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# ABSTRACT

## Evaluating the Effect of Ownership Status on Hospital Quality: The Key Role of Innovative Procedures[*]

Mortality differences between university, non-teaching public and for-profit hospitals are investigated using a French exhaustive administrative dataset on patients admitted for heart attack. Our results show that innovative procedures play a key role in explaining the effect of ownership status on hospital quality. When age, sex, diagnoses and co-morbidities are held constant, the mortality rates in for-profit and university hospitals are similar, but they are lower than in public non-teaching hospitals. When additionally controlling for innovative procedures, the mortality rate is higher in for-profit hospitals than in the two groups of public hospitals. This suggests that the quality of care in for-profit hospitals relies on innovative procedures and that, after controlling for case-mix and innovative treatments, there is a better quality of care in public hospitals.

JEL Classification: I12, I18

Keywords: hospital performance, innovative procedures, stratified duration model, hospital quality

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# I. Introduction

In many countries, there is debate among politicians and scholars about the extent to which hospital ownership status influences hospital performance. An extensive literature has developed in the US to compare the performances of for-profit and not-for-profit hospitals (Sloan, 2000; Kessler and McClellan, 2001). In parallel, other research has focused on the diffusion of new efficient technologies which have spread since the 1990s and improved hospital outcomes (Cutler and McClellan, 1996; Heidenreich and McClellan, 2001; Ho, 2002; Bradley et al., 2005; Skinner and Staiger, 2009). The contribution of our paper is to show the important role of innovative procedures in explaining the effect of ownership status on hospital quality. European countries usually have a mix of public hospitals which have to treat all patients, and of for-profit hospitals which select their patients. Public hospitals have a limited global budget provided by the government and the total cost of disposable medical supplies is charged to this budget. Because of research and teaching activities, university hospitals have a larger budget than non-teaching public hospitals, so they can perform more innovative procedures. By contrast, for-profit hospitals are most often considered to be profit-maximizing entities and each unit of disposable medical supply used for a procedure is fully reimbursed. In France, for-profit hospitals have no research or teaching activities.

In this paper, we study the in-hospital mortality differences between public and for-profit hospitals in France for patients admitted for a heart attack.[1] In contrast with other studies, we distinguish university hospitals from non-teaching public hospitals as they exhibit different health practices. We assess to what extent mortality differences can be explained by differences in case-mix and use of innovative procedures. Our empirical strategy relies on the estimation of a very flexible duration model with hospital-specific baseline hazards on a French exhaustive administrative dataset.

The literature is plagued by two types of selection issues. First, the type of insurance can vary across patients, as is the case in the US. A selection effect occurs if patients with better insurance coverage are admitted to a specific type of hospital. To overcome this problem, one can focus on patients with the same insurance (McClellan and Staiger, 2000), or study countries where there is universal coverage such as Taiwan (Lien, Chou and Liu, 2008). In France, there is universal

[1] In France, there are also not-for-profit hospitals funded as public hospitals but run as private ones. They treat only 4.8% of heart attack patients and are excluded from our analysis. Their inclusion does not change the results.

coverage as a single payer reimburses costs at a flat rate to all patients.

A selection bias also appears when patients with the lowest chances of survival due to co-morbidities and secondary diagnoses tend to be admitted to or transferred from a specific type of hospital. In France, for-profit hospitals may refuse the sickest patients to maximize their profit (as in-hospital deaths are costly and a hospital's reputation depends on its success statistics), whereas public hospitals have to provide them with care. Non-teaching public hospitals may transfer the sickest patients because they do not have the equipment needed to treat them. We limit this bias in our study by controlling for a wide range of secondary diagnoses. McClellan and Staiger (1999) show that much more detailed medical data on disease severity and comorbidity do not add much when taking into account heterogeneity among patients.

Our results show that when age, sex, diagnoses and co-morbidities are held constant, the mortality rates in for-profit and university hospitals are similar, but they are lower than in public non-teaching hospitals. When additionally controlling for innovative procedures, the mortality rate is higher in for-profit hospitals than in the two groups of public hospitals. This suggests that the quality of care in for-profit hospitals relies on innovative procedures and that, after controlling for case-mix and innovative treatments, there is a better quality of care in public hospitals.

The structure of the paper is as follows. Section 2 presents our exhaustive administrative dataset on patients' stays. Section 3 develops the empirical strategy used to compute the probability of death by ownership status, net of case-mix and innovative procedures. Section 4 presents the results and Section 5 concludes.

# II. Data

We use the exhaustive data on stays in French hospitals provided by the "Programme de Médicalisation des Systèmes d'Information" over the 1998-2003 period. We select patients aged over 35 admitted to a university hospital, a non-teaching public hospital or a for-profit hospital for heart attack (acute myocardial infarction, AMI).

We know the duration of stay and the type of entry: whether patients come from home, or were transferred from another service or hospital. As we do not have any details on previous hospitalization for transferred patients, we focus on patients coming from home. We end up with a sample of 325,760 patients in 1,020 hospitals, among whom 21.0% are in for-profit hospitals, 28.5% are in university hospitals and 50.6% are in other public hospitals. We also know the type of exit: death (8%), home return (59%), transfer to another service (2%), to another acute care hospital (24%) or to another type of hospital (7%). As we cannot follow patients when they are discharged, we study patients during their stay within the hospital. We focus on exits to death and treat all other exits as right-censored.

We have information on the age and sex of patients, as well as detailed information on comorbidities (i.e. pre-existing conditions), secondary diagnoses and treatment procedures. Detailed comorbidities and diagnoses are related to the way of life (smoking, alcoholism, obesity, hypertension), chronic health problems (diabetes, conduction diseases, history of coronary disease), disease complications (renal failure, heart failure), and location of heart attack (anterior, posterior, sub-endocardial, other).

Treatments include bypass surgery, which is a traditional procedure, and catheter, angioplasty and stent, which are more recent. All these procedures are intended to unblock the clogged section of a vein or an artery which caused the heart attack. A bypass surgery reroute involves grafting a vein or artery taken from elsewhere in the body to bypass the blockage. A catheter is a thin tube inserted into a vein to facilitate injections and drips. Angioplasty consists in inflating a balloon catheter to crush a blockage and open up the blood vessel for improved flow. The stent is a spring-shaped prosthesis used as a complement to angioplasty to keep the artery dilated. This was the most innovative procedure in use during our period of study and its use has increased over time.

For each hospital, we compute the Kaplan-Meier estimator for exit to death while other types of exits are treated as censored. The probability of death is constructed for each hospital as one minus the Kaplan-Meier estimator. It is then averaged by ownership status, weighted by the number of patients admitted to the hospital. Figure 1 shows the probability of death as a function of the duration (in days) by ownership status. This probability is similar for for-profit and university hospitals, but is significantly higher for non-teaching public hospitals. For instance, the probability of death after 5 days is 4.2% for for-profit hospitals, 4.3% for university hospitals and 6.6% for other public hospitals, as shown in Appendix Table A.1.

Table 1 presents descriptive statistics by ownership status on exits, demographic characteristics (full interactions between sex and age brackets), comorbidities, secondary diagnoses and procedures. In particular, transfer rates are very similar for for-profit and university hospitals. Other public hospitals have a higher rate of transfers to other acute care hospitals, probably because they are less able to treat patients needing surgery.

For-profit and university hospitals both treat a smaller proportion of patients aged above age 80 than other public hospitals. They use more than twice as many catheters as other public hospitals (70% vs. 28%). Treatments with stents are more than three times more frequent (40% and 36% vs. 11%).

We now propose an approach to assess whether the differences in in-hospital mortality between for-profit, university and non-teaching public hospitals can be explained by differences in patients' characteristics and treatment procedures.

# III. Empirical strategy

We now present the econometric approach used to compute the probability of death net of the effects of case-mix and innovative procedures by ownership status.

Let $i$ index the patient and $j(i)$ the hospital where patient $i$ is admitted. We focus on the latent duration before death, the other exits being treated as censored. We consider that this latent duration follows a Cox model stratified by hospital. The hazard rate is given by:

$$\lambda\left(t \middle| X_i, j(i)\right) = \lambda_{j(i)}(t)\exp\left(X_i\beta\right)$$

where $X_i$ includes the patient's characteristics (age, sex, comorbidities and secondary diagnoses) and the procedures. The vector of coefficients $\beta$ captures their effect on mortality. $\lambda_j(t)$ is the hazard rate specific to hospital $j$ which is left completely unspecified, allowing for considerable flexibility in the way hospitals may differ, in particular because of their ownership status.

The parameters of the patients' variables are estimated by Stratified Partial Likelihood (Ridder and Tunali, 1999; Gobillon, Magnac and Selod, 2011). For every hospital $j$, an estimator $\hat{\Lambda}_j(t)$ of the integrated hazard $\Lambda_j(t) = \int_0^t \lambda_j(t)dt$ and its covariance matrix can be recovered in a second stage using the estimator proposed by Breslow (1974). The probability of death after a duration $t$ is given by: $\exp\left(-\hat{\Lambda}_j(t)\right)$, its covariance matrix being recovered using the delta method.

For each duration, we average the probability of death across hospitals by ownership status (for-profit, university or other public), weighting the hospitals by the number of admitted patients. We compare the probability of death for for-profit, university and other public hospitals when introducing different sets of patients' variables (individual characteristics and/or treatment procedures). This approach allows us to compare the probabilities of death net of the effects of case-mix and innovative procedures between the three types of hospitals across durations.

# IV. Results

Table 2 reports the estimated coefficients of patients' variables for three specifications. In column (1), only variables related to age, sex, comorbidities and secondary diagnoses are introduced. As usually reported in the literature, older people and females are more likely to die. The propensity to die decreases from 1999 onwards, maybe because care and knowledge about treatments improve.[2] Comorbidities and secondary diagnoses have a negative or positive effect on in-hospital mortality. The negative effect is a little surprising, but patients with detected pathologies may be better monitored and thus better treated than other patients. Finally, the location of infarctus given by secondary diagnoses is an important determinant of the propensity to die.

In column (2), we add a dummy for catheter (possibly used jointly with an angioplasty or a stent) which is intended to capture a specific treatment but may also pick up some unobserved heterogenity.[3] It has the expected negative effect on mortality. Finally, in column (3), we replace the dummy for catheter by dummies for detailed procedures (catheter only, angioplasty with catheter, stent with angioplasty and catheter). All the procedures have the expected negative effect on mortality. Note that the estimated coefficient of stent is lower in absolute terms than the estimated coefficient of catheter, whereas patients treated with a stent also have a catheter and their care is more costly for the hospital. In fact, surgeons treating patients first use a catheter, and then add stents if they consider them necessary because the patient is at risk because of severely damaged arteries or veins.

We now investigate the differences in probability of death between for-profit, university and

[2] Note that, surprisingly, the propensity to die is lowest in 1998. This may be due to coding errors, as 1998 is the first year for which exhaustive data are available. We assessed the robustness of the results excluding 1998 data and the results remain very similar.

[3] We also added a dummy for by-pass surgery, but its introduction is innocuous for the analysis since only 0.9% of patients in our sample are treated with by-pass surgery. We could check that the introduction of this dummy does not affect our results.

other public hospitals when controlling for the different subsets of individual variables. Figure 2 represents the probability of death as a function of duration by type of hospital when controlling only for age, sex, comorbidities and secondary diagnoses in the first stage.[4] The probabilities of death in the different types of hospitals are much closer than those obtained on raw data (which are reported on Figure 1). During the first ten days, the period during which innovative procedures are performed, the probabilities of death in for-profit and university hospitals are lower than the probability of death in non-teaching public hospitals. University and for-profit hospitals have similar probabilities of death. After ten days, the probability of death in university hospitals is lower than in for-profit hospitals.[5]

Figure 3 represents the probabilities of death obtained from the model when adding a dummy for catheter (possibly used jointly with an angioplasty or a stent). The probabilities of death are those of patients not receiving any innovative procedure. Non-teaching public hospitals now have the lowest mortality rates. This change can be explained by the more intensive use of catheters in university and for-profit hospitals and by the fact that the negative effect of catheters on mortality is now netted out. Interestingly, there is now a large gap between for-profit and university hospitals even though their catheter use is similar. This may be because we now take into account the fact that for-profit hospitals perform innovative procedures on older patients who would not be eligible for such procedures in university hospitals, and the propensity to die when treated differs across age groups. In particular, the catheter rate between the two types of hospital differs above age 80, and is as high as 12.3% for females above 90 years old in for-profit hospitals, versus only 4.9% in university hospitals (see Table A.2).[6] When introducing interactions of age×sex dummies with a catheter dummy, we also find that females aged above 80 treated with a catheter have a higher mortality than females aged 35-60 treated with a catheter (the difference

[4] The level of probabilities cannot be directly compared between Figure 1 and Figures 2-4. Figure 1 represents the average probability of death by ownership status. By contrast, Figures 2-4 represent the probability of death for the reference category of the model by ownership status. Nevertheless, it is still meaningful to compare the differences in probability of death between university, non-teaching public and for-profit hospitals across figures.

[5] Mortality in for-profit hospitals seems to catch up with that in non-teaching public hospitals after fourteen days. However, this result should be considered with caution as changes in probabilities of death after ten days are computed with a limited number of patients (since most patients have been discharged) and selection biases may increase. In particular, after 14 days, only 14.5% of patients remain in our sample.

[6] The differences in reimbursement rules between the private and public sectors explain this difference. For-profit hospitals have incentives to perform innovative procedures on older people because they are reimbursed on a fee-for-services basis, whereas university hospitals have a global budget system that limits spending on innovative procedures, and they may avoid treating older people because their survival rate is lower.

being significant at 10%).[7]

Our results are confirmed by Figure 4, which represents the probabilities of death obtained when replacing the catheter by some dummies for detailed procedures. We see that the curves remain unchanged. Overall, our results suggest that the quality of care in for-profit hospitals mostly relies on innovative procedures. When neutralizing the effects of case-mix and innovative treatments on mortality, it is found that the quality of care is higher in public hospitals than in for-profit hospitals.

# V. Conclusion

Mortality differences between university, non-teaching public and for-profit hospitals are investigated using a French exhaustive administrative dataset on patients admitted for heart attack. Our results show that innovative procedures are a key factor in explaining the high quality of care in for-profit hospitals. Moreover, when holding constant the use of innovative procedures and case-mix, the quality of care is higher in public hospitals than in for-profit hospitals.

It is possible to draw a comparison with clinical trials showing that aspirin, beta blockers and reperfusion explain the substantial difference of 3.9 points in one-year survival between the highest and lowest quintiles of US hospitals ranked according to their rate of innovation diffusion across time (Skinner and Staiger, 2009). Here, catheters have an impact of 4.5 points on the mortality difference between for-profit and non-teaching public hospitals, which is also large.

We have shown the important role of innovative procedures when studying hospital quality by ownership status. With the implementation of the French hospital payment reforms (T2A) in 2004-2008, financial incentives in public and for-profit hospitals have changed. Public hospitals are not in a global budget system anymore but are now paid a fee by diagnosis-related group (DRG). For-profit hospitals have also adopted this system, although their fee by DRG is different (it can be higher or lower depending on the DRG). An interesting extension of our work could be to assess how these changes in the hospital payment system affect the quality of care by ownership status.

[7] The corresponding regression is available from the authors upon request.

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Table 1: Descriptive statistics

| | For-profit | University | Other public | All |
|---|---|---|---|---|
| **Type of exit** | | | | |
| Death | 0.060 | 0.064 | 0.097 | 0.080 |
| Home | 0.699 | 0.697 | 0.481 | 0.588 |
| Transfer to another service | 0.005 | 0.013 | 0.029 | 0.019 |
| Transfer to another acute care hospital | 0.149 | 0.140 | 0.335 | 0.241 |
| Transfer to another type of hospital | 0.087 | 0.086 | 0.058 | 0.072 |
| **Demographic characteristics** | | | | |
| Female, age 35-60 | 0.035 | 0.041 | 0.031 | 0.035 |
| Female, age 60-70 | 0.046 | 0.045 | 0.043 | 0.044 |
| Female, age 70-80 | 0.100 | 0.088 | 0.108 | 0.101 |
| Female, age 81+ | 0.102 | 0.106 | 0.171 | 0.138 |
| Male, age 35-60 | 0.268 | 0.311 | 0.219 | 0.256 |
| Male, age 60-70 | 0.174 | 0.169 | 0.141 | 0.156 |
| Male, age 70-80 | 0.189 | 0.162 | 0.175 | 0.174 |
| Male, age 81+ | 0.087 | 0.076 | 0.111 | 0.096 |
| **Secondary diagnoses and comorbidities** | | | | |
| Alcohol problems | 0.011 | 0.009 | 0.013 | 0.012 |
| Diabetes | 0.169 | 0.144 | 0.152 | 0.153 |
| Obesity | 0.082 | 0.065 | 0.052 | 0.062 |
| Renal failure | 0.046 | 0.046 | 0.052 | 0.049 |
| Excessive smoking | 0.144 | 0.143 | 0.098 | 0.120 |
| Hypertension | 0.356 | 0.277 | 0.284 | 0.297 |
| Surgical French DRGs (GHMC) | 0.046 | 0.062 | 0.018 | 0.036 |
| Vascular disease | 0.068 | 0.030 | 0.040 | 0.043 |
| Peripheral arterial disease | 0.076 | 0.052 | 0.060 | 0.061 |
| Stroke | 0.033 | 0.025 | 0.033 | 0.031 |
| History of coronary artery disease | 0.058 | 0.030 | 0.037 | 0.039 |
| Heart failure | 0.130 | 0.129 | 0.183 | 0.156 |
| Conduction disease | 0.203 | 0.156 | 0.214 | 0.195 |
| Severity index (IGS) | 0.270 | 0.228 | 0.305 | 0.276 |
| Location unknown or not reported | 0.321 | 0.253 | 0.283 | 0.282 |
| Anterior location | 0.325 | 0.269 | 0.278 | 0.285 |
| Posterior location | 0.113 | 0.092 | 0.117 | 0.109 |
| Sub-endocardial | 0.103 | 0.064 | 0.088 | 0.085 |
| Other location | 0.138 | 0.322 | 0.233 | 0.239 |
| **Treatments** | | | | |
| CABG or Coronary Bypass surgery | 0.015 | 0.020 | 0.000 | 0.009 |
| Catheter (possibly with angioplasty/stent) | 0.704 | 0.698 | 0.278 | 0.487 |
| Catheter alone | 0.238 | 0.231 | 0.146 | 0.190 |
| Catheter with dilatation | 0.061 | 0.112 | 0.022 | 0.056 |
| Catheter with dilatation and stent | 0.405 | 0.355 | 0.109 | 0.241 |

Note: another service refers to a service which is not ischemic, patients being treated there for a pathology different from their AMI.

Table 2: Cox model stratified by hospital, propensity to die

| Explanatory variables | Age, sex, diagnoses | Age, sex, diagnoses, catheter | Age, sex, diagnoses, and all procedures |
|---|---|---|---|
| Year 1998 | < ref > | < ref > | < ref > |
| Year 1999 | 0.163*** | 0.191*** | 0.190*** |
| | (0.027) | (0.027) | (0.027) |
| Year 2000 | 0.131*** | 0.180*** | 0.181*** |
| | (0.027) | (0.027) | (0.027) |
| Year 2001 | 0.136*** | 0.203*** | 0.203*** |
| | (0.027) | (0.027) | (0.027) |
| Year 2002 | 0.111*** | 0.179*** | 0.179*** |
| | (0.027) | (0.027) | (0.027) |
| Year 2003 | 0.106*** | 0.172*** | 0.172*** |
| | (0.028) | (0.028) | (0.028) |
| Female, age 35-60 | < ref > | < ref > | < ref > |
| Female, age 60-70 | 0.665*** | 0.600*** | 0.602*** |
| | (0.081) | (0.081) | (0.082) |
| Female, age 70-80 | 1.190*** | 1.019*** | 1.020*** |
| | (0.073) | (0.073) | (0.073) |
| Female, age 81+ | 1.837*** | 1.471*** | 1.471*** |
| | (0.072) | (0.072) | (0.072) |
| Male, age 35-60 | -0.457*** | -0.429*** | -0.439*** |
| | (0.078) | (0.078) | (0.078) |
| Male, age 60-70 | 0.384*** | 0.357*** | 0.354*** |
| | (0.075) | (0.075) | (0.075) |
| Male, age 70-80 | 1.016*** | 0.893*** | 0.894*** |
| | (0.072) | (0.072) | (0.072) |
| Male, age 81+ | 1.665*** | 1.341*** | 1.341*** |
| | (0.072) | (0.072) | (0.072) |
| Alcohol problems | 0.443*** | 0.342*** | 0.343*** |
| | (0.066) | (0.067) | (0.066) |
| Diabetes | -0.048*** | -0.061*** | -0.060*** |
| | (0.018) | (0.018) | (0.018) |
| Obesity | -0.285*** | -0.231*** | -0.232*** |
| | (0.042) | (0.042) | (0.042) |
| Renal failure | 0.411*** | 0.354*** | 0.353*** |
| | (0.019) | (0.019) | (0.019) |
| Excessive smoking | -0.543*** | -0.470*** | -0.473*** |
| | (0.042) | (0.042) | (0.042) |
| Hypertension | -0.596*** | -0.573*** | -0.571*** |
| | (0.016) | (0.016) | (0.016) |
| Surgical French DRGs (GHMC) | -0.045 | 0.254*** | 0.234*** |
| | (0.034) | (0.036) | (0.036) |
| Vascular disease | -0.414*** | -0.410*** | -0.409*** |
| | (0.030) | (0.030) | (0.030) |
| Peripheral arterial disease | -0.010 | -0.025 | -0.021 |
| | (0.025) | (0.025) | (0.025) |
| Stroke | 0.352*** | 0.292*** | 0.293*** |
| | (0.025) | (0.025) | (0.025) |
| History of coronary artery disease | -0.219*** | -0.237*** | -0.235*** |
| | (0.030) | (0.030) | (0.030) |
| Heart failure | 0.096*** | 0.052*** | 0.053*** |
| | (0.014) | (0.014) | (0.014) |
| Conduction disease | 0.903*** | 0.871*** | 0.869*** |
| | (0.013) | (0.013) | (0.013) |
| Severity index (IGS) | 0.186*** | 0.203*** | 0.202*** |
| | (0.021) | (0.021) | (0.021) |
| Location unknown or not reported | < ref > | < ref > | < ref > |
| Anterior location | -0.295*** | -0.205*** | -0.210*** |
| | (0.017) | (0.017) | (0.017) |
| Posterior location | -0.565*** | -0.465*** | -0.472*** |
| | (0.020) | (0.020) | (0.020) |
| Sub-endocardial | -1.028*** | -0.979*** | -0.978*** |
| | (0.028) | (0.028) | (0.028) |
| Other location | -0.530*** | -0.456*** | -0.459*** |
| | (0.027) | (0.027) | (0.027) |
| CABG or Coronary Bypass surgery | | -0.966*** | |
| | | (0.090) | |
| Catheter | | -1.091*** | -0.900*** |
| (possibly with dilatation or stent) | | (0.021) | (0.091) |
| Catheter alone | | | -1.291*** |
| | | | (0.031) |
| Catheter with dilatation | | | -0.682*** |
| | | | (0.040) |
| Catheter with dilatation and stent | | | -1.057*** |
| | | | (0.028) |
| Number of observations | 325,760 | 325,760 | 325,760 |
| Number of deaths | 25,964 | 25,964 | 25,964 |



Note: ***: significant at 1% level; **: significant at 5% level; *: significant at 10% level.

Figure 1: Probability of death as a function of duration (in days), Kaplan-Meier

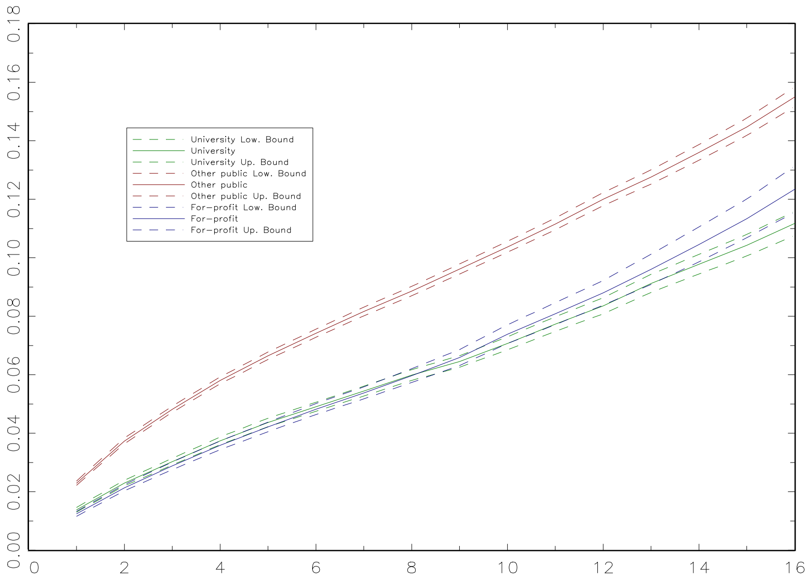


Figure 2: Probability of death as a function of duration (in days), model: age×sex, secondary diagnoses and comorbidities

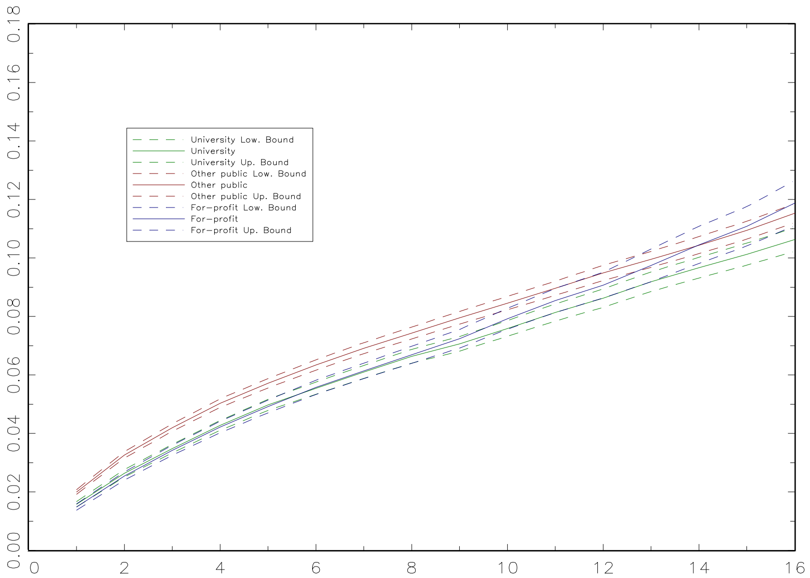

Figure 3: Probability of death as a function of duration (in days), model: age×sex, secondary diagnoses, comorbidities and catheter

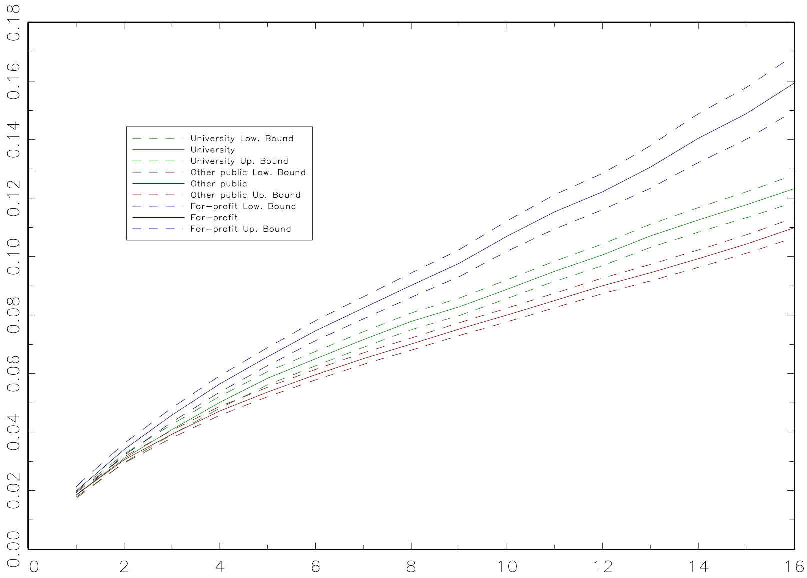


Figure 4: Probability of death as a function of duration (in days), model: age×sex, secondary diagnoses, comorbidities and procedures

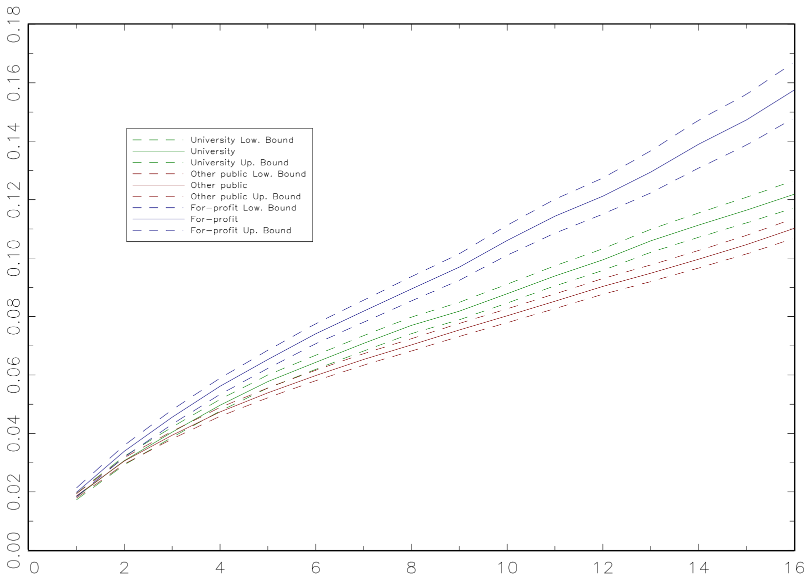

Table A.1: Probability of death by model and ownership status

| | Kaplan-Meier | | | Model: age, sex, diagnoses and comorbidities | | | Model: age, sex, diagnoses, comorbidities and catheter | | | Model: age, sex, diagnoses, comorbidities and procedures | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | For-profit | University | Other public | For-profit | University | Other public | For-profit | University | Other public | For-profit | University | Other public |
| 1 day | .012 | .014 | .023 | .015 | .016 | .020 | .020 | .019 | .019 | .020 | .018 | .019 |
| | [.012,.013] | [.013,.015] | [.022,.024] | [.014,.016] | [.015,.017] | [.019,.021] | [.018,.021] | [.017,.020] | [.018,.019] | [.018,.021] | [.017,.019] | [.018,.019] |
| 3 days | .029 | .030 | .048 | .034 | .035 | .042 | .046 | .041 | .039 | .046 | .040 | .039 |
| | [.028,.030] | [.029,.031] | [.047,.049] | [.033,.036] | [.033,.036] | [.041,.043] | [.043,.048] | [.039,.043] | [.038,.041] | [.043,.048] | [.039,.042] | [.038,.041] |
| 5 days | .042 | .043 | .066 | .049 | .050 | .057 | .066 | .058 | .054 | .065 | .058 | .054 |
| | [.041,.044] | [.042,.045] | [.065,.068] | [.047,.051] | [.048,.052] | [.056,.059] | [.063,.069] | [.056,.061] | [.052,.055] | [.062,.068] | [.056,.060] | [.052,.056] |
| 10 days | .074 | .071 | .104 | .079 | .076 | .085 | .107 | .089 | .080 | .106 | .088 | .080 |
| | [.071,.077] | [.068,.073] | [.102,.106] | [.076,.083] | [.073,.079] | [.082,.087] | [.102,.112] | [.086,.092] | [.078,.082] | [.101,.0111] | [.085,.091] | [.078,.083] |
| 15 days | .113 | .104 | .145 | .111 | .101 | .109 | .149 | .118 | .104 | .147 | .116 | .105 |
| | [.107,.120] | [.101,.108] | [.142,.148] | [.104,.118] | [.097,.105] | [.106,.113] | [.140,.158] | [.113,.122] | [.101,.107] | [.139,.156] | [.112,.121] | [.101,.108] |

Note: For a given duration, the point estimate is reported on the first row and the confidence interval is reported in brackets on the second row.

Table A.2: Proportion of catheters, by age×sex category and ownership status

| Patient category | Private | University | Other public |
|---|---|---|---|
| Female, age 35-60 | 0.835 | 0.835 | 0.433 |
| Female, age 60-70 | 0.768 | 0.790 | 0.337 |
| Female, age 70-80 | 0.668 | 0.677 | 0.243 |
| Female, age 80-85 | 0.516 | 0.396 | 0.119 |
| Female, age 85-90 | 0.286 | 0.163 | 0.041 |
| Female, age 91+ | 0.123 | 0.049 | 0.014 |
| Male, age 35-60 | 0.843 | 0.853 | 0.458 |
| Male, age 60-70 | 0.787 | 0.808 | 0.377 |
| Male, age 70-80 | 0.715 | 0.716 | 0.275 |
| Male, age 80-85 | 0.555 | 0.487 | 0.149 |
| Male, age 85-90 | 0.342 | 0.226 | 0.062 |
| Male, age 91+ | 0.203 | 0.090 | 0.033 |