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Institutional risk factors for outbreaks of nosocomial gastroenteritis: survival analysis of a cohort of hospital units in South-west England, 2002–2003

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Summary Nosocomial outbreaks of gastroenteritis are a major burden on hospital inpatient services, costing an estimated £115 million annually to the English National Health Service. We actively followed-up 171 inpatient units from four major acute hospitals and 11 community hospitals in South-west England for one year. Outbreaks of gastroenteritis were ascertained through an active surveillance network using standard clinical definitions. Survival analysis Cox regression models using an outbreak of gastroenteritis as the endpoint were fitted to identify institutional and operational attributes related to increased outbreak rates at the level of the care unit. Greater number of beds in unit [hazard ratio (HR) 1.22 (per 10 additional beds), 95% confidence intervals (CI) 0.96–1.55] was associated with increased hazard, as were geriatric (HR 2.6, 95%CI 1.6–4.3) and general medical (HR 1.7, 95%CI 1.1–2.6) care units. The average length of stay on a unit was inversely associated with outbreak incidence [HR = 0.89 (per additional week of stay), 95%CI 0.80–0.99]. Larger care units and those with higher throughput have

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increased rates of gastroenteritis outbreaks. These results should guide infection control policy and support the design of hospitals with smaller care units.

Introduction

Healthcare-associated infections (HCAIs) are recognized to be a major cause of additional morbidity and mortality to hospitalized persons, much of which is preventable. In England, nosocomial infections have been estimated to cost the National Health Service (NHS) nearly £1 billion annually and contribute 3.65 million additional bed-days.[1] The average cost of a microbiologically confirmed nosocomial infection in US hospitals has been estimated to be over $15 000.[2] Even modest sustained decreases in HCAIs would have a major beneficial impact.

Urinary tract, respiratory tract, surgical site, skin and bloodstream infections are currently recognized as the major nosocomial infections.[3] Surveillance for these infections is well developed. However, it is becoming increasingly clear that gastroenteritis outbreaks are also a major burden on the health services of industrialized nations. The main control measures to interrupt transmission in hospitals are to close a unit to new admissions, and to exclude infected staff from duty for 48 h after their last symptoms.[4] We have estimated that in 2002–2003, these measures cost the English NHS approximately £115 million, or 1% of the inpatient services budget.[5] In Sweden, in 1996, it was reported that approximately one in five hospital wards in the Stockholm area had an outbreak of gastroenteritis.[6] Also, broad-based surveillance systems around Europe have documented the scale of gastroenteritis outbreaks in healthcare settings.[7]

Noroviruses are the predominant pathogen detected in such outbreaks.[5,6,8,9] This group of viruses is notoriously difficult to control in hospital settings for a number of reasons. Noroviruses affect all age groups (including both patients and staff) and they have a very small infectious dose. The viruses are spread by a number of routes, including direct and indirect faecal-oral and vomitus-oral transmission.[10] Vomitus-oral transmission may be particularly important in hospital settings. There is frequently no prodrome to norovirus gastroenteritis, and so an infected person may projectile vomit in a hospital setting. The resulting aerosol of virus particles can be swallowed inadvertently or settle and contaminate environments.[11-13]

Hospitalized persons are more vulnerable to infectious diseases than the general population by virtue of their greater age and underlying conditions.[14] Risk of death caused by gastroenteritis is far greater in the elderly than in other age groups.[15] Regardless of age, norovirus gastroenteritis in hospitalized persons is more severe than in other groups.[16]

To date, no studies have been published examining the institutional factors related to outbreaks of gastroenteritis in hospitals. This study analysed the prospective follow-up of functional care units for unit-level risk factors predictive of outbreaks of gastroenteritis. We have previously shown this to be a very high incidence population, with an average incidence of more than one outbreak per unit in the year of follow-up.[5] Noroviruses were detected in 65% of all outbreaks where specimens were available ($N=122$), but 25% of outbreaks were negative for all pathogens, and no specimens were available for another 125 outbreaks. Thus, we analysed all events meeting a clinical definition, regardless of the diagnostic results.

Methods

Population and follow-up

The system of active, prospective outbreak surveillance and null reporting has been described in detail in a prior publication.[5] Briefly, three hospital administrations (NHS trusts), that comprise 90% of inpatient beds in the county of Avon, England, were monitored under active surveillance for outbreaks of gastroenteritis. In total, these three trusts include four major acute hospitals and 11 community hospitals, which comprise 171 inpatient functional care units containing 2900 inpatient beds. The surveillance scheme employed standard clinical definitions of a case and of an outbreak of gastroenteritis, standard data collection forms and the full range of modern diagnostic tests for viral pathogens. Infection control nurses were