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Research paper

Clinical management of drug-resistant bacteria in Australian hospitals: An online survey of doctors' opinions

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Abstract *Background:* To gain a better understanding of clinical practice for the treatment of common drug-resistant infections.
Methods: A web-based anonymous survey was developed to gain a better understanding of clinical practice of patients infected with drug-resistant bloodstream infections (BSI). The survey instrument was a questionnaire requesting doctors to provide their opinion on the most likely choice of an antibiotic, dose and route of administration for patients infected with a drug-resistant *Escherichia coli*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa* or *Enterococcus faecium*.
Results: All of the survey participants ($n = 28$) were hospital-based doctors. Choice of therapy for drug-resistant *E. coli* and *K. pneumoniae* was uniform across survey participants. However, optimal treatment of ceftazidime-resistant *P. aeruginosa* and VRE was less clear.
Conclusion: The survey adds to the limited body of evidence in this clinical area and can be a useful tool for health economists in determining the additional cost of treating patients with drug-resistant infections.

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Highlights

- Clinical management of drug-resistant BSIs in hospitals is not well-defined.
- Therapy for drug-resistant BSI caused by *E. coli* and *K. pneumoniae* was uniform.
- Optimal therapy for BSIs caused by drug-resistant *P. aeruginosa* and VRE is unclear.
- Such data are needed to determine the treatment costs of drug-resistant infections.

Introduction

The impact of drug-resistant infections is broad and places a significant burden on the patient, the healthcare system and society more broadly. Despite several high-profile international reports [1—3] we currently don't know the health or the economic burden in Australia [4]. Quantifying the impact of drug-resistant infections is necessary for clinical practice improvements as well as to develop measurable indicators to report against the first National Antimicrobial Resistance Strategy [5].

Generating an estimate of the cost of drug-resistant infections is a challenge. From the patient or societal perspective, measures of early death, loss of effective labour supply or more broadly a loss of economic viability in a world without antibiotics [6] are required. Quantifying costs from a healthcare perspective is more attainable and includes estimating the number of hospital bed days [7] and other costs such as staffing and clinical management. Many studies aim to determine the additional length of hospital stay and staff needed to treat patients but very few have focused on determining antibiotic choice, dose and duration of treatment. In light of the growing need for more complicated therapy and increased use of 'last-line' reserve agents to treat multi-resistant infections [8], now more than ever such studies are needed. Knowledge gained from clinical management studies would serve to benefit infection control practitioners as well health economists who need this information to generate more accurate estimates of the economic burden of drug-resistance.

The current Australian Therapeutic guidelines (eTG) offer the most comprehensive directive of the clinical management of patients with a variety of syndromes including treatment of methicillin-resistant *Staphylococcus aureus* (MRSA) [9]. They do not include therapy options for other common hospital-associated drug-resistant infections such as those that comprise the "ESKAPE" pathogens including *Enterococcus faecium* (*E. faecium*), *Klebsiella pneumoniae* (*K. pneumoniae*) and *Pseudomonas aeruginosa* (*P. aeruginosa*). These organisms, both susceptible and resistant, cause as much as two-thirds of all healthcare-associated infections [10] and are increasingly impervious to therapy [11]. The study aimed to gain doctors' views of the most likely antibiotic management of patients with a bloodstream infection (BSI) caused by drug-resistant *E. faecium*, *Escherichia coli*, *K. pneumoniae* and *P. aeruginosa*.

Methods

Development of the survey questions

The questions for the survey were developed and reviewed by an expert panel consisting of two independent infectious diseases experts and two non-clinical researchers. The survey participants were asked to answer questions relating to the treatment of confirmed drug-resistant BSI caused by four pathogenic bacteria. There were 3 main questions pertaining to treatment of third-generation cephalosporin resistant *E. coli*; third-generation cephalosporin resistant *K. pneumoniae*; vancomycin-resistant *E. faecium* and ceftazidime-resistant *P. aeruginosa*. The following three questions were asked for each of the survey organisms.

Survey questions

Question 1. Recognising that therapy is determined by laboratory results, what is the most commonly used management for an 'average' stable patient[1] with confirmed drug-resistant bloodstream infection

(i) drug name,
(ii) route of administration,
(iii) dose and
(iv) dosing interval

Question 2. Would you use combination therapy to treat confirmed drug-resistant bloodstream infections?

Question 3. Once the patient is stable, would you consider outpatient parenteral antibiotic therapy for the management of (Y/N).

Survey administration

The questionnaire was delivered using an online Survey Monkey software (http://www.surveymonkey.com). All responses were anonymous. The link to the survey was sent along with information to participants' pack that

[1] For the purpose of this survey an 'average' patient is considered to be a stable male (average weight 86 kg) or a stable female (average weight 72 kg).