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ORIGINAL ARTICLE

Improving the patient journey through a risk assessment approach for ESBL-E

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Abstract

The increase in multidrug resistant organisms (MDRO), including extended-spectrum beta-lactamase producing Enterobacteriaceae (ESBL-E), presents a challenge for infection prevention and control (IPC) teams to find adequate isolation facilities. Not all ESBL-E positive patients may present a risk for ongoing transmission and require isolation. Reducing unnecessary isolation can help with patient flow and reduce adverse events associated with isolation precautions.

The Canterbury District Health Board Infection Prevention and Control (IPC) team aimed to improve the bed management and patient journey for ESBL-E colonised/infected patients through the introduction of a risk-assessment approach for deciding the IPC and isolation requirements for these patients. Hospital policy and procedures were revised to include a process for categorising patients according to their individual risk factors for transmission of ESBL-E. Each category requires a specific set of IPC measures. To facilitate the new policy, a colour assessment tool in the form of a poster was developed as a quick reference for staff.

The new policy and poster were introduced across all hospital sites over several months. Several single rooms a day were freed up which facilitated overall bed management and patient flow. Patients with a low risk of transmission of ESBL-E benefited from a potential better journey of care. Furthermore, IPC surveillance reports did not demonstrate any increase in nosocomial ESBL-E cases.

Implementing a risk assessment for the placement and care of ESBL-E patients can improve the management of this patient group, while mitigating the risk of transmission of antimicrobial resistance.

Keywords: Infection prevention and control, risk assessment, antimicrobial drug resistance, patient isolation, New Zealand

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Introduction

This paper describes a quality improvement project which aimed to improve the patient journey and bed flow in an acute hospital through enabling some patients who are recognised as extended-spectrum beta-lactamase producing *Enterobacteriaceae* (ESBL-E) carriers to be cared for without isolation requirements. A risk assessment approach for the placement and infection prevention and control (IPC) management of known or suspected colonised or infected ESBL-E adult inpatients was developed and implemented across all hospital sites.

Background

The increase in antimicrobial resistant organisms, including ESBL-E, is a challenge for IPC teams worldwide.[1,2] Preventing the transmission of these multidrug resistant organisms (MDRO) in healthcare facilities minimises the risk to other patients as well as helping to reduce the spread of antimicrobial resistant organisms within the wider community. Recommended IPC measures for patients colonised or infected with ESBL-E include a single room, contact precautions and dedicated toilet facilities.[3,4]

In Canterbury, New Zealand, the incidence of ESBL-E isolated from the general population has steadily increased since 2009 in line with the rest of the country with the annual incidence in 2014 reported as 60.8 per 100 000 population.[5] ESBL-E admissions to the Canterbury District Health Board (CDHB) public hospitals have also increased; on average 10 to 15 ESBL-E positive in-patients a day. The hospitals are old with limited numbers of single rooms and/or toilets. Subsequently these patients compete for isolation facilities with other patients admitted with meticillin-resistant *Staphylococcus aureus* (MRSA), vancomycin-resistant enterococci (VRE), viral gastroenteritis and other infectious diseases. The requirements for a single room and dedicated toilet can result in delays in transferring patients from the Emergency Department (ED) to a ward or from one hospital facility to another.

Patients colonised or infected with MDRO are at risk of negative psychological effects from being isolated in a single room during their care.[6,7] In addition they may be at risk of other adverse effects including delays in treatment or transfer.[8,9,10] A patient's rehabilitation may be compromised if staff assume the patient cannot come out of their room for therapy activities due to isolation procedures.

As part of an ongoing quality improvement focus, the CDHB IPC Service reviewed their policies and procedures relating to the management of known colonised or infected ESBL-E adult patients. The impetus for change was partly in response to the emerging evidence in the literature that strict isolation precautions are not always required for ESBL-E patients, and also as a result of frequent internal notifications of ESBL-E patient-related issues, such as bed-blocking in the ED while awaiting a single room or sub-optimal rehabilitation due to isolation requirements. The notifications were both formal through incident reports and informal through face-to-face interaction with bed managers and clinical staff. In addition, the IPC Service recognised that their policies were not aligned to national MDRO guidelines.[3]

The aim of the project was to improve the hospital journey of a patient with ESBL-E and optimise bed management for patients requiring isolation precautions. The objectives were to:

a) introduce a risk assessment to reduce isolation requirements for patients with ESBL-E
b) improve bed management and patient transfers from the ED related to isolation room requirements

The outcome measures for this project were:

a) Nil increase in the proportion of hospital-acquired ESBL-E cases
b) A decrease in known ESBL-E patients admitted to single isolation rooms
c) Increased clinician satisfaction with bed management for ESBL-E patients

Methods

This quality improvement project included a revision of the MDRO policy based on current evidence for best practice and the development of a user-friendly risk assessment tool for ESBL-E. These changes were communicated to clinicians through an education and clinical support programme provided by the IPC department.

Setting

The CDHB provides inpatient healthcare services for around 1500 patients over 13 hospital sites. ESBL-E is not endemic within our hospital facilities and nosocomial transmission is low. Prior to this project the CDHB MDRO policy for ESBL-E patients included strict contact isolation precautions, with some slight modifications introduced in 2010 in the rehabilitation wards only, to allow improved rehabilitation activities (Figure 1). Active screening for ESBL-E includes any patients who have had an overseas or domestic public hospital admission within the previous 12 months.

Most of the hospital facilities are older in design and pose a challenge for effective isolation of patients, due to having many multi-bed rooms, few single rooms, limited numbers of toilets and bathrooms and poor location and design of the dirty utility rooms.

Intervention

The current project was undertaken in two stages in 2012 and 2016, following a previous modification to the MDRO policy (Figure 1).

The CDHB IPC and Quality Improvement Committees approved the project without a requirement for formal ethics approval. Initially a comprehensive literature review was undertaken to determine the current and emerging evidence for the management of ESBL-E colonised or infected patients. The transmission of ESBL-E within the healthcare setting is primarily through contact with faecal or urinary contaminated equipment, the patient environment or via healthcare worker hands.[4] Invasive devices and other factors that require the patient to receive substantial hands-on care may also increase the risk of transmission. The level of risk of cross infection may also be relative to patient clinical factors. ESBL-E is a frequent source of urinary tract infections,[11] and as these organisms colonise the bowel, incontinence is considered a significant risk factor. Other evidence suggests that certain ESBL organisms may increase the risk of transmission within healthcare facilities.[12-14] It was concluded that patients who are colonised or infected with ESBL-E may not have any or all of the above risk factors and could therefore be safely cared for without isolation precautions.

In the first stage, in 2012, the IPC Service implemented a significantly revised policy for the management of ESBL-E colonised or infected patients. The changes were based on a risk assessment approach that took into consideration any risk factors the patient may have for pathogen spread. The nurse or other clinician uses an assessment tool to categorise the patient as a low, medium or high risk and apply the associated set of IPC measures (Figure 2).

The revised policy also included specific guidance for disinfecting the immediate environment after disposal of body fluids in the dirty utility room. The shortage of ensuite bathrooms and toilets to dedicate for ESBL-E positive patients often necessitated the use of commodes or pans, and the poor facility design e.g. little or no bench space or no protective sluice guards, and frequent access by nursing staff made the dirty utility room a high risk for cross infection.

To supplement the policy review, a visual assessment tool in the form of a colour A4 poster was designed with the purpose of providing a visual resource to assist clinical staff in applying the new policy (Figure 2). The intention was for the poster to be displayed in a prominent area for clinical staff to refer to.

The changes were initially trialled in three clinical areas – an acute medical admitting unit, a general medical ward and three rehabilitation wards for older persons. Feedback from these areas resulted in some minor changes to the poster before the policy and poster was introduced across all the hospital inpatient areas in the 2nd half of 2012.

During the implementation of the project, the policy changes were communicated directly to clinical managers and IPC link nurses, through IPC education at ward level, and via newsletter articles. A hard copy of the poster was provided to each clinical area for display. Frequent *ad hoc* queries were responded to during routine ward rounds and over the telephone by the IPC team. As the IPC team received a daily report of all patient admissions with MDRO alerts, they were in a position to actively promote the new policy each time an ESBL-E positive patient was admitted. This level of support by the IPC team assisted

in the change management process and enabled a risk-based assessment to be embedded into the care of ESBL-E patients.

In the second stage in 2016, further refinements were made to the risk assessment tool by including, colonisation or infection with ESBL *Klebsiella pneumoniae* (ESBL-KP) as a medium risk factor.

Statistical analysis of quality measures was performed using SPSS (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.). Chi-squared tests were used to compare proportions and logistic regression to assess changes in this proportion over time. Two-tailed p values are reported.

Results

The implementation of a revised policy for the management of ESBL-E patients using a risk-based approach to isolation has had moderate success, based on the quality outcome measures.

Following the intervention, the proportion of CDHB hospital-acquired ESBL-E cases (out of all new ESBL-E cases) decreased from 21% (15/71) in 2012 to 7.9% (14/178) in 2018, (p = 0.001) (Figure 3).

In the year following Phase 1, this proportion decreased by 70% (OR 0.27, 95% CI 0.11 -0.66; p = 0.004). However, there was no sustained impact seen in the following two years. Following Phase 2, a further reduction of 70% compared to 2012 was seen (OR 0.22, 95% CI 0.09-0.53; p= 0.001) (Table I).

Twenty to 30% of single isolation rooms are freed up daily, which would have previously been occupied by a low-risk ESBL-E patient. The greatest reduction in isolation requirements was observed in ESBL-E patients admitted with medical conditions who were self-caring, e.g. exacerbation of asthma, chest pain, and antenatal. Many ESBL-E admissions meet the medium risk category due to factors such as high dependence on nursing care, diarrhoea, or a surgical wound. A simple user-satisfaction email survey was sent to 53 of the senior nursing leaders and bed management staff seeking feedback on the impact of the intervention towards bed management and improved patient access to rehabilitation and transfers. Of the 13 (24%) surveys that were returned, 12 respondents indicated the revised policy had a positive impact on patient flow and 10 suggested that the quality of care for patients had improved.

Patient satisfaction feedback was not actively sought during this project; however, there will be patients in the low and medium risk categories who will not be isolated, and thus will benefit from not being exposed to the unfavourable effects associated with isolation.

Anecdotal feedback from IPC ward rounds indicated that the poster was useful as a quick reference and the colour coding made it visually easy to use. In most areas, it is on display at the nursing station, the IPC notice board or easily accessible electronically on the CDHB Internet site.

Despite intensive support from the IPC team, the change in practice took a long time to become embedded into routine practice, as evident from the daily phone conversations with ward staff about new ESBL-E admissions.

Discussion

This report describes an IPC risk assessment approach to the management of ESBL-E in a non-endemic acute care setting. The approach permits some patients to be cared for with standard precautions instead of the traditional isolation and contact precautions. Patients are more easily admitted from the ED or transferred between wards and hospitals without the requirement for a single room, thus improving bed management and patient flow. The patient journey of care is not compromised through exposure to adverse outcomes of isolation, and rehabilitation activities are not constrained by isolation policies.

The introduction of a risk assessment policy in our organisation brings it in line with New Zealand national guidelines.[3] These guidelines suggest that identification of a patient colonised with ESBL-E does not automatically indicate a high risk of spread and advises that an assessment is undertaken to identify factors that would increase the risk of MDRO spread. Risk factors listed in these guidelines

include incontinence, inability to comply with preventative measures as well as the epidemiology of the organism and type of healthcare environment. Rogers *et al.*[15] investigated the use of infection control precautions for ESBL-E and carbapenem-resistant *Enterobacteriaceae* (CRE) in Australian hospitals and reported that 41% of respondents implemented a risk assessment approach to the use of contact precautions for ESBL-E.

The introduction of standard precautions for some ESBL-E patients on admission did not result in an increase in healthcare associated ESBL-E cases in our acute facilities. The comparative effectiveness of using standard or contact precautions to prevent the spread of ESBL-E has been widely discussed in the recent literature. Zahar compared the rates of ESBL producing *E. coli* in two hospitals in France, where standard precautions were implemented in one and contact precautions in the other.[16] There was no significant difference in the rate of ESBL-E between the two facilities over five years. Tschudin-Sutter reported no difference in the transmission rates of ESBL-producing *E. coli* after the cessation of contact precautions in an acute care hospital.[17] In a study based in a paediatric ward, findings suggested that contact precautions and isolation may not control the rates of ESBL-E where sporadic cases arise, independent of cross infection.[18] A systematic review aimed to assess the effectiveness of contact precautions solely against MDRO transmission concluded that the quality of evidence in most of the studies limited the interpretation of the data.[19]

The revised CDHB policy upholds contact precautions and isolation for patients with incontinence or diarrhoea as these are considered risk factors for ESBL-E transmission.[3] These risk factors were examined in a trauma setting, where the number of isolation days was halved without an increase in hospital-acquired MDRO infections when trauma patients were only isolated with contact precautions if they were deemed likely to soil the environment.[20]

Patients colonised or infected with ESBL-KP in our organisation are considered a higher risk for transmission of ESBL-E and consequently these patients are cared for with contact precautions. Higher transmission rates of ESBL-KP have been reported in the literature,[14,21,22] which may be associated with greater levels of environmental contamination.[23]

There was a moderate improvement in bed management for ESBL-E patients after the introduction of the risk assessment policy. The MDRO status of a patient has been shown to delay admission to a hospital bed from the ED for up to two and half hours.[24,25] Kotkowski *et al.* reported improvements to ED admission time and no significant changes to nosocomial MRSA or VRE following changes to policy in a large acute care hospital in Massachusetts, USA.[26]

The clinician feedback survey indicated that the quality of care for patients had improved; however, the impact on rehabilitation care was not specifically addressed in the survey questions. Disruption to rehabilitation care for MDRO positive patients has been reported previously.[27] Many of the ESBL-E admissions who meet the medium or high-risk requirements are elderly and require rehabilitation. One of the challenges with this patient cohort is that they often have long-term continence issues. The risk assessment places incontinent persons in the high-risk category but often the incontinence risk may be mitigated successfully with continence products, which many patients manage themselves. Although the ESBL-E policy and flowchart remain in use, those wards caring for inpatients with a prolonged stay and requiring rehabilitation implement modified contact precautions procedures that allow for patient-centred care. Sztajzel *et al.* suggest that individualised patient IPC control measures can be successfully implemented for MDRO colonised patients to improve their rehabilitation activities.[28]

In this project, the use of the visual assessment tool proved helpful in providing an at-a-glance reference for nurses making the risk assessment. Visual communication resources can be used as effective tools for simplifying complex information and reinforcing written policy.[29,30]

Although this project produced positive results, limitations are acknowledged. The new policy and procedures were introduced in a non-endemic setting for ESBL-E; in healthcare facilities with a higher

background rate of ESBL-E transmission, the rate of healthcare associated ESBL-E may differ. Patient feedback was not actively sought so any perceived benefits for them are based on anecdotal evidence from clinical staff.

Conclusions

In conclusion, this project improved the patient flow of ESBL-E patients within our hospitals and potentially improved the ESBL-E colonised patient journey. IPC professionals should be aware of current opinion and changing evidence for practice. Local infection prevention and control measures should take into consideration the setting, epidemiology, virulence factors, mode of transmission, and degree of transmissibility of ESBL-E in order to optimise both bed management and the patient safety.

Conflict of Interest

The authors declare that there is no conflict of interest.

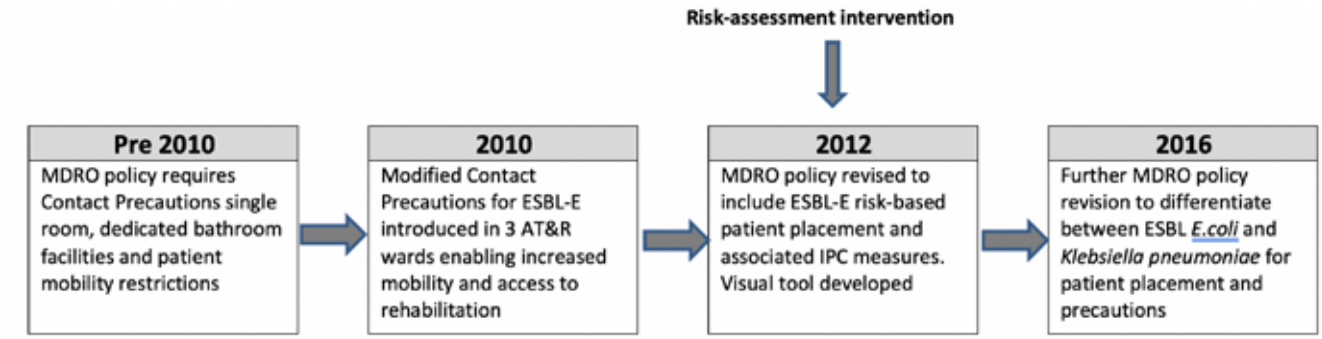

Figure 1. Timeline for the implementation of an ESBL-E risk-assessment intervention

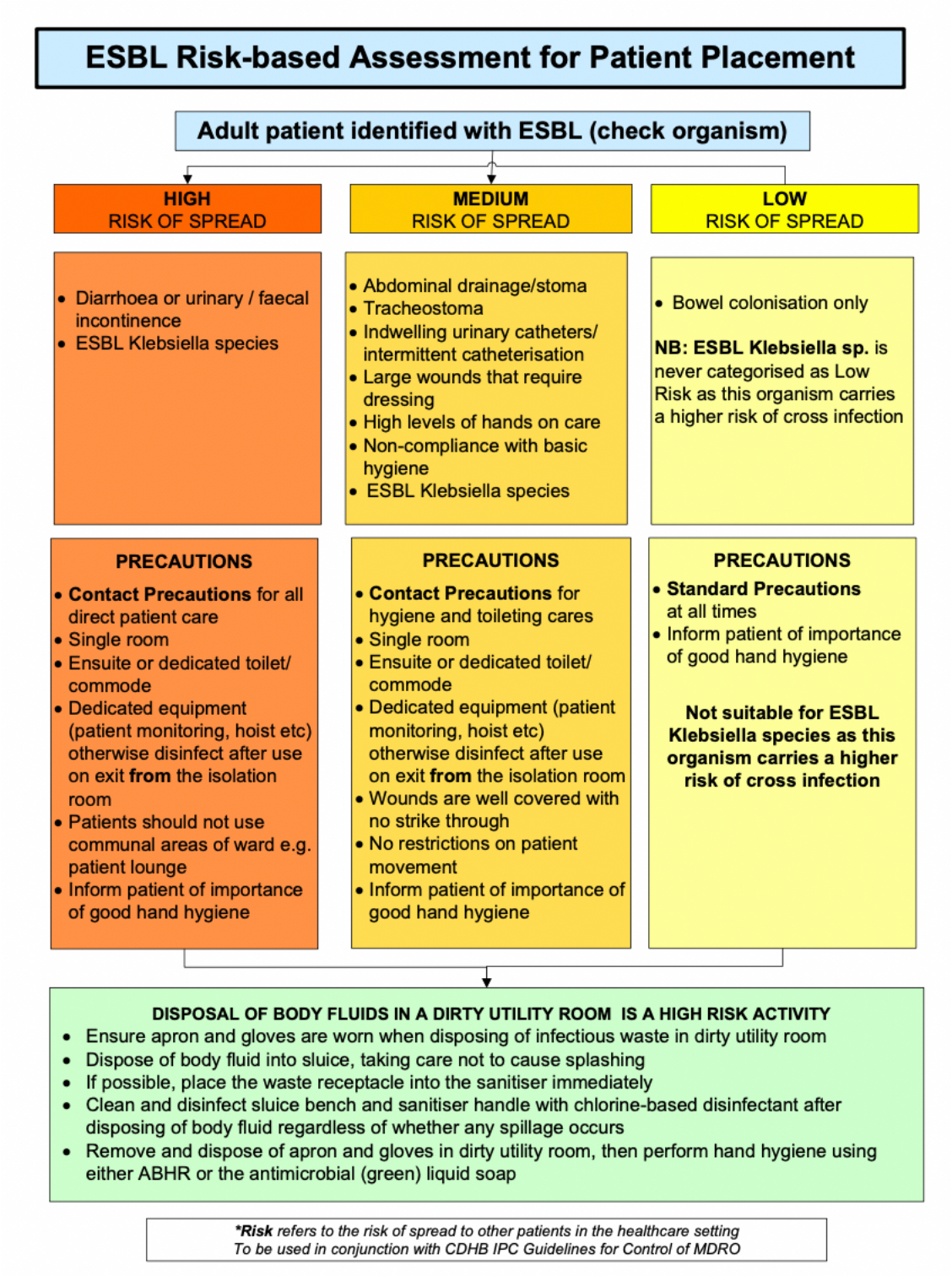

Figure 2. ESBL Risk-based Assessment tool and poster

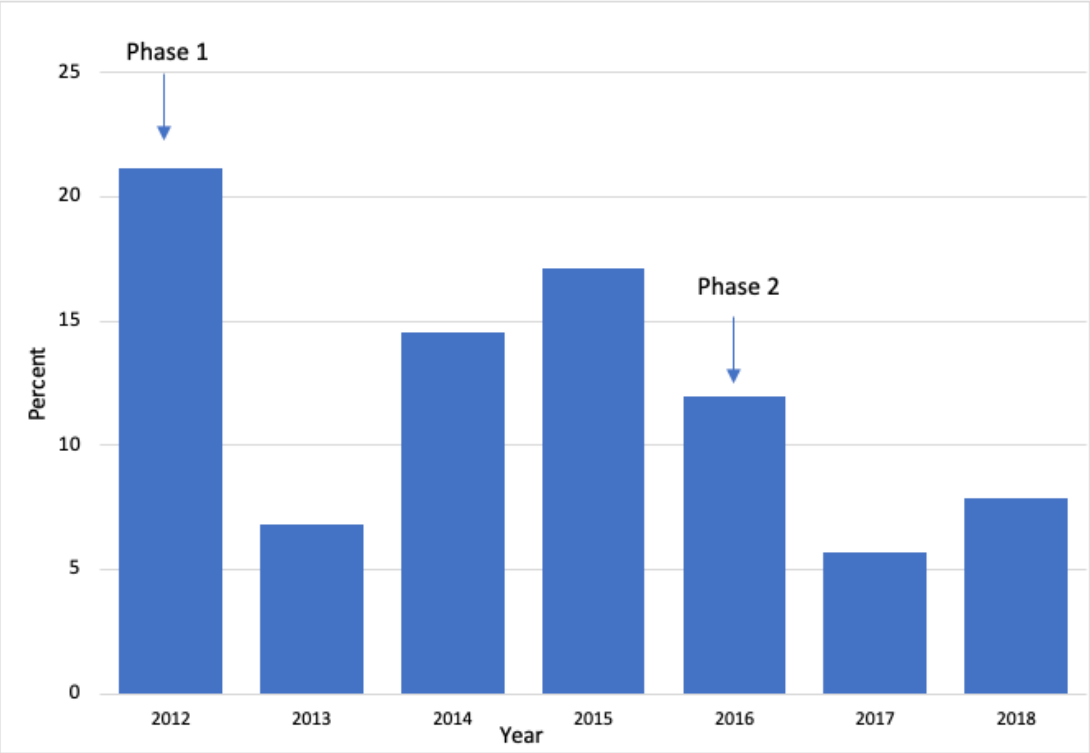

Figure 3. Proportion of hospital-acquired ESBL-E cases to the total number of new ESBL-E cases per year.

Table I. Risk of aquiring ESBL-E in hospital compared to 2012

Year	OR (95% CI)	P-value
2013	0.27 (0.11 to 0.66)	0.004
2014	0.63 (0.29 to 1.36)	0.246
2015	0.77 (0.38 to 1.59)	0.482
2016	0.51 (0.24 to 1.06)	0.070
2017	0.23 (0.09 to 0.53)	0.001
2018	0.32 (0.14 to 0.70)	0.005

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