ECONOMIC IMPACT OF ICU-ACQUIRED MULTI-DRUG RESISTANT BACTERIAL INFECTIONS: *EVIDENCE FROM SOUTHERN EUROPE*

Miquel Serra-Burriel, PhD‡
‡Centre for Research in Health and Economics (CRES), Pompeu Fabra University (UPF), Barcelona, Spain.

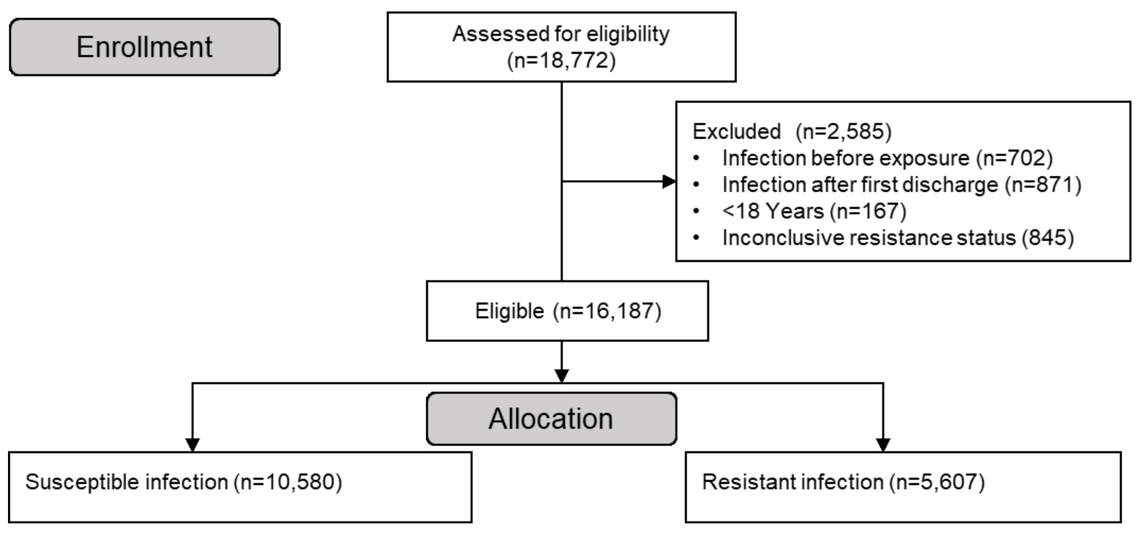
Background

Multi-drug resistant (MDR) bacterial infections in intensive care units (ICU) have been associated with substantial morbidity and economic cost. Southern Europe has had historically high levels of antimicrobial resistance. The present study estimated the attributable burden of MDR ICU-acquired bacterial infections on hospital length of stay (LOS) and direct costs in a sample of ICUs in southern European countries.

Methods

We used a subset of ICU hospital-acquired infection (HAI) data from the European Surveillance System (TESSy) from Spain, Italy, and, Portugal to examine the impact of HAI MDR on LOS. The data covered from 2008 to 2017 within 378 voluntary participant hospitals. We used an instrumental variable (IV) approach to remove the effect of selection bias by exploiting the variation in resistance evolution across type of microorganism unrelated to the patient trajectory or characteristics. Estimates were censored for mortality to avoid competing risks bias.

Figure 1. *Study Flowchart*



Results

The study included 16,187 ICU-admitted patients developing an ICU-acquired bacterial (mean age 61.39; 33.23% female; 61.90% in Spain, 22.57% Italy, and, 15.53% Portugal). 5,607 (34.64%) of the primary infections were MDR. Multivariate estimates yield an adjusted average difference in LOS of 0.98 days 95%CI (0.40 to 1.56; p<0.001; 4.43% increase). While IV estimates reveal an increase in LOS of 4.19 days 95%CI (2.14 to 6.24; p<0.001; 18.97% increase). The estimated increase would translate into an excess direct cost of 4,401€ per MDR infection (2018) in Spain, 5,571€ in Italy, and, 3,616€ in Portugal.

Figure 2. *MDR temporal evolution (GAM smoothing)*

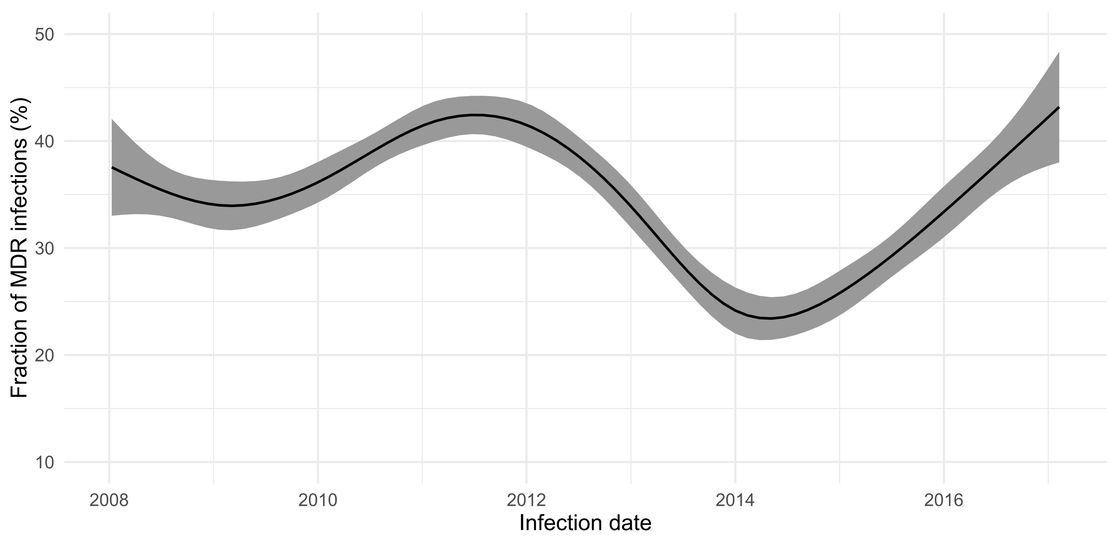


Figure 3. *LOS temporal evolution (GAM smoothing)*

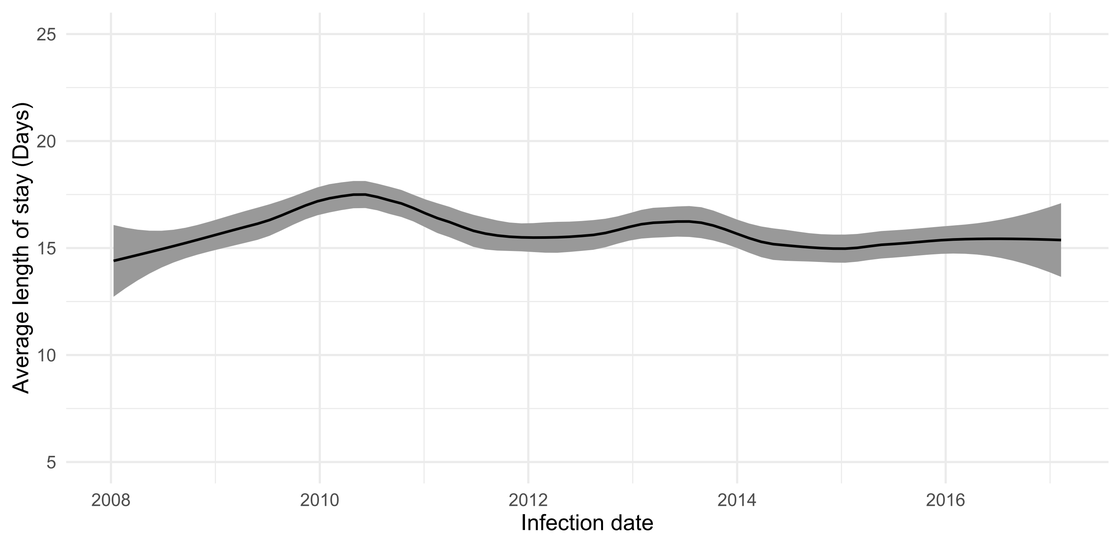


Table 1. *OLS vs. IV estimates*

Model	**Estimate (in days)**	95%CI	p-value	Effect size
OLS multivariate	**0.98**	[0.40-1.56]	p<0.001	4.43%
Controls for: time to infection, country fixed-effects, hospital fixed-effects, ICU fixed-effects, Age, Gender, type of exposure and bacteria.				
IV multivariate	**4.19**	[2.14-6.24]	p<0.001	18.97%
F-statistic	52.4			
Wu-hausman	1.2			
Controls for: time to infection, country fixed-effects, hospital fixed-effects, ICU fixed-effects, Age, Gender, type of exposure and bacteria.				

Discussion

The present study provides ECDC real-world evidence on the effects of MDR on bacterial infections in ICU settings. Compared with standard modeling, IV analysis appears to produce less-biased estimates of prolonged length of stay. Significant resource optimization and cost containment are expected from effective strategies reducing resistance in bacterial ICU acquired infections.

Funding: this study was funded with an unrestricted grant by Angelini Sp.A.

upf. Universitat Pompeu Fabra Barcelona

CRES CENTRE FOR RESEARCH IN HEALTH AND ECONOMICS