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Prolonged Hospital Stay, an Adverse Effect of Strict National Policy for Controlling the Spread of Highly Resistant Microorganisms

Healthcare facilities (HCFs) are increasingly plagued by highly drug-resistant organisms (HDROs).[1] These HDROs include carbapenamase-producing Enterobacteriaceae (CPE) and glycopeptide-resistant enterococci (GRE), with low prevalence rates in France.[2,3] French recommendations for the control of HDROs consist of strict contact precautions for colonized patients, screening and contact precautions of contact patients, with neither transfer nor new admissions until 3 negative screening tests.[4] However, this strategy is burdensome and limits use of hospital services. Difficulties in implementing these measures may induce reluctance of downstream HCFs to accept admission of HDRO-positive patients. Our purpose was to describe the length of stay (LOS) and evaluate the delay in transferring patients colonized with HDROs to downstream units.

This study was performed at a 950-bed university hospital. We conducted a matched case-control study from January 2009 to January 2013. Cases were defined as patients colonized or infected with HDRO. Control patients were those not colonized or infected with HDROs. Control patients were those matched with cases on gender, age, first ward and period of hospitalization (same period during the previous or following year), and diagnosis-related groups (DRGs). All possible controls were selected from the DRG system and included. Data were retrospectively collected: comorbidities, type of HDRO, date of positive result, dates of admission and discharge, destination at discharge, origin of the HDRO (either referred to the hospital or acquired in our hospital) and DRG.[5] A hospital-acquired HRDO was defined as an HDRO cultured from screening or clinical samples more than 48 h after admission, and infection was defined according to standard criteria.[6] LOS was calculated by the difference between discharge and admission dates at our hospital. Univariate comparisons used a Wilcoxon rank or χ^2 test. LOS had a right-skewed distribution and was log transformed. Mean LOS of cases and controls was compared using general linear model analysis for matched data in SAS, LSMEANS (SAS Institute).

In total, 190 patients were included, 49 cases and 141 controls (Table 1). Twenty-eight cases were colonized with GRE (25 *van*A, 3 *van*B enzymes), 19 with CPE (16 OXA-48, 2 KPC, 1 NDM-1 enzymes) and 2 with both HDROs. Twenty-four cases (49%) were hospital acquired, 18 with GRE and 6 with CPE; 19 (39%) cases were secondary to an outbreak occurring in our hospital, 15 with GRE and 4 with CPE. Median duration between admission and date of HDRO-positive culture was 11 days (interquartile range [IQR], 6–20). Four cases developed an infection with HDROs. The number of cases increased over time, from 1 in 2008 to 25 in 2012. The median Charlson score was significantly higher in cases than in controls, and the McCabe score was similar (Table 1). Median LOS was 31 (15–72) days in cases and 14 (8–25) days in controls ($P < .01$). Patients were hospitalized primarily in medical units before discharge in cases ($n = 25$, 51%) and controls ($n = 77$, 55%, $P = .79$); 32 cases (68%) and 91 controls (64%) were discharged home ($P = .96$). After adjustment for ward, MDRO colonization status, type of care required for primary diagnosis, and destination at discharge, there was a statistically significant difference in duration of hospitalization between the HDRO group and the HDRO-free group. Log-transformed matched adjusted mean LOS was estimated at 45.1 days in cases and 21.4 days in controls ($P < .001$). Mean excess LOS due to colonization with HDRO was 23.7 days (95% confidence interval [CI], 21.3–26.1).

French national recommendations are effective in controlling the spread of HDROs.[7,8] However, this strict policy may have adverse effects on the care of colonized patients[9] and may cause a delay in transfer to downstream HCFs. Our results suggested that colonization with HDROs was associated with a mean excess LOS of 23.7 days. The national strategy for controlling HDROs is based on strict contact precautions for colonized and contact patients, with implementation of cohorting and dedicated staff in an outbreak situation. This strategy leads to potential adverse clinical and economic effects. Indeed, costs generated by HDRO control include loss of income due to interruption of transfers and admissions and costs of additional staff for cohorting, microbiological tests, and contact precautions.[10] These costs may prevent HCFs from admitting these patients, especially to rehabilitation units or long-term care facilities (LTCFs), where resources may be scarce. In addition, care of HDRO carriers may disrupt care organization, eg, rehabilitation in dedicated areas. Additionally, the perceived risk of transmission may be enhanced by healthcare workers' perceived risk of HDRO acquisition and fear of these "high-risk bugs." The major strength of our study is the statistical method, which addresses group differences in matched patients, therefore minimizing confusion bias due to demographic characteristics, comorbidity, and the hospitalization context and providing an accurate estimation of excess LOS due to HDRO. However, the single-center design limits generalizations, since connections between acute care and rehabilitation or LTCFs are specific to each healthcare network. This also argues for flexible recommendation in units with limited human and budget resources. Additionally, controls were matched to cases for hospital stay during the year before or after the episode, thus controlling for the potential impact of preventive measures

TABLE 1. Description and Crude Comparison of Case Patients and Control Patients

Characteristics	Cases, $n = 49$	Controls, $n = 141$	P
Demographic			
Age, median (IQR)	73 (63–77)	71 (59–80)	.93
Female	22 (45)	60 (43)	.77
Clinical			
Category of disease			
Cardiovascular	11 (22)	27 (19)	1.00
Pulmonary	16 (33)	47 (33)	
Digestive/urinary	3 (2)	12 (8)	
Metabolic	3 (2)	12 (8)	
Infectious	8 (16)	22 (16)	
Other	8 (16)	21 (15)	
Charlson comorbidity score, median (IQR)	6 (4–8)	5 (3–6.5)	.03
McCabe score			
0	17 (35)	45 (34)	.99
1	26 (53)	72 (54)	
2	6 (12)	17 (13)	
Microbiological			
Carriage of MDRO	21 (43)	27 (19)	<.01
ESBLPE	13 (62)	18 (66)	
MRSA	5 (24)	7 (24)	
Other	3 (14)	2 (10)	
Time from admission to HDRO+ result, days, median (IQR)	11 (6–20)	…	…
Time from HDRO+ to hospital discharge, days (IQR)	10 (4–17)	…	…
Hospital stay			
Year of admission to the ward			
2008	1 (2)	1 (1)	<.01
2009	3 (6)	24 (17)	
2010	4 (8)	50 (35)	
2011	15 (31)	35 (25)	
2012	25 (51)	29 (21)	
2013	1 (2)	2 (1)	
Ward at the time of HDRO-positive culture			
ICU	12 (25)	36 (25)	.79
Medical unit	25 (50)	77 (55)	
Surgical unit	12 (25)	28 (20)	
Destination at discharge			
Home	33 (67)	91 (64)	.96
Transfer to acute HCF	3 (6)	8 (6)	
Transfer to rehabilitation unit	9 (18)	31 (22)	
Death	4 (8)	11 (8)	
Duration of hospital stay, median days (IQR)	31 (15–72)	14 (8–25)	<.01
Mean duration of hospital stay, days	62	21	
Number of intrahospital transfers			
0	33 (67)	106 (75)	.03
1	6 (13)	25 (18)	
≥2	10 (20)	10 (7)	

NOTE. Data are no. (%) unless otherwise indicated. ESBLPE, extended-spectrum β-lactamase-producing Enterobacteriacae; HCF, healthcare facility; HDRO, highly drug-resistant organism; ICU, intensive care unit; IQR, interquartile range; MDRO, multidrug-resistant organism; MRSA, methicillin-resistant *Staphylococcus aureus*.

on LOS in control patients. The standard of care may have been different from one year to another.

In conclusion, strict measures for controlling dissemination of HDROs delay transfer of colonized patients to downstream HCFs. The 23.7-day mean excess length of stay likely leads to extra cost and suboptimal care in colonized patients. This adverse effect should be anticipated in hospitals involved in management of HDROs.

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Risk of Human Immunodeficiency Virus and Hepatitis C Virus Infection Related to Endocavitary Ultrasound Probe Exposure in France

The nature of disinfection of endocavitary ultrasound probes depends on recommendations that vary from low-level to high-level disinfection between countries.[1-3] The risk of major viral cross-transmission—namely, human immunodeficiency virus (HIV) and hepatitis C virus (HCV) cross-transmission—related to endocavitary probe exposure is poorly known. Low-level disinfection of probes, with specific probe sheaths, is recommended in France.[3] After reported contamination of probes by human papillomavirus, Epstein-Barr virus, and suspicions regarding HCV, patients and clinicians questioned themselves, and public health authorities called for more evidence on potential risks.[4-6] We investigated whether exposure to endocavitary ultrasound probes was associated with HIV and HCV infections.

We analyzed a cohort of all patients tested for HIV and HCV at Lyon University Hospital (Lyon, France) between 2004 and 2012. Information on endovaginal, transrectal, and transesophageal probe exposures was extracted from electronic healthcare records of inpatients and outpatients. All in-hospital ultrasounds were prospectively encoded in the hospital's database under the French coding system of clinical procedures, the Classification Commune Des Actes Medicaux (CCAM).[7] Information on HIV/HCV serological testing was extracted from the virology database. The main risk factor was exposure to endocavitary ultrasound probes in the 12 months preceding serological testing. Men were excluded from the analysis of endovaginal probe exposure.

In the analysis of prevalent cases, primary end points were HIV/HCV-prevalent seropositivity. HIV/HCV prevalence was also assessed according to probe exposure. Multivariable logistic regressions were adjusted for sex (except for endovaginal probe exposure), age in years (<40, 40–49, 50–59, 60–