

## Antimicrobial resistance of bloodstream infections in a Scottish haemodialysis population, with a focus on vascular access method

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### Introduction

Infection is the second highest cause of mortality amongst patients with end-stage renal disease.<sup>1</sup> Haemodialysis (HD) populations are exposed to conditions that heighten the risk of acquiring bloodstream infections (BSIs).<sup>2,3</sup> Multidrug resistance (MDR) is a growing problem and associated with excess mortality.<sup>4</sup>

Antimicrobial choice influences MDR prevalence, and knowledge of resistance patterns facilitates effective antimicrobial stewardship.<sup>5</sup> In this study, antimicrobial resistance (AMR) of BSIs in a contemporary Scottish HD cohort is reported by vascular access type – arterio-venous fistula (AVF), arterio-venous graft (AVG), tunnelled central venous catheter (TCVC) or non-tunnelled central venous catheter (NTCVC).

### Methods

Retrospective observational data on adult patients utilising inpatient and outpatient HD across seven West of Scotland units were collected using the Strathclyde Electronic Renal Patient Record for the year of 2017. The prevalent HD vascular access type and microbial species for each BSI occurring >14 days apart were recorded. The associated AMR was verified using the NHS Greater Glasgow and Clyde and NHS Forth Valley Microbiology databases. MDR was defined according to the joint European Centre for Disease Prevention and Control and Centers for Disease Control and Prevention initiative<sup>6</sup>.

### Results

There were 147 BSIs amongst 786 patients undergoing HD across 217,503 HD days. There were 126,674 AVF, 25,511 AVG, 64,353 TCVC and 965 NTCVC days, with BSI rates/1000 HD days of 0.39, 0.55, 1.26 and 3.11 respectively. There were 168 microbial isolates – 43 Gram-negative, 49 coagulase-negative Staphylococci, 36 Staphylococcus aureus, 8 Streptococcus species, 4 Enterococcus species, 22 other Gram-positive species, 5 Candida species and one unidentified organism. AMR data was available for 140 species. Table 1 displays AMR across vascular access subtypes, with comparison to Scottish population data.<sup>7</sup> Figure 1 displays a graphical summary of microbial species AMR.

Although all Staphylococcus aureus isolates were susceptible to flucloxacillin and vancomycin, one MDR S. aureus BSI occurred in the AVF group (rate of 0.008/1000 HD days). Three Enterococci were MDR, including two glycopeptide-resistant strains, 1 in the NTCVC group (1.04/1000 HD days) and 2 in the AVF group (0.02/1000 HD days). There were 12 MDR Gram-negatives, 5 in the AVF (0.04/1000 HD days), 6 in the TCVC (0.09/1000 HD days) and 1 in the NTCVC (1.04/1000 HD days) subgroups. Three extended spectrum beta-lactamase producing enterobacteriales were noted, 2 in the AVF (0.02/1000 HD days) and 1 in the TCVC (0.02/1000 HD days) group. One intrinsically carbapenem-resistant Stenotrophomonas maltophilia occurred in the TCVC group (0.02/1000 HD days).

### Discussion

MDR BSI is common in the HD population, and there is a wide degree of variation between pathogens across the HD vascular subtypes. The susceptibility of Staphylococci to vancomycin and Gram-negatives to gentamicin suggest the empirical use of these antibiotics in this HD population remains appropriate. There

is higher Gram-negative AMR to ciprofloxacin and gentamicin compared with the Scottish population, potentially reflecting increased usage of these antimicrobials in the HD population. Gram-negative AMR to temocillin is concerning given this antibiotic was only recently introduced into the local formulary, highlighting the need for ongoing AMR surveillance.