable X_{ipq} include the age of women, physicians’ densities at the *département* level and the number of out-patient consultations with a GP, a gynecologist and a midwife. As for the principal analysis, we control for the implementation of the reform for volunteer physicians in the

²⁶The rate of premature births is around 6-7% in the French population[23].

Table 3.5: Impact of the reform on pre-term births and pregnancy duration

	Pre-term birth		Pregnancy duration	
	(1)	(2)	(3)	(4)
Average Treatment Effect on the Treated	-0.00065 (0.0309)	-0.00726 (0.0309)	-1.0832 (1.7823)	-0.6216 (1.7748)
Effects of the number of consultations				
GP	-	-0.00194 (0.00155)	-	0.16731* (0.0891)
Gynecology	-	-0.00716*** (0.00189)	-	0.27320** (0.1085)
Midwife	-	-0.00381** (0.00175)	-	0.40550*** (0.1009)
R-Square	0.9153	0.9161	0.9652	0.9657
Number of consultations	No	Yes	No	Yes
Number of pregnancies	18,809	18,809	18,809	18,809
Number of women	16,811	16,811	16,811	16,811

Sources: Author's calculations from the EGB-S database.

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. This table reports the coefficient (standard errors in parentheses) of the DD estimator. Results of the impact of the direct payment abolition reform on the probability of pre-term births (columns (1) and (2)) and the pregnancy duration in days (columns (3) and (4)) are reported. The DD estimator measures an Average Treatment Effect on the Treated (women who are not beneficiaries of the CMU-C). Standard errors are clustered at the individual level to account for possible heterogeneity in the unobserved characteristics of pregnant women between pregnancy episodes. Fixed effects models are estimated by OLS regressions. Regressions control for individual (mother) fixed effects.

last semester of 2016. The estimation includes individuals' fixed effects and quarterly dummies. Table 3.5 reports the results of the estimation of equation (3.6) with (column 1 and 3) and without (column 2 and 4) the number of out-patient consultations in control.

We find no evidence of a significant impact of the reform on (i) the probability of pre-term births and (ii) the duration of a pregnancy episode. Interestingly, the number of consultations with a gynecologist or a midwife prevents the risk of pre-term birth. Results show that an additional consultation with a gynecologist or a midwife is associated with a lower probability that a pregnancy results in a pre-term birth, and a longer pregnancy duration.

8 Robustness

In the main analysis of the reform impact, the triple differences' estimation relies on a control group that corresponds to the period before the 6th month of pregnancy. To ensure the robustness of the results, we propose to analyze the impact of the reform without using the shock of the transition to the 6th month of pregnancy as an identification strategy. In fact, this strategy might suffer from two limitations. First, women in the control period (before 6 months) and women in the treatment period (after 6 months) are the same. Second, it results in the possibility for those women to anticipate the transition to the 6th month of pregnancy. So women could delay care consumption to the moment when they are exempted from direct payments. To account for this possibility, we implement a Difference-in-Differences (DD) analysis on a sample of pregnancy episodes observed exclusively during the treatment period²⁷ (after 6 months of pregnancy). This estimation compares the differential in care consumption of pregnant women between CMU-C (control group) and non CMU-C (treatment group) beneficiaries, before and after the reform. We estimate (i) an "event-study" to check for a difference in the pre-reform trends in outcomes between women in treatment and control groups; (ii) an average effect of the reform on the treated (women who are not beneficiaries of the CMU-C). For the purpose of the event-study analysis, we aggregate the observations by months. The event-study analysis estimates the effect of being in the treatment group (no CMU-C) by month from mid-2014 to mid-2018. There are 29 months observed before the reform (January 2017) and 17 months observed after. The sample used for the robustness is composed of 53,044 observations belonging to 17,189 pregnancy episodes and 15,539 pregnant women.

Results of the DD estimation are reported in tables 3.J.1 and 3.J.2 in appendix 3.J. They are consistent with the results obtained with the triple differences estimator. Concerning the effect of the reform on out-patient consultations, the DD and the DDD estimators both estimate a very close effect on the number of GP consultations. The DD estimator finds that the reform led to an increase of 6.8 GP consultations per 100 pregnant women (table 3.J.1). In comparison, the DDD estimator found a 6.4 increase in the number of GP consultations per 100 pregnant women. However, the effect is only significant at the 10% level in the DD estimation, and the coefficient measuring the effect of the reform on the number of GP consultations at hospital is not significant in the DD estimation. Again, no impact of the reform is found on the number of gynecological consultations. Finally, consistent with the results of the DDD estimation, a significant decrease in the number of midwife consultations is found. This effect is observed for mid-

²⁷This led to the exclusion of 1,620 pregnancy episodes and 1,272 women.

wife consultations taking place at hospital.

Results of the event-study analysis reported in figure 3.J.1 enables to test for the reliability of the identifying assumption of the DD estimator, i.e., the "common trend" assumption. In fact, the DD estimator corresponds to the "true" causal effect of the reform only under the hypothesis that the trends in the outcomes of affected (not CMU-C) and unaffected (CMU-C) women would have evolved similarly in the absence of the reform. This assumption cannot be formally tested since we cannot observe at the same time the outcome of a woman treated by the reform, and the outcome for the same woman in the absence of the reform. But we can observe if the trends in the outcomes of affected and unaffected women evolved similarly before the reform, or not. This test is given by the coefficients on the left of the vertical bar in figure 3.J.1, which estimate the difference in the number of consultations between not CMU-C and CMU-C beneficiaries by month before the reform, in comparison with the difference observed in December 2016. If coefficients before the reform are significant, it means that the common trend assumption is violated.

Results displayed in figure 3.J.1 suggest that this assumption appears to hold for midwife consultations, gynecologist consultations and ED visits (except for one or two specific months in the beginning of the period). However, the common trend assumption is less reliable for GP consultations. Of the 27 months observed before the reform (January 2017), there are 5 months for which the difference in the number of consultations between affected (not CMU-C) and unaffected (CMU-C) women is significantly lower than the difference observed just before the reform (December 2016). It might explain that an average effect of the reform on the number of GP consultations is not detected, especially for consultations taking place at hospital. But it is not a concern for the results of the DDD estimation since this estimator does not rely on the "common trend" assumption to obtain consistent estimates (see section 6).

Concerning the spillover effects of the reform, results reported in table 3.J.2 show no impact on the number of ED visits. This result is consistent with the results of the triple differences estimation. It confirms that there is no evidence of a substitution between emergency care and out-patient care to avoid the payment of a consultation in the population of pregnant women. More precisely, the use of EDs as substitutes for out-patient care is not observed among pregnant women whose liquidity constraints have been removed by the reform. Our results do not rule out the existence of a possible substitution between EDs and outpatient care for reasons other than liquidity constraints.

9 Discussion and concluding remarks

This paper assesses the impact of the French 2017 direct payment abolition reform on the out-patient care and the emergency care consumed by pregnant women. The reform removed direct payments for the care consumed by pregnant women after 6 months of pregnancy on top of the recommended prenatal care, until day 12 after the birth delivery. The presence of direct payments for out-patient care can prevent utilization because it imposes a liquidity constraint on patients' income.

Estimating the effect of this reform allows to test the validity of two hypotheses. First, it tests if liquidity constraints have an influence on the consumption of out-patient care. Second, it tests the existence of a substitution between out-patient care and emergency care to avoid the payment of a consultation. The influence of direct payments (which impose a liquidity constraint) on care consumption in high-income countries has received little attention in the literature. Also, to the best of our knowledge, the spillover effects of removing direct payments for out-patient care have not been studied yet.

In France, only a part of the French population might be subject to liquidity constraints, since a free CHI called "CMU-C" ensures no direct payments and full coverage to individuals with very low income. Analyzing the effect of the 2017 "Tiers-Payant" reform offers an opportunity to test for the presence of liquidity constraints in France, which has never been done by previous studies. It is somewhat a challenge since the reform only affected a small part of the population, i.e., pregnant women who are not beneficiaries of the CMU-C. But since the income threshold to be eligible to the CMU-C is very low (70% of the poverty line), it is possible that some individuals remain subject to liquidity constraints.

Using a triple differences estimator, we find a small but positive impact of the "Tiers-Payant" reform on the number of GP consultations at hospital. In all, the reform led to an increase of 6.4 GP consultations per 100 pregnant women. In addition, we find a decrease in the number of midwife consultations taking place at the hospital for affected women (not CMU-C) following the reform. Taking together, these results suggest that liquidity constrained women substituted GP consultations to midwife consultations since the price of the latter was lower before the reform, when direct payments were required. Such evidence supports the existence of liquidity constraints for a proportion of pregnant women who are not covered by the CMU-C.

This result is remarkable since, as mentioned in section 2, pregnant women were already exempt from direct payments for the prenatal care recommended by the NHI guidelines before the reform. So the impact of the reform estimated in this study is

probably underrated since it concerns a small part of the population that was already exempt from direct payment for a specific care package. For this reason, we should find a stronger effect of the reform in general population.

Turning to the second hypothesis, we find no impact of the reform on the number of ED visits. This result implies that EDs are not used as substitutes for out-patient care by pregnant women who were subject to liquidity constraints before the reform. This result is important for the literature on inappropriate ED visits. It provides empirical evidence that the presence of direct payments for out-patient consultations does not encourage liquidity constrained patients (here, pregnant women) to use EDs for non-urgent conditions. However, it does not prevent the existence of a substitution between ED visits and out-patient consultations for other reasons than liquidity constraints.

The findings of this paper are robust to the use of an alternative specification. A difference-in-differences (DD) model is estimated to account for the possibility that pregnant women can delay care consumption to the period when direct payments are exempted. Estimations are consistent with results from the triple differences model, though the estimated effect of the reform on GP consultations taking place at the hospital is less precise with the DD estimation.

This study has several limits. First, the main caveat is that our findings are estimated on the very specific population of pregnant women. This population has very specific care needs, and a pregnancy is not comparable with a disease. A majority of pregnancies are planned, and so the burden of direct payments can be anticipated. Plus, recommended prenatal care was already exempt from direct payment before the reform. All these reasons make the external validity of the results questionable. Therefore, an experimentation consisting in removing direct payments for out-patient care should be conducted in the general population. Given the characteristics of the 2017 reform and the population targeted, one should expect to find a stronger influence of liquidity constraints in the general population. Such an experimentation would be useful for the discussion about the extension of the direct payment abolition reform to the whole French population.

A second caveat is that since administrative databases are used, information related to women's socio-demographic characteristics is very limited. To compensate this lack, data on physician's density around women's place of residence was imported as mentioned in section 5.

Last, results could be biased if women applied for the CMU-C complementary insurance in the expectation of a pregnancy. But in this case, results would be downward biased to zero.

To conclude, this paper provides empirical evidence that (i) there are still liquidity constraints for care in France, and (ii) the presence of direct payments for out-patient care does not encourage the utilization of EDs. Our results suggest that liquidity constraints restrict access to medical consultations, and thus support a general withdrawal of direct payments for out-patient care. But it should be confirmed by an experimentation conducted in the general population since our results were estimated on the specific population of pregnant women.

This paper is the very first to estimate a causal effect of the abolition of direct payments for out-patient consultations in France. To our knowledge, it is also the first to provide evidence of the influence of liquidity constraints on access to care consultations. It contributes to a rare literature on the effect of direct payments on health care consumption.

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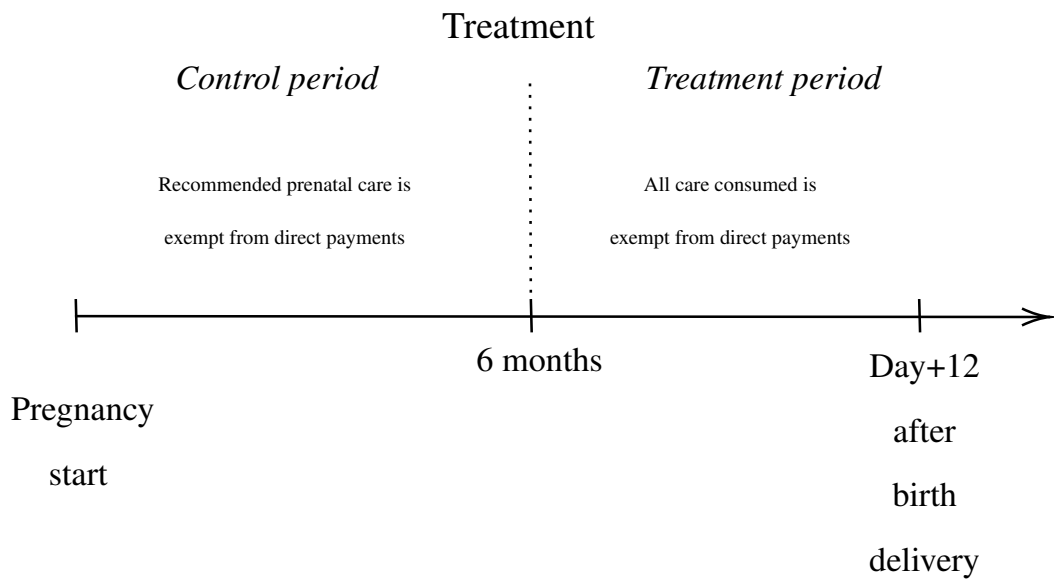
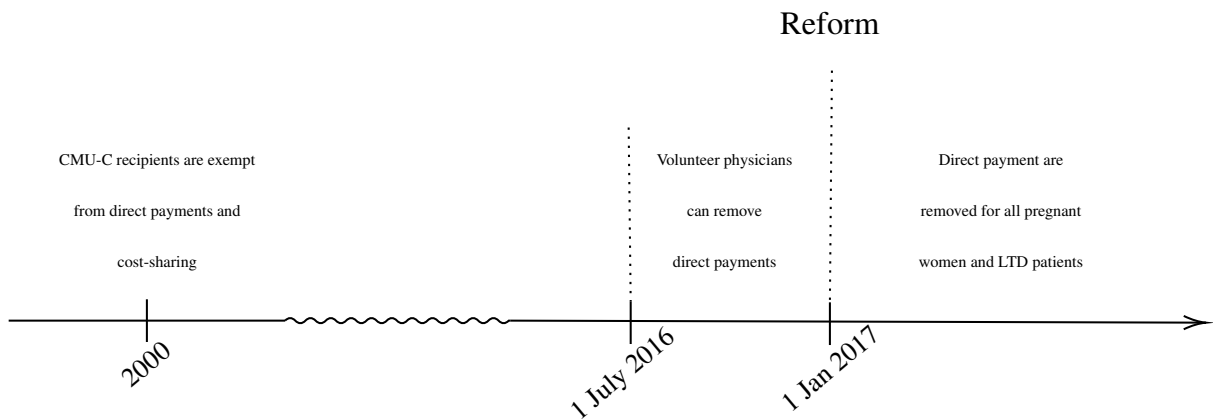
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Appendix

3.A Timelines of the reform



3.B Algorithm for the identification of pregnancy episodes

We present below the principal diagnoses, the associated diagnoses and the birth delivery medical procedures to select in order to identify hospital admissions resulting in single living births. This algorithm applies only for requests in the French national administrative database related to hospital admissions, the PMSI (*Programme de Médicalisation des Systèmes d'Information*).

- Principal diagnosis: O.80.0
- Associated diagnosis: Z37.0
- Birth delivery procedures: JQGD001, JQGD003, JQGD004, JQGD005, JQGD008, JQGD010, JQGD012, JQGD013, JQGA002, JQGA003, JQGA004, JQGA005.

Table 3.B.1: Number of birth deliveries identified in the data

	2014	2015	2016	2017	2018	All
Birth deliveries identified through the algorithm	7,399	7,424	7,490	7,237	7,146	36,696
Hospitalizations for birth delivery (Z37) but no delivery act	10	13	17	8	9	57
Gestational age missing	142	180	184	158	180	844
Gestational age lower than 6 months (182 days)	11	13	15	12	15	66
Delay between two pregnancy episodes lower than 9 months	2	0	1	6	1	10
Final sample of birth deliveries	7,234	7,218	7,273	7,053	6,941	35,719
Total approximation ($\times 97$)	701,698	700,146	705,481	684,141	673,277	3,464,743

Sources: Author's calculations from the EGB-S database.

Notes: 35,719 pregnancy episodes are identified through the algorithm for the 2014-2018 period. Since the EGB-S database is a 1/97th sample of individuals affiliated to the French NHI, we multiply the number of birth deliveries by 97 to approximate the number of birth deliveries that would have been selected in the comprehensive database (the SNIIRAM data).

Table 3 reports the number of birth deliveries identified through the use of the algorithm in the EGB-S database. After selecting relevant birth deliveries, the sample is composed of 35,719 birth deliveries observed during the 2014-2018 period. Since the EGB-S database is a 1/97th sample of individuals affiliated to the French NHI, we approximate the number of birth deliveries that would have been identified by the algorithm if applied to comprehensive data. Approximation shows that 3,464,743 would be identified. For seek of comparison, we present in table 3.B.2 the number of birth deliveries registered in national statistics data from INSEE. When multiple births are excluded, we count 3,862,472

birth deliveries between 2014 and 2018 in France. This allows us to compare the approximate number of single live births that would have been identified in non-sampled data (the SNIIRAM comprehensive database) to the number of single live births observed in national registers. Table 3.B.3 shows that the number of birth deliveries identified in the EGB-S database through the algorithm is around 10% lower than the number of birth deliveries in national registers.

Table 3.B.2: National statistics on birth deliveries in France

	2014	2015	2016	2017	2018	All
Total (1)	818,565	798,948	783,640	769,553	758,590	3,929,296
Twins (2)	13,825	13,539	13,189	12,822	12,505	65,880
Triplets or more (3)	191	190	206	182	175	944
Single live births (4)						
(4) = (1) - (2) - (3)	804,549	785,219	770,245	756,549	745,910	3,862,472

Sources: National administrative data from the National Institute of Statistics and Economic Studies (INSEE).
Notes: Between 2014-2018, 3,862,472 single live births were registered in France. Last row reports estimates of the number of single live birth in France by year to compare with the approximate number of birth deliveries identified in the EDB-S database (last row of table 3.B.1).

Table 3.B.3: Total number of full-term single live birth deliveries in France

	2014	2015	2016	2017	2018	All
Estimates from national registers	804,549	785,219	770,245	756,549	745,910	3,862,472
Approximation from the EGB-S sample	701,698	700,146	705,481	684,141	673,277	3,464,743
Difference	103,151	85,073	64,764	72,408	72,633	397,729
%	12.82%	10.83%	8.41%	9.57%	9.74%	10.30%

Sources: Author's calculations from EGB-S database ; National administrative data from the National Institute of Statistics and Economic Studies (INSEE).

Notes: The number of full-term single live birth deliveries is 10% lower in the approximation made from the EGB-S database in comparison with national registers.

3.C Sample frequencies

Table 3.C.1: Distribution of pregnancy episodes by quarter and treatment status

Year	Quarter	Number of pregnancies				Number of observations			
		Before month 6	After month 6	CMU-C: Yes	All	Before month 6	After month 6	CMU-C: Yes	All
2014	Q3	3,139	1,686	695	3,743	28,440	11,903	7,509	40,343
	Q4	3,085	1,781	787	3,942	27,272	10,684	7,547	37,956
2015	Q1	3,180	1,752	818	4,004	27,855	10,489	7,758	38,344
	Q2	3,240	1,884	846	4,088	28,879	11,360	8,382	40,239
	Q3	3,136	1,962	858	4,064	27,851	12,005	8,330	39,856
	Q4	3,223	1,892	877	4,124	28,266	11,705	8,580	39,971
2016	Q1	3,163	1,795	864	4,004	28,993	10,641	8,431	39,634
	Q2	3,131	1,939	870	4,002	27,361	12,068	8,352	39,429
	Q3	2,947	1,886	877	3,955	26,231	11,560	8,381	37,791
	Q4	3,085	1,706	891	3,857	27,099	10,597	8,747	37,696
2017	Q1	3,059	1,711	883	3,857	27,523	10,236	8,688	37,759
	Q2	2,975	1,857	864	3,819	26,549	11,401	8,671	37,950
	Q3	2,836	1,853	856	3,759	24,722	11,456	8,173	36,178
	Q4	2,864	1,625	796	3,637	25,053	9,996	7,751	35,049
2018	Q1	2,887	1,557	757	3,599	25,792	9,377	7,369	35,169
	Q2	2,060	1,706	576	2,830	20,286	10,420	6,119	30,706
All		18,148	17,189	3,979	18,809	428,172	175,898	128,788	604,070
Women		16,322	15,539	3,583	16,811				

Sources: Author's calculations from the EGB-S database.

Notes: Panel starts on 2014-07-01 and ends on 2018-06-30 (4 consecutive years). Q1 corresponds to the first quarter of a year and includes the months of January, February and March. Q2 corresponds to the second quarter of a year, etc. Pregnancy episodes are identified on the basis of their outcome, birth delivery. As a result the starting date of pregnancy is calculated retrospectively thanks to the delay from the last period (see section 5 for details). Choice was therefore made to start and to end the panel at the middle of a calendar year in order to have a balanced number of observations before and after the 6th month of pregnancy in the first and the last quarters of the panel. The number of women is lower than the number of pregnancy episodes because some women of the panel have multiple pregnancies during the period of observation.

3.D Summary statistics by treatment status

Table 3.D.1: Number of medical consultations and ED visits

	(1)	(2)		(3)		(4)	(5)
	All	Before 2017		After 2017		After 2017	
		Before 6 month	After 6 month	Before 6 month	After 6 month	Before 6 month	After 6 month
	Sum	Sum	Sum	Sum	Sum	Sum	Sum
GP consultations							
Total	67,347	34,582	9,416	18,344	5,005		
Out-patient care outside hospital	60,209	31,438	7,949	16,533	4,289		
Hospital outpatient care	7,138	3,144	1,467	1,811	716		
Gynecological consultations							
Total	70,971	29,408	16,993	15,544	9,026		
Out-patient care outside hospital	49,484	21,994	10,404	11,585	5,501		
Hospital outpatient care	21,487	7,414	6,589	3,959	3,525		
Midwife consultations							
Total	53,024	13,118	18,741	9,258	11,907		
Out-patient care outside hospital	11,392	4,285	2,082	3,441	1,584		
Hospital out-patient care	41,632	8,833	16,659	5,817	10,323		
Emergency Department visits							
Total	10,766	5,033	1,766	2,977	990		
Hospitalized	1,357	390	458	221	288		
Non-hospitalized	9,409	4,643	1,308	2,756	702		
N	604,070	279,178	113,724	148,994	62,174		
Pregnancies	18,809	13,954	11,940	7,164	6,614		
Women	16811	13,069	11,404	7,086	6,553		

Sources: Author's calculations from the EGB-S database.

Notes: Column 1 reports the total number of consultations and ED visits in the sample for the whole period of observation (mid-2014 to mid-2018). Column 2 (*resp.* 4) reports consultations and visits consumed during the control period (before 6 months of pregnancy) before (*resp.* after) the reform (2017). Column 3 (*resp.* 5) reports consultations and visits consumed during the treatment period (after 6 months of pregnancy) before (*resp.* after) the reform.

Table 3.D.2: Weekly means of pregnancy characteristics and care consumption

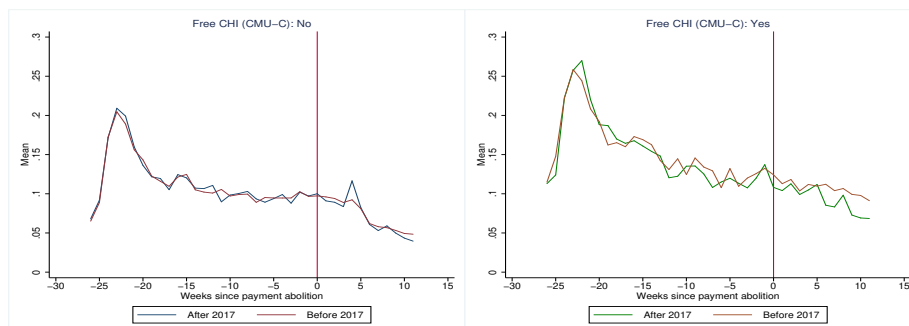
	(1)		(2)				(3)		(4)		(5)				(6)		(7)	
	All		Before 2017				Difference		After 2017				Difference					
	Mean	St.Dev	Mean	St.Dev	Mean	St.Dev	p-value	Mean	St.Dev	Mean	St.Dev	Mean	St.Dev	p-value				
Pregnancy characteristics																		
Mother's age	29.923	5.519	29.748	5.494	30.105	5.478	0.000	29.911	5.582	30.219	5.542	0.000						
Pregnancy duration (in weeks)	37.395	1.213	37.359	1.222	37.446	1.207	0.000	37.361	1.207	37.492	1.194	0.000						
N. of observed pregnancy weeks	37.206	6.640	38.381	4.854	35.611	8.842	0.000	35.574	7.458	39.304	2.904	0.000						
GP consultations																		
Total	0.107	0.331	0.124	0.354	0.077	0.282	0.000	0.123	0.354	0.076	0.278	0.000						
Out-patient care outside hospital	0.096	0.311	0.113	0.336	0.065	0.257	0.000	0.111	0.335	0.064	0.257	0.000						
Sector 1	0.095	0.311	0.112	0.335	0.063	0.254	0.000	0.112	0.336	0.064	0.255	0.000						
Sector 2	0.004	0.064	0.005	0.070	0.003	0.059	0.000	0.003	0.060	0.003	0.056	0.050						
Hospital out-patient care	0.012	0.111	0.011	0.109	0.012	0.114	0.035	0.012	0.113	0.011	0.108	0.099						
Gynecological consultations																		
Total	0.113	0.326	0.105	0.314	0.125	0.344	0.000	0.104	0.311	0.134	0.355	0.000						
Out-patient care outside hospital	0.078	0.272	0.079	0.272	0.076	0.269	0.000	0.078	0.270	0.081	0.278	0.012						
Sector 1	0.032	0.180	0.035	0.187	0.030	0.175	0.000	0.032	0.177	0.028	0.170	0.000						
Sector 2	0.049	0.219	0.047	0.213	0.050	0.224	0.000	0.048	0.215	0.056	0.238	0.000						
Hospital out-patient care	0.035	0.190	0.026	0.166	0.050	0.227	0.000	0.027	0.164	0.054	0.234	0.000						
Midwife consultations																		
Total	0.101	0.337	0.047	0.218	0.186	0.458	0.000	0.062	0.249	0.206	0.474	0.000						
Out-patient care outside hospital	0.027	0.178	0.016	0.127	0.049	0.251	0.000	0.023	0.152	0.035	0.204	0.000						
Hospital out-patient care	0.074	0.291	0.031	0.178	0.138	0.397	0.000	0.039	0.200	0.170	0.437	0.000						
Emergency Department visits																		
Total	0.024	0.165	0.017	0.139	0.034	0.194	0.000	0.020	0.148	0.041	0.213	0.000						
<i>Not related with birth delivery</i>	0.017	0.138	0.017	0.139	0.014	0.128	0.000	0.020	0.148	0.015	0.131	0.000						
Hospitalized	0.009	0.095	0.001	0.035	0.021	0.146	0.000	0.001	0.037	0.027	0.164	0.000						
<i>Not related with birth delivery</i>	0.002	0.044	0.001	0.035	0.003	0.054	0.000	0.001	0.037	0.003	0.058	0.000						
Non-hospitalized	0.016	0.132	0.016	0.134	0.013	0.122	0.000	0.018	0.142	0.014	0.125	0.000						
<i>Not related with birth delivery</i>	0.015	0.130	0.016	0.134	0.012	0.116	0.000	0.018	0.142	0.012	0.116	0.000						
N	627,532		266,425		146,242			142,219		72,646								
Pregnancies	18,809		13,294		15,988			6,836		6,527								
Women	16,811		12,489		14,527			6,768		6,466								

Sources: Author's calculations from the EGB-S database.

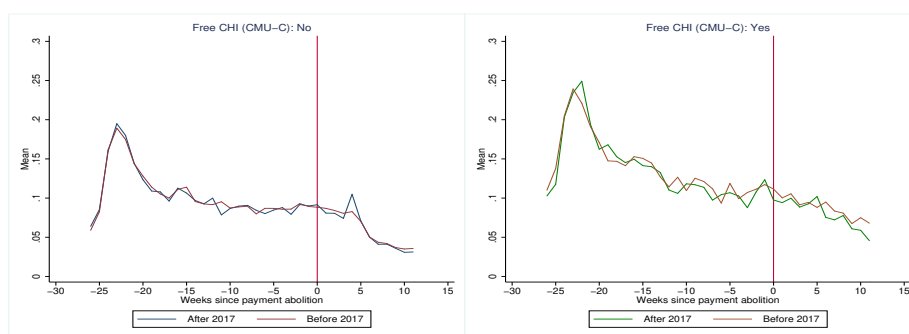
Notes: Column 1 reports weekly means (and standard deviations) of the sample. Column 2 (*resp.* 5) reports the same statistics for pregnancy episodes that were below 6 months of pregnancy before (*resp.* after) the reform (2017). Column 3 (*resp.* 6) reports statistics for pregnancy episodes that were above 6 months of pregnancy before (*resp.* after) the reform (and thus could have been (*resp.* were) exempt from direct payments. Columns 4 and 7 report p-values for tests of equality of means.

3.E Trends in out-patient consultations

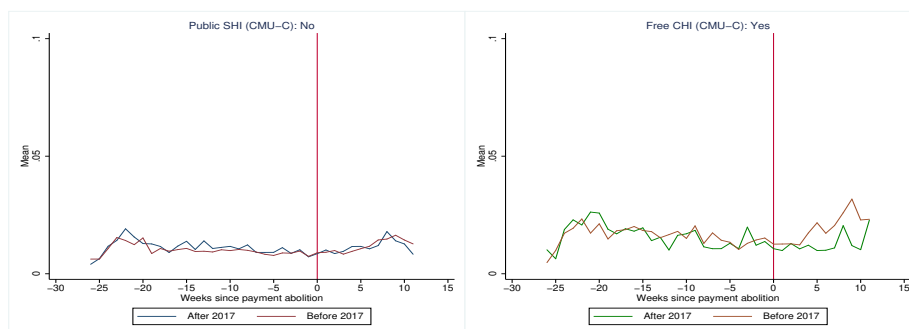
Figure 3.E.1: Trends in GP consultations



(a) Total GP consultations



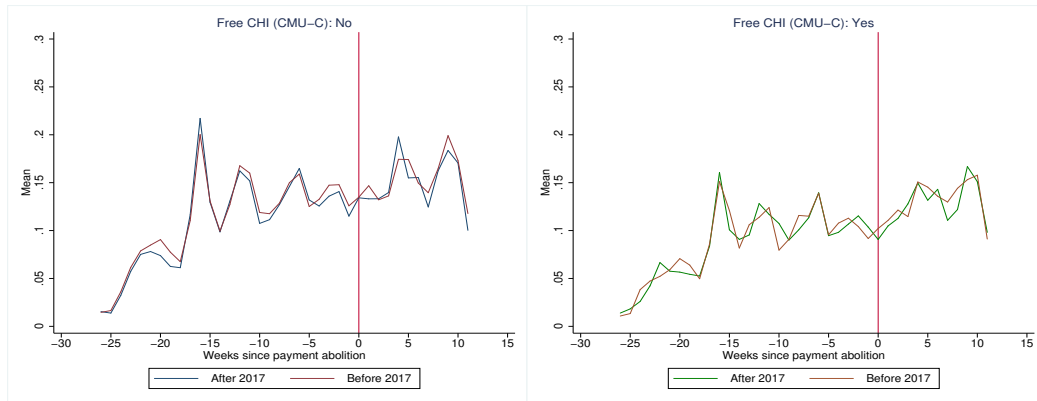
(b) Outpatient GP consultations



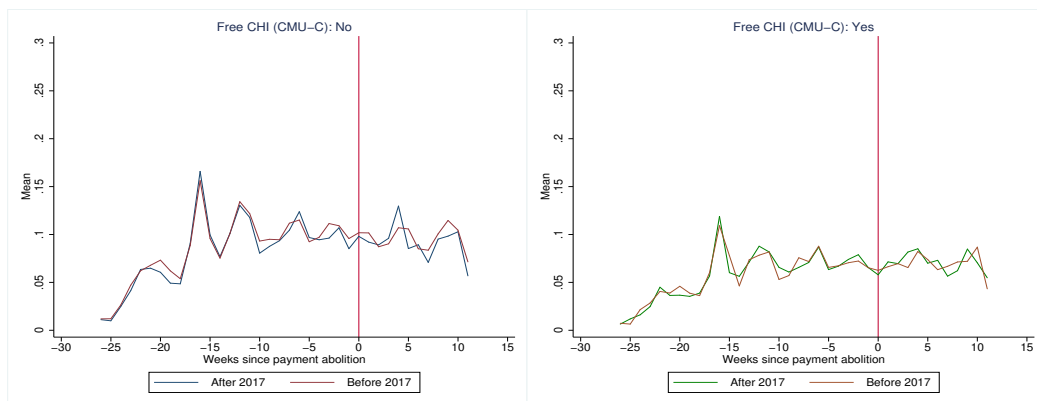
(c) Hospital outpatient GP consultations

Sources: Author's calculation from EGB-S. *Notes:* Trends in means of GP consultations by weeks of pregnancy (reported on the x-axis as a distance in weeks from the first week of the 6th month of pregnancy (week=0)) are represented before and after the reform (2017). Graphs on the left side concern women affected by the reform. Graphs on the right side concern women remaining unaffected by the reform (beneficiaries of the free CHI "CMU-C").

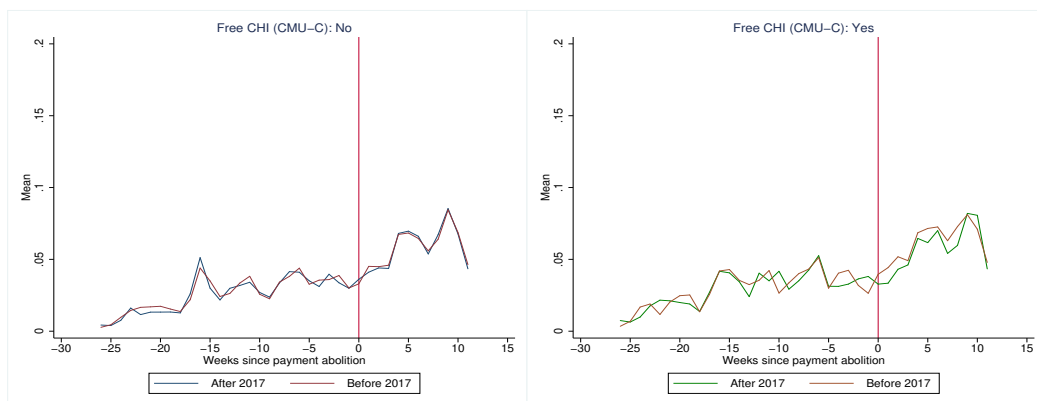
Figure 3.E.2: Trends in gynecological consultations



(a) Total gynecological consultations



(b) Outpatient gynecological consultations

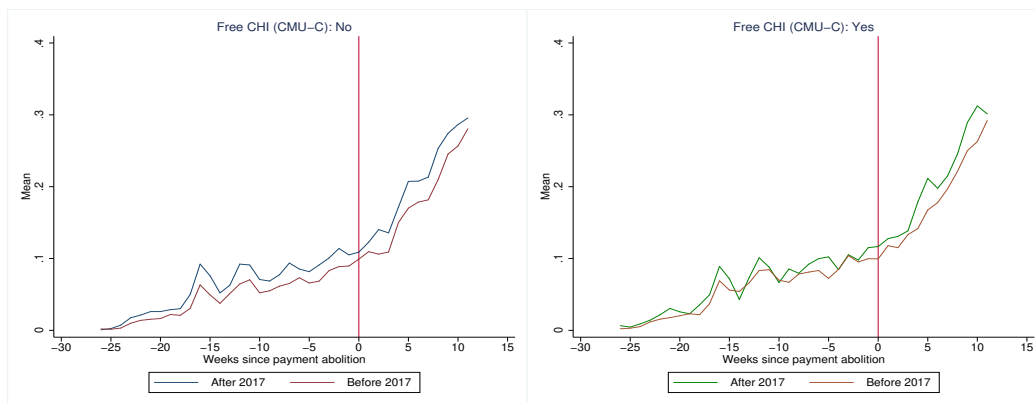


(c) Hospital outpatient gynecological consultations

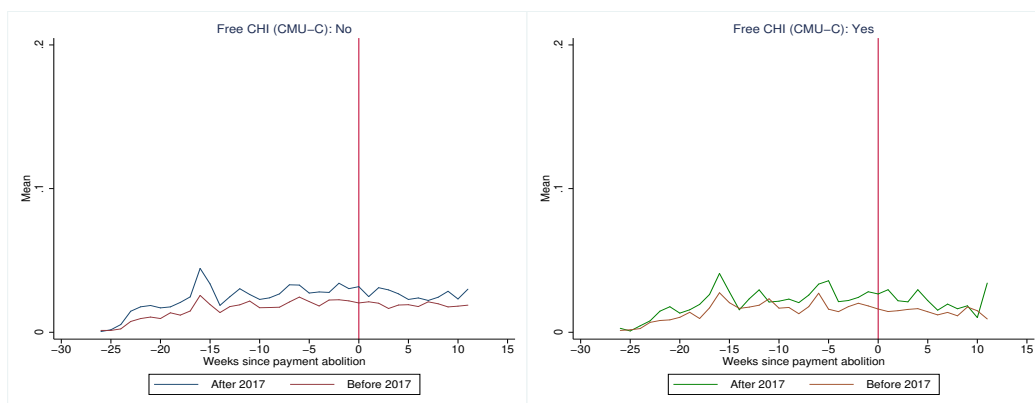
Sources: Author's calculation from EGB-S.

Notes: Trends in means of gynecological consultations by weeks of pregnancy (reported on the x-axis as a distance in weeks from the first week of the 6th month of pregnancy (week=0)) are represented before and after the reform (2017). Graphs on the left side concern women affected by the reform. Graphs on the right side concern women remaining unaffected by the reform (beneficiaries of the free CHI "CMU-C").

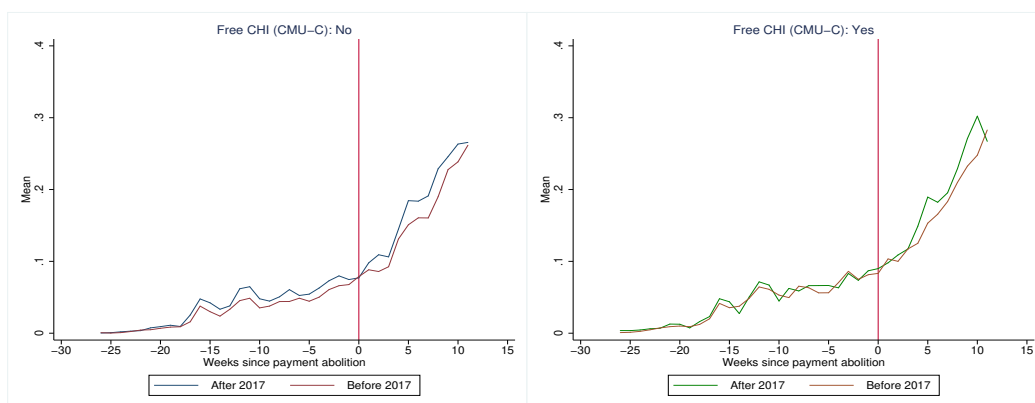
Figure 3.E.3: Trends in midwife consultations



(a) Total midwife consultations



(b) Outpatient midwife consultations



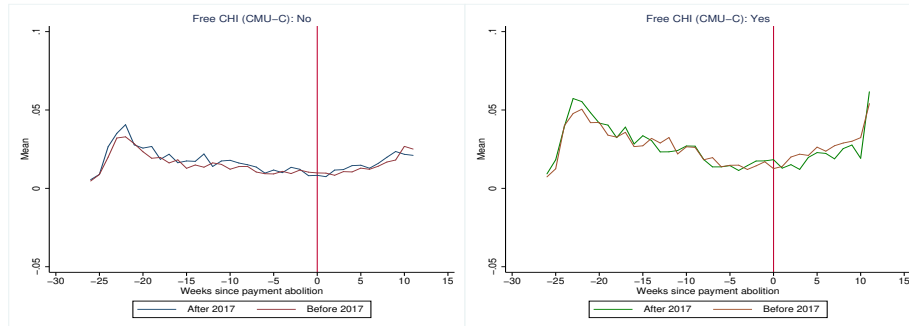
(c) Hospital outpatient midwife consultations

Sources: Author's calculation from EGB-S.

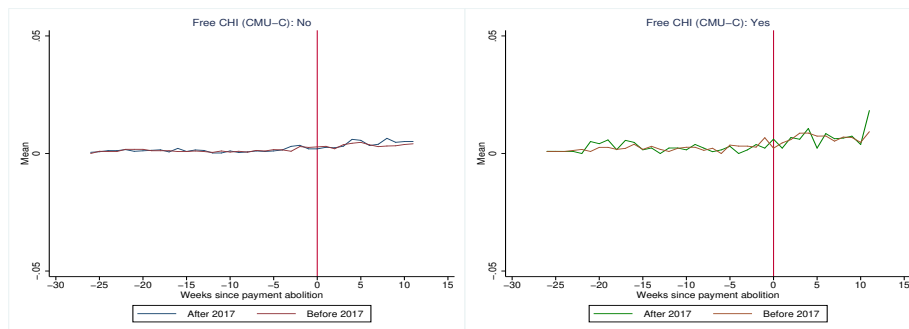
Notes: Trends in means of midwife consultations by weeks of pregnancy (reported on the x-axis as a distance in weeks from the first week of the 6th month of pregnancy (week=0)) are represented before and after the reform (2017). Graphs on the left side concern women affected by the reform. The right side concern women remaining unaffected by the reform (beneficiaries of the free CHI "CMU-C").

3.F Trends in ED visits

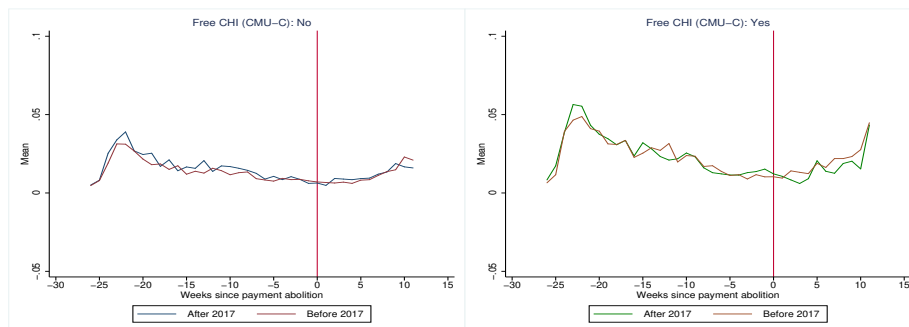
Figure 3.F.1: Trends in ED visits



(a) Total ED visits



(b) Hospitalized ED visits



(c) Non-hospitalized ED visits

Sources: Author's calculation from EGB-S. *Notes:* Trends in means of ED visits by weeks of pregnancy (reported on the x-axis as a distance in weeks from the first week of the 6th month of pregnancy (week=0)) are represented before and after the reform (2017). Graphs on the left side concern women affected by the reform. Graphs on the right side concern women remaining unaffected by the reform (beneficiaries of the free CHI "CMU-C").

3.G Individuals unaffected by the reform

Prior to the 1st of January 2017, direct payments were already removed for the following specific populations and/or under the following circumstances:

- (a) Beneficiaries of a free complementary health insurance (CHI) called CMU-C and managed by the French NHI. It prohibits direct payments for care and ensures full coverage. Attribution depends on household's income which must not exceed a certain threshold. This threshold is rather low and corresponds to 70% of the poverty line in France.
- (b) Beneficiaries of the "Aide à la Complémentaire Santé" (ACS) program which consists in providing a check to patients paid by the social security, and which can only be used to purchase a private CHI. ACS program was designed to avoid the threshold effect generated by the CMU-C insurance program by subsidizing the purchase of a CHI for individuals with income just above the eligibility threshold.
- (c) Beneficiaries of the "State Medical Aid" (AME). This program ensures full coverage and no direct payments for all the care consumed by low-income foreigners in an irregular situation, and living in France for at least 3 months.
- (d) Victims of a work-related accident or an occupational disease for all the care received related to the accident or the occupational disease.
- (e) Care provided to participants of a screening campaign (e.g. a mammogram performed as part of the breast cancer screening campaign)
- (f) Inpatient care delivered in a hospital which contracted with the French NHI.
- (g) Contraception consultations for minors over 15.

3.H Mandatory examinations during pregnancy

Before the 2017 "Tiers-Payant" reform, direct payments (and cost-sharing) were already removed for a set of medical examinations recommended by NHI guidelines to pregnant women. Since the 1st of January 2017, direct payments (and cost-sharing) are removed for the care consumed on top of these medical examinations, from the first day of the 6th month of pregnancy until the 12th day after the birth delivery.

The following table details the recommended prenatal care examinations which were already exempt from direct payment before the reform:

Table 3.H.1: Summary of recommended care during pregnancy

Pregnancy month	0 -3	4	5	6	7	8	9	NHI coverage	Direct Payments
Prenatal consultation	✓	✓	✓	✓	✓	✓	✓	100%	No
Ultrasound	✓	×	✓	×	×	✓	×	70% before 6th month	Possible before the 6th month
								100% after	
Childbirth preparation sessions	×	✓	×	×	7 sessions			100%	No
Biological tests	✓	×	×	✓	×	✓	×	100%	No
Anesthesia consultation	×	×	×	×	×	✓	×	100%	No

Note: A free dental check-up is also proposed during the 4th and 5th month of pregnancy. Care recommended by the French NHI guidelines is denoted by a checkmark. On the contrary, a cross is displayed when care is not recommended.

Sources: <https://www.service-public.fr/particuliers/vosdroits/F963> ; <https://www.ameli.fr/assure/sante/themes/grossesse/consultation-suivi-mensuel> ; <https://www.service-public.fr/particuliers/vosdroits/F164> ; <https://www.ameli.fr/medecin/exercice-liberal/prescription-prise-charge/situation-patient-maternite/situation-patient-maternite>

3.I Number of pre-term births

Table 3.I.1: Number of pre-term births by group of beneficiaries

	(1) All	(2) Before 2017		(3) After 2017	
		CMU-C: No	CMU-C: Yes	CMU-C: No	CMU-C: Yes
Full-term births	18,060	2,416	9,570	1,368	4,706
Pre-term births	749	123	377	72	177
Total	18,809	2,539	9,947	1,440	4,883
Women	16,811	2,401	9,470	1,425	4,854

Sources: Author's calculations from the EGB-S database.

Notes: This table reports the number of pre-term births by group of beneficiaries of the CMU-C. A birth delivery is considered premature if the pregnancy duration is lower than 240 days (8 months).

3.J Robustness of the results

3.J.1 Average effect of the reform: DD analysis

Table 3.J.1: Difference-in-differences estimates of the reform impact on consultations

	(1)	(2)	(3)
	Total consultations	Outpatient consultations outside hospital	Hospital outpatient consultations
Outcome A: General Practitioner (GP) consultations			
Average Treatment Effect on the Treated	0.068435*	0.046077	0.022358
	(0.0396)	(0.0363)	(0.0148)
R-Square	0.4201	0.4125	0.4609
Outcome B: Gynecological consultations			
Average Treatment Effect on the Treated	-0.05743	-0.03537	-0.02206
	(0.0437)	(0.0327)	(0.0298)
R-Square	0.4293	0.5342	0.4681
Outcome C: Midwife consultations			
Average Treatment Effect on the Treated	-0.15994***	-0.00588	-0.15406***
	0.0619	0.0203	0.0587
R-Square	0.493	0.4711	0.5018
Number of observations	53,044	53,044	53,044
Number of women	15,539	15,539	15,539

Sources: Author's calculations from the EGB-S database.

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. This table reports the coefficient (standard errors in parentheses) of the difference-in-difference estimator, measuring the impact of the direct payment abolition reform on medical consultations of pregnant women affected by the reform (who are not beneficiaries of the free CHI CMU-C). An average treatment effect on the treated (ATE) is thus estimated. Fixed effects models are estimated by OLS regressions. Regressions control for individual (mother) fixed effects as well as for time (months) fixed effects.

Table 3.J.2: Difference-in-differences estimates of the reform impact on ED visits

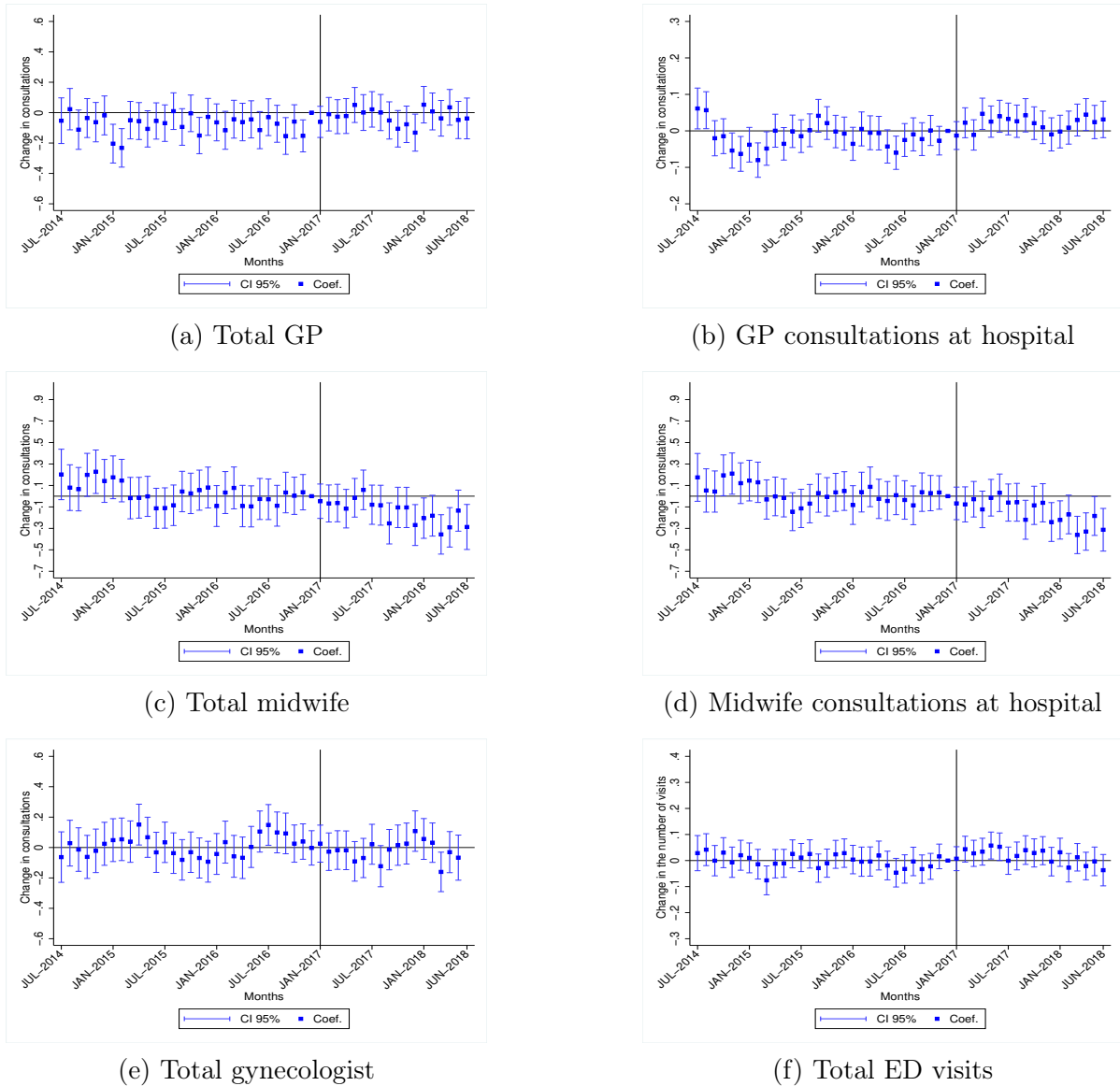
	(1) Total	(2) Hospitalized	(3) Non-hospitalized
Average Treatment Effect on the Treated	0.013241 (0.0178)	0.004997 (0.00858)	0.008244 (0.0154)
R-Square	0.4447	0.3646	0.4491
Number of observations	53,044	53,044	53,044
Number of women	15,539	15,539	15,539

Sources: Author's calculations from the EGB-S database.

Notes: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. This table reports the coefficient (standard errors in parentheses) of the difference-in-differences estimator, measuring the impact of the direct payment abolition reform on the ED visits of pregnant women affected by the reform (who are not beneficiaries of the free CHI CMU-C). An average treatment effect on the treated (ATET) is thus estimated. Fixed effects models are estimated by OLS regressions. Regressions control for individual (mother) fixed effects as well as for time (months) fixed effects.

3.J.2 Event-study analysis

Figure 3.J.1: Event-study analysis of the reform impact by months - DD estimation



Sources: Author's calculation from EGB-S. *Notes:* Results of an event-study analysis are reported. This analysis estimates the impact of being affected by the reform (i.e. not beneficiary of the CMU-C) by months, from mid-2014 to mid-2018. Coefficients of the interaction between a binary indicator for being in the treatment group (not beneficiary of the CMU-C) and month dummies are reported with their associated confidence intervals (CI). Regressions are estimated by OLS. Standard errors are clustered at the individual (pregnant women) level. Individuals' fixed effects are included in the regression.

General conclusion

This thesis contributes to understand the role served by the EDs within the French health care system. EDs are dealing with a rapid increase in the number of visits for decades that creates difficulties to manage the demand, and are subject to many problems that affect their efficiency: congestion, under-staffing, lack of hospital beds, violence, among others. These problems have been pointed out for more than 30 years [5] but they are still unsolved [2]. This thesis explores the influence of mechanisms other than population growth and aging on the utilization of EDs. We pay particular attention to the growing proportion of patients coming to the EDs for inappropriate reasons. Our results can be useful for policy makers because they provide insights about: (1) the influence of an ED opening on a hospital's admission activity and revenue, (2) the respective magnitude of patients' characteristics and of care supply characteristics in the explanation of inefficient utilization of EDs, (3) the role of direct payments on ED use.

Results and contributions

In the first chapter, we investigate a supply-side explanation to the increase in ED visits by analyzing the contribution of an ED on a hospital's activity. We built an original data set that identifies the openings (and closings) of EDs that took place in the French hospital industry between 2002 and 2012. This allows us to analyze the consequences of a 2001 French reform that encouraged the development of the emergency care activity among private-for-profit hospitals (PFP) to relieve public hospitals from congestion. We find that the opening of an ED yields to a +12.6% increase in the proportion of long stays (hospitalizations of one night or more), and a +18.5% in the length of long stays. These results suggest that the conditions of patients admitted through the ED are more severe than the conditions of other patients. Consequently, we find a positive impact of an ED opening on the hospital total revenue (+6.5%) and the revenue per admission (+11%). These results are, to our knowledge, the first to provide empirical evidence of

the influence of EDs on hospitals' activity. They show that EDs represent a financial interest for hospitals that goes beyond the revenue generated by ED visits. It also increases the hospital revenue through a higher proportion and a higher intensity of long stays. Since French hospitals are financed by a payment system per stay that encourages an increase in the number and in the casemix of stays, it is likely that EDs represent an opportunity to treat (more) lucrative patients. These incentives might encourage an increase in the opening of new EDs. At least, it does not encourage hospitals to participate in a reduction of EDs' utilization. Our result gives empirical support to public policy that aims at limiting the use of EDs, and proposes to compensate hospitals for the loss of revenue. Recently in France, an intervention involving hospitals in diverting inappropriate ED users to a primary care consultation with a GP has been decided. A 2 years experiment is conducted on a sample of 36 volunteer hospitals. The experiment consists of the payment of €60 to the hospital for each inappropriate patient diverted to a primary care facility²⁸. Our results can also be helpful to evaluate the effect of this experimentation, and in particular the optimal payment to provide a hospital to divert a patient.

The second chapter analyzes the determinants of inappropriate visits to EDs. We contribute to the literature by using a French survey that is, to our knowledge, the first to provide a direct assessment of the appropriateness of an ED visit. This measure is completed by a physician after each visit. We find that 30% of ED visits in France are divertible and 16% are delayable. This result confirms the large proportion of inappropriate ED visits in the total number of visits in France. In addition, the survey provides information on both patients' characteristics and characteristics of the health care system (availability of GPs, time of the visit, alternatives to EDs, among others). We use these two components of the data to compare the respective contributions of both characteristics to the inappropriate use of EDs. We estimate a recursive model with Instrumental Variables to deal with the non-exogeneity of the patient's decision to visit the ED. We find that (i) 84% of the explained variance of appropriateness is explained by self-referrals; (ii) 20% of the explained variance of the probability to self-refer to EDs is explained by health system's characteristics; and (iii) 27% of the explained variance of appropriateness is explained by health system's characteristics. Put together, these results suggest that public interventions whose objective are to prevent EDs from inappropriate utilization should focus on patients coming on self-referral, but that important gains in efficiency can be expected from policies aiming at improving the organization of out-patient care provision in the health system. The characteristics of the health care system that influ-

²⁸ *Arrêté du 23 février 2021, JORF N°0056 du 6 mars 2021*, available from <https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000043220407>.

ence the decision to self-refer and/or the inappropriate use of EDs are informative. They suggest that improving access to primary care services out of office hours (during the night and/or on weekend) could improve the efficient use of EDs. These results provide concrete solutions to relieve EDs from inappropriate visits and improve efficiency. We also contribute to the literature on the appropriate use of EDs by explaining the decision to self-refer in a structural specification instead of using it as a proxy of appropriateness.

The last chapter of this thesis analyzes the effects of a 2017 French reform that removed direct payments for all the care consumed by pregnant women after the 6th month of pregnancy. Direct payments create a liquidity constraint on individuals' income that can deter care consumption, especially among low-income individuals. Recent empirical evidence from the US supports the liquidity sensitivity of health care consumption [4]. In France, a free complementary health insurance (CHI) managed by the National Health Insurance (NHI) already exists to exempt the care consumption of low-income individuals from direct payments. Therefore, this study investigates whether there are still individuals who are constrained by the price of a medical consultation despite the existence of this free CHI. To do so, we use a sample of the exhaustive database on individuals' care consumption, the SNIIRAM. This database records all out-patient care and hospital care consumed by almost all the French population. Using a triple differences estimator, we estimate the causal impact of the reform on the number of out-patient consultations, and the number of ED visits made by pregnant women. We find that the abolition of direct payments led to a small increase in the number of General Practitioner (GP) consultations of pregnant women (+6.4 consultations by month per 100 women). This result suggests that a small proportion of pregnant women was still subject to liquidity constraints for care, despite the existence of the CMU-C. In addition, we test for the existence of a substitution between out-patient care and emergency care. Since ED visits are free from direct payments, liquidity constrained individuals might prefer to go to the ED instead of a general practice to avoid the payment of a consultation. We find no effect of the reform on the number of ED visits made by pregnant women. Put together, the results provide empirical evidence that the presence of direct payments for out-patient consultations restricts the access to GP care of liquidity constrained pregnant women, and do not encourage the use of EDs for non-urgent conditions. This paper is the very first to propose an evaluation of the 2017 "Tiers-Payant" reform in France on care consumption. It contributes to a very scarce literature on the liquidity sensitivity of health care consumption in high-income countries, but also to the literature on the inappropriate utilization of EDs by suggesting that the absence of direct payments for ED visits is not a determinant of inappropriate use. Finally, these findings provide useful information for the public debate about

extending the exemption of direct payments for care to the general French population. Since the results are estimated on the specific population of pregnant women, we recommend to confirm the results by an experiment conducted in the general French population.

In 2022, in France, a fixed fee will be charged as a direct payment to all patients not admitted to hospitalization after an ED visit²⁹. Our results are useful to evaluate the implementation of this fixed fee. The objective of an introduction of a copayment for non-hospitalized ED visits is to reduce inappropriate ED visits by acting on the demand side through financial penalties put on patients. But copayments and direct payments can restrict access to care, especially for low-income individuals. We have provided empirical evidence of the sensitivity of care consumption to liquidity constraints in the French population. These results should be considered to evaluate the net effect of this copayment. In particular, one should examine the effects on access to EDs and on patients' health outcomes. On top of that, the use of copayments should be compared with other types of interventions. Our results in chapter 2 show that if patients are responsible for a large part of the explained variability in inappropriate ED visits, sizeable efficiency gains can still be obtained by improving access to primary care. The latter option has the advantage to decrease inappropriateness without restricting access to EDs.

Further developments

In this thesis, we studied the role served by EDs within the French health system through the implementation of micro-econometrics' analyses. We have shown that EDs are the recipient of both urgent conditions, and conditions that should be treated by out-patient care services. We found that the latter conditions represent 46% of ED visits in France. Since EDs are a go-between out-patient care and hospital care, they are among the first to be affected by the failures of the health care system. This thesis explored the influences of hospitals' incentives, patient's characteristics, out-patient care management and direct payments on the utilization of EDs. We found that sizeable efficiency gains can be obtained by improving the provision of out-patient care. Providing alternatives to emergency care during the night and on weekends has the advantage to decrease inappropriate ED visits without restricting access to care.

Still, there are many questions raised by EDs which are not addressed in this thesis. As economists, we studied the consequences of an overuse of EDs with respect to the efficiency of public health expenditure. In another on going research project, we explore the trade-

²⁹See article 28 of the law for the 2021 budget of the French Social Security, available from https://www.assemblee-nationale.fr/dyn/15/textes/l15b3397_projet-loi. The amount of this fee should be €18 (source: <https://www.service-public.fr/particuliers/actualites/A14542>).

off that exists between two objectives for a regulator: the efficiency of public expenditure and the health outcomes of patients. In fact, there are many public interventions that can be implemented to minimize inappropriate ED visits: copayments, gatekeeping, triage, among others. These measures are effective in improving efficiency. However, many of them might be associated with a decrease in access to care, medical errors, and so health outcomes. Therefore, further research is needed to assess the effectiveness of these interventions from both perspectives: the efficiency of public expenditure and the health of patients.

We explored the causes of the observed increase in ED visits, with a particular attention devoted to inappropriate visits. One of the consequences of this increase is the overcrowding of EDs. Further research should address this question with respect to the productive efficiency of EDs. Does congestion mainly occurs in inefficient EDs ? Is it influenced by the productivity of physicians ? Other determinants than an excess of demand for emergency care should be envisaged to explain congestion.

Another outcome that has received little attention in the literature on EDs is the quality of care. Future research should investigate the impact of inappropriate ED visits on the quality of care delivered at the ED. An important question to address is whether a higher proportion of inappropriate ED use is associated with a lower quality of care. Because the challenge of many health systems that are overwhelmed by the increase in ED visits is to reduce inappropriate visits without decreasing the quality of care provided to patients.

New research opportunities will be offered by the production of a second wave of the "Enquête Urgence" in France in 2023 [3]. This second wave of the survey will take place 10 years after the first wave. The first wave of the survey recorded information on both patients and EDs characteristics for 99.7% of EDs and 93.6% of patients [1]. This second survey will provide a pseudo-panel that will give the opportunity to study the evolution of the emergency care activity in France. In particular, it will be of interest to study the changes in the inappropriate utilization of EDs, and the determinants of these changes. Also, new research opportunities could be supported by the collection of additional information in the second survey. For instance, recording a unique ID for each emergency physician would make it possible to investigate the heterogeneity of medical decisions, and possible personal bias in the assessment of appropriateness according to physicians' characteristics.

Overall, the challenges raised by the increase in ED visits have still received limited attention in France. We have compiled a non-exhaustive list of the many research questions that should be addressed by economists to increase the knowledge on the role served by EDs. There are not many comprehensive databases on EDs and EDs' users in France. It

GENERAL CONCLUSION

is therefore unfortunate that some existing databases, like the *Résumé de Passage aux Urgences* (RPU) database, are still underused. Research opportunities should be supported by the use of all available information.

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RÉSUMÉ

L'objet de cette thèse est d'étudier la place occupée par les services d'urgence au sein du système de soins Français. En France, les urgences ont toujours été à l'interface entre les soins de ville et les soins hospitaliers. Depuis plusieurs décennies, la plupart des pays de l'OCDE subissent une forte augmentation des recours aux urgences, dont une proportion croissante se trouve être pour des raisons dites inappropriées. Ces recours nuisent à l'efficacité des systèmes de santé. Nous nous proposons d'étudier les déterminants de cette augmentation des recours aux urgences, au moyen d'analyses micro-économétriques. Dans le chapitre premier, nous montrons que l'ouverture d'un service d'urgence entraîne une augmentation du revenu par hospitalisation pour l'hôpital. Ce résultat suggère qu'une partie de l'ouverture des services d'urgence pourrait être expliquée par des incitations financières du côté des offreurs de soins. Le second chapitre propose d'estimer les contributions respectives des caractéristiques des patients et de l'organisation du système de soins dans les recours aux urgences pour raisons inappropriées. Nos résultats issus d'une estimation par variables instrumentales indiquent que des gains d'efficacité substantiels peuvent être obtenus par la mise en place de politiques visant à améliorer l'offre de soins de ville. Le dernier chapitre examine la présence de contraintes de liquidité pour l'accès aux soins de ville, et l'utilisation des urgences en substitution aux consultations médicales pour éviter les paiements directs. Nos résultats indiquent que les contraintes de liquidité n'incitent pas à préférer les urgences à la médecine de ville.

MOTS CLÉS

Services d'urgence, Hôpital, Recours non-pertinents, Efficacité, Paiement direct, Micro-économétrie.

ABSTRACT

This thesis analyzes the role served by Emergency Departments (EDs) within the French health system. In France, EDs have traditionally served as gateways between out-patient care and hospital care. Over the past few decades, most OECD countries have experienced a sharp increase in ED visits. In particular, the increase in the use of EDs for inappropriate reasons threatens the efficiency of health systems. We propose to study the determinants of the rise in ED visits using micro-econometrics analyses. The main finding of the first chapter is that the opening of an ED increases the hospital's revenue per admission. This result suggests that the rise in ED openings might, to some extent, be influenced by supply-side incentives. In the second chapter, we estimate the respective contributions of patients' characteristics and the characteristics of the health care system to the inappropriateness of ED visits. Using an instrumental variable estimation, we find that policies aiming at improving the organization of primary care supply can achieve substantial efficiency gains. The last chapter tests for the presence of liquidity constraints in France, and for the use of EDs in substitution to care consultations to avoid direct payments. We find that liquidity constraints has no impact on the inappropriate use of EDs.

KEYWORDS

Emergency Departments, Hospital, Inappropriate visits, Efficiency, Direct payments, Micro-econometrics