The utility of a blood culture database to identify patients suitable for outpatient parenteral antibiotic treatment

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ABSTRACT

Background The clinical and cost-effectiveness of outpatient parenteral antimicrobial therapy (OPAT) services are well described. We used a blood culture database as a novel approach to case finding and determined its utility in identifying inpatients suitable for OPAT.

Methods From December 2012 to November 2013, consecutive adult inpatients with bacteraemia, and those recruited to OPAT, were prospectively studied. Univariate and multivariate logistic regression analysis were used to investigate the association between bacteraemic patient characteristics and OPAT recruitment.

Results There were 470 bacteraemic and 134 OPAT patients. The blood culture database identified 22 (16.4%; CI 10.5 to 23.6) additional patients suitable for OPAT, 4.7% (95% CI 3.0% to 7.0%) of the total bacteraemic cohort. 20 (90.9%) of these patients had community-acquired bacteraemia. Bacteraemic patients with urinary tract infections (UTIs), 11/157 (7.0%; 95% CI 3.5% to 12.2%) were most commonly recruited to OPAT and *Escherichia coli* was the most common blood culture isolate. In the *E. coli* bacteraemic subgroup, extended-spectrum β-lactamase (ESBL) producers were significantly higher in the OPAT group, compared with the non-OPAT group, 9/11 (81.8%) vs 17/192 (8.9%), p<0.001. Among OPAT patients, there were no deaths within 30 days and no significant difference in relapse rates between bacteraemic and non-bacteraemic patients, 1/22 (4.6%) vs 5/112 (4.5%). In logistic regression analysis, there were no patient characteristics in the bacteraemic cohort that predicted recruitment to OPAT. In a subgroup analysis of patients with Gram-negative bacteraemia, ESBL production was strongly associated with OPAT recruitment, OR 5.85 (95% CI 1.94 to 17.58), p=0.002.

Conclusions A blood culture database proved a useful adjuvant to a clinical referral system, particularly for patients with community onset, multidrug resistant UTIs caused by ESBL producing *E. coli*. All bacteraemic patients recruited to OPAT received treatment safely and had good clinical outcomes.

INTRODUCTION

Outpatient parenteral antibiotic treatment (OPAT) enables patients to receive treatment with intravenous antibiotics in their home or in an ambulatory care setting rather than in hospital. It is widely used in the UK and is associated with admission avoidance, decreased length of inpatient stay, cost savings and high levels of patient satisfaction.[1–5] In carefully selected patients, outcomes are comparable with hospital based treatment[6 7] and national guidelines assist with service delivery, development and good clinical practice. OPAT is also part of the UK government's healthcare strategy of moving hospital services into the community so OPAT is likely to continue to expand over the next 5 years.[8]

While there is much published literature on the success of OPAT services, there is little on methods used to identify patients. Traditionally, patient identification can be passive, waiting for a referral, or active, targeting specific specialties (eg, orthopaedics or acute assessment units). Often referrals are unsuitable for several reasons. These include patients living outside designated postcodes, inability to attend hospital for treatment on a daily basis, being elderly with multiple comorbidities that necessitate prolonged hospital stay, difficulty with vascular access and having conditions treatable with oral antibiotics. Bacteraemic patients feature in some OPAT populations although it is unclear the site of infection causing bacteraemias and how these patients were recruited.[7 9–11] Overall, there is little in the literature on the value of microbiological results in patient identification with the emphasis on clinical assessment and the safe delivery of treatment.[7 12] We used an existing blood culture database as a novel approach for recruitment, and determined its utility in identifying additional adult inpatients suitable for OPAT.

PATIENTS AND METHODS

Study setting

This study was undertaken at the Royal London Hospital (RLH), Barts Health NHS Trust. The RLH serves a diverse population of about 250 000 patients in Tower Hamlets, East London and is a regional referral centre for the North-East London sector. In addition to accident and emergency, general medicine, surgery, paediatric and maternity services, the RLH has 60 high-dependency and critical care beds (including neurosurgical, renal, and obstetric and gynaecological beds), specialist wards for renal transplant and haemodialysis patients, and a high-level intensive care unit.

Study population

From December 2012 to November 2013, consecutive bacteraemic inpatients and patients recruited to OPAT were prospectively studied. Patients aged <16 years were excluded.

Bacteraemia cohort and definitions

In bacteraemic patients, age, gender, inpatient specialty, site of infection, organism, susceptibility profile and mortality related outcomes were

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recorded. Bacteraemia was considered significant if a blood culture was isolated from a patient with a compatible clinical syndrome that was unlikely to be a skin or environmental contaminant. This was based upon the patient's history, examination, response to antimicrobial therapy and bacterial isolates from other body sites.[13] Specialties at the time of bacteraemia were categorised as medicine, surgery (including orthopaedics), critical care, and obstetrics and gynaecology. For hospital-acquired or device related bacteraemia, the Centres for Disease Control and Prevention definitions were used to define the sites of infection[14] and for community-onset bacteraemia, sites were defined following clinical, microbiological and radiological assessment. Bacteraemia in patients with an unknown source were classified as undefined.

Microbiology data

Blood cultures were analysed using an automated system BacT/ALERT3D (bioMerieux, Mary l'Etoile, France). Isolates were identified using either the VITEK MS system (bioMerieux, Mary l'Etoile, France, database V.2.0) or Bruker Biotyper (Bruker Daltonic, Leipzig, Germany, software V.3.0) MALDI-TOF MS systems according to the manufacturer's instructions and the laboratory standard operating procedures. Susceptibility testing was performed on the Microscan walkAway system (Siemens Healthcare Diagnostics, Deerfield, Illinois, USA).

OPAT cohort, data collection and ascertainment

Over the same period age, gender, site of infection, medical specialty, presence of bacteraemia, duration of treatment and outcomes were recorded for all patients recruited to OPAT. Where possible, patients were treated with intravenous antibiotics once daily. Patients under 16 years of age were excluded. Patients were recruited by referrals from inpatient teams or general practitioners. or actively sought by attendance at acute assessment unit board rounds or attendance at multidisciplinary team meetings (eg, orthopaedics). In addition, some OPAT referrals were made as a consequence of blood culture results. These results prompted assessment for OPAT suitability by either an infection specialist (including a microbiologist) or the patient's clinical team. Patients received treatment in their homes or via a fast response nursing team in an ambulatory care setting.

Statistical analysis

We analysed the characteristics of bacteraemic patients (age, gender, place of acquisition, inpatient specialty, site of infection and mortality), comparing those who received and did not receive OPAT. For patients recruited to OPAT, we compared patient characteristics and duration of intravenous treatment for bacteraemic and non-bacteraemic patients. We also describe bacteraemic isolates from patients who received OPAT and compared these to patients who did not receive OPAT.

Quantitative data are presented as numbers and percentages. Associations between two categorical variables were tested using the Pearson's χ^2 test and continuous variables using t-tests. As patients may present with more than one bacteraemic episode, we used number of patients as the denominator to calculate percentages for patient characteristics and number of bacteraemic episodes as the denominator for infection characteristics.

Univariate and multivariate logistic regression analyses were used to examine the association between age, gender, inpatient specialty and site of infection, and recruitment to OPAT in bacteraemic patients. As all OPAT bacteraemic episodes were community-onset, we could not adjust for place of acquisition because there were no OPAT patients with hospital-acquired bacteraemia. In a subgroup analysis of patients with Gram-negative bacteraemia, we also examined the association between *Escherichia coli* infection and extended-spectrum β-lactamase (ESBL) production, and recruitment to OPAT. Generalised estimating equations were used to account for dependency between multiple bacteraemic episodes for patients in the univariate and multivariate analyses. Data were analysed using Stata SE (V.13.1).

Clinical governance

The clinical governance audit committee of Barts Health NHS Trust approved the study.

RESULTS

Over the 12-month period, the number of inpatients with bacteraemia and patients recruited to OPAT are illustrated in figure 1.

Bacteraemic patients

There were 470 patients with bacteraemia yielding 556 positive blood cultures. Patient demographic, clinical and mortality data are summarised in table 1. Twenty-two (4.7%; 95% CI 3.0% to 7.0%) bacteraemic patients were recruited to OPAT. All patients recruited had community-onset infection (either community-acquired or healthcare-associated). Of these, 20 had community-acquired bacteraemia, equivalent to 20/200 (10.0%; 95% CI 6.2% to 15.0%) of all community-acquired bacteraemic episodes.

Compared with surgical patients, significantly more medical patients were recruited to OPAT. Outpatient treatment episodes were most common for urinary tract infection (UTI), 11/157 (7.0%; 95% CI 3.5% to 12.2%), skin and soft tissue infection

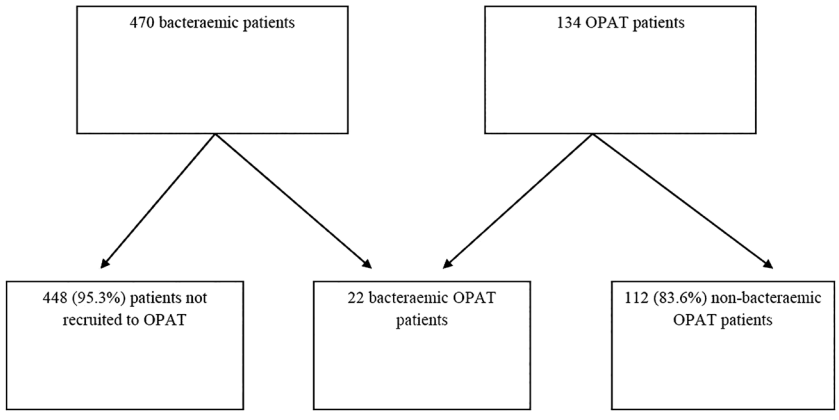

Figure 1 Inpatients with bacteraemia and patients recruited to outpatient parenteral antibiotic treatment (OPAT) between December 2012 and 2013.

Table 1 Demographic and clinical data on 470 patients, with 556 associated bacteraemic or fungaemic episodes, who did and did not receive OPAT

	OPAT		
	Yes	No	p Value*
Patients	22	448	
Infections (Bacteraemic/fungaemic episodes)	25	531	
Age† (years), n (%)			
16–30	2 (9.1)	38 (8.5)	0.621
31–50	7 (31.8)	99 (22.1)	
51–70	8 (36.4)	156 (34.8)	
>70	5 (22.7)	155 (34.6)	
Gender†, n (%)			
Male	11 (50.0)	262 (58.5)	0.431
Female	11 (50.0)	186 (41.5)	
Place of acquisition, n (%)			
CA	20 (90.9)	188 (35.4)	<0.001
HCA	2 (9.1)	198 (37.3)	
HA	0	143 (26.9)	
Not defined	0	2 (0.4)	
Specialty, n (%)			
Medicine	22 (88.0)	430 (81.0)	<0.001
Surgery	2 (8.0)	101 (19.0)	
O&G	1 (4.0)	0 (0.0)	
Sites of infection, n (%)			
CVC (uncomplicated)			0.129
Tunnelled	0	33 (6.2)	
Non-tunelled	2 (8.7)	27 (5.1)	
CVC‡ (complicated/metastatic spread)	2 (8.0)	21 (4.1)	
Peripheral cannula		1 (0.2)	
Urinary tract (catheter-associated)		58 (10.9)	
Urinary tract§ (non-catheter-associated)	11 (44.0)	146 (27.5)	
Biliary tract	3 (12.0)	51 (9.6)	
GI¶ tract	3 (12.0)	32 (6.0)	
GU tract		9 (1.7)	
Liver abscess		9 (1.7)	
LRT (non-ventilator-associated)		35 (7.0)	
LRT (ventilator-associated)		4 (0.8)	
Skin and soft tissue infection	3 (12.0)	26 (4.9)	
Peripheral joints (native)	1 (4.0)	2 (0.4)	
Peripheral joints (prosthetic)		1 (0.2)	
Meningitis		3 (0.6)	
Not defined		73 (13.8)	
Mortality, n (%)			
Inpatient	0	22 (4.9)	0.287
7-day	0	12 (2.7)	0.437
30-day	0	24 (5.4)	0.265

One patient had a bacteraemic and non-bacteraemic episode, so this was recorded in both groups.
*χ^2 test.
†Patient-specific variables. Age and gender were reported as a percentage of patients.
‡Complicated CVC or metastatic infections occurred only in renal haemodialysis patients. This included vertebral column, infective endocarditis and pacemaker infection.
§Two were complicated lower UTIs, one postprostatic biopsy.
¶Enteric fevers (2×*S. paratyphi* and 1×*S. typhi*).
**Metastatic complication of fistula site and catheter-associated UTIs in renal haemodialysis patients.
CA, community-acquired; CVC, central venous catheter; GI, gastrointestinal; GU, genito-urinary; HA, hospital-acquired; HCA, health-care associated; LRT, lower respiratory tract; O&G, obstetrics and gynaecology; OPAT, outpatient parenteral antibiotic treatment; UTIs, urinary tract infections.

(SSTI), 3/29 (10.3%; 95% CI 2.2% to 27.4%), gastrointestinal tract infection (all enteric fevers), 3/8 (37.5%; 95% CI 8.5% to 75.5%) and biliary tract infection, 3/54 (5.6%; CI 95% 1.2% to 15.4%). There was no statistically significant difference in 30-day mortality between bacteraemic patients receiving OPAT and those not receiving OPAT; 0 vs 24/470 (5.4%; 95% CI 3.3% to 7.5%).

OPAT patients

Of the 134 patients who received OPAT, 22 (16.4%; 95% CI 10.5% to 23.6%) were bacteraemic. All these patients were recruited through the blood culture database and were not referred directly from clinical teams. There was one patient with a bacteraemia and a non-bacteraemic episode so this information was recorded in both groups.

Demographic and clinical data of all OPAT patients are summarised in table 2. UTI, 11/51 (21.6%; 95% CI 11.3% to 35.3%) was the most common cause of bacteraemia in OPAT patients. Unadjusted data demonstrated significant differences in sites of infection, with more upper UTIs in the bacteraemic group compared with the non-bacteraemic group, 9/22 (40.9%) vs 26/123 (21.1%), p=0.046. There were no deaths in either bacteraemic or non-bacteraemic patients and no significant difference in relapse rates at 30 days; 1/22 (4.6%) vs 5/112 (4.5%).

Table 2 Demographic and clinical data on 134 patients who received OPAT (145 treatment episodes), with bacteraemia and without bacteraemia

	Without bacteraemia	With bacteraemia	p Value*
Patients	112	22	
Episodes	123	22	
Age† (years), n (%)			0.777
16–30	20 (17.9)	2 (9.1)	
31–50	35 (31.3)	7 (31.8)	
51–70	35 (31.3)	8 (36.4)	
>70	22 (19.6)	5 (22.7)	
Gender†, n (%)			0.701
Male	51 (45.5)	12 (50.0)	
Female	61 (54.5)	11 (50.0)	
Specialty, n (%)			0.941
Medical	109 (88.6)	19 (86.4)	
Surgical	10 (8.1)	2 (9.1)	
O&G	4 (3.3)	1 (4.6)	
Site of infection, n (%)			0.025
Urinary tract (upper)	26 (21.1)	9 (40.9)	
Urinary tract (lower)	14 (11.4)	2‡ (9.1)	
Biliary tract	0	2 (9.1)	
Skin and soft tissue	57 (46.3)	2 (9.1)	
Central venous catheter	0	2 (9.1)	
GI tract	2 (1.6)	3 (13.6)	
Infective endocarditis	0	1 (4.6)	
LRT	1 (0.8)	0	
Meninges	2 (1.6)	0	
Orthopaedic infections	6 (4.9)	1 (4.6)	
Vertebral column (VC)	2	0	
Osteomyelitis (non-VC)	0	0	
Peripheral joints	3	1	
Sternal wound	1	0	
Other	15§ (12.2)	0	
Outcome†, n (%)			0.987
Recovered/anticipated outcome	107 (95.5)	21 (95.5)	
Relapse	5 (4.5)	1 (4.6)	
Death within 30 days of treatment completion, N (%)	0	0	N/a
Duration of intravenous treatment (days)			0.207
Mean (SD)	8.6 (9.5)	6.2 (4.0)	
Median (max–min)	7.0 (0.0–64.0)	6.0 (0.0–14.0)	

*χ^2 test for categorical variables, t-test for continuous variables.
†Patient-specific variables so reported as a percentage of patients. One patient is in both columns because they had one episode without bacteraemia and one with bacteraemia.
‡One postprostatic biopsy.
§Other included liver abscesses, malignant otitis externa, meningitis, leptospirosis, infected ovarian cysts, prepatella bursitis, fistula infection, tuberculosis, bronchiectasis and community-acquired pneumonia with empyema.
GI, gastrointestinal; LRT, lower respiratory tract; O&G, obstetrics and gynaecology; OPAT, outpatient parenteral antibiotic treatment.

Total number of days on intravenous antibiotics received out of hospital was 1198, roughly equivalent to the number of bed days saved. The most common drugs administered were either intravenous ceftriaxone once daily or ertapenem. In bacteraemic and non-bacteraemic groups, median (IQR) duration of intravenous treatment was non-significantly different, 7 (5–8) vs 6 (3–8).

Microbiology

For all bacteraemic patients, 377 (67.8%) blood culture isolates were Gram-negative. The most common organisms were *E. coli* and *Staphylococcus aureus* (table 3). More patients with *E. coli* bacteraemia were recruited to OPAT compared with other blood culture isolates and, among these, ESBL production was significantly higher in the OPAT group compared with the non-OPAT group, 9/11(81.8%) vs 17/192 (8.9%), p<0.001.

Bacteraemic patient characteristics and recruitment into OPAT

Univariate and multivariate logistic regression analysis to investigate the association between bacteraemic patient characteristics and those recruited to OPAT is reported in table 4. There were no statistically significant associations in univariate or multivariate logistic regression analysis. In a subgroup analysis of patients with Gram-negative bacteraemia, ESBL production was strongly associated with OPAT recruitment, OR 5.85; 95% CI 1.94 to 17.58, p=0.002 (table 5).

DISCUSSION

This is the first paper to examine the utility of a blood culture database to identify patients suitable for OPAT. An additional 16.4%, or 22 extra patients, were recruited to OPAT through the blood culture database. Without this 'prompt', clinical assessment of bacteraemic patients for OPAT suitability is unlikely to have occurred. Although a useful adjuvant to a clinical referral system, more patients were probably not recruited due to severity of infection, as bacteraemic patients often

Table 3 Bacteraemia isolates on 470 patients, with 556 associated bacteraemic or fungaemic episodes, receiving or not receiving OPAT

	OPAT		
	Yes (N=25)	No (N=531)	p Value*
Escherichia coli, n (%)	11 (44.0)	192 (36.2)	0.426
ESBL +ve	9	19	<0.001†
ESBL −ve	2	173	
K. pneumonia, n (%)	2 (8.0)	51 (9.7)	0.812
ESBL +ve	0	14	0.388†
ESBL −ve	2	37	
P. aeruginosa, n (%)	0	24 (4.5)	0.277
MSSA, n (%)	2 (8.0)	51 (9.7)	0.789
MRSA, n (%)	0	3 (0.6)	0.706
Candida species, n (%)	1 (4.0)	9 (1.7)	0.397
Other‡, n (%)	9 (36.0)	202 (38.0)	0.837

One patient had a bacteraemic and non-bacteraemic episode, so this was recorded in both groups.
*Pearsons χ^2 test. Tests each bacteraemic isolate verses all other bacteraemic isolate.
†ESBL +ve versus ESBL –ve for each bacteraemic isolate.
‡These include two *S. paratyphi*, one *S. typhi*, one *P. mirabilis*, one *E. aerogenes*, one Group G streptococcus, one *Streptococcus viridans*, one *Acinetobacter* and one *Candida haemulonii*.
ESBL, extended-spectrum β-lactamases; MRSA, methicillin-resistant *Staphylococcus aureus*; MSSA, methicillin-susceptible *S. aureus*; OPAT, outpatient parenteral antibiotic treatment.

Table 4 Univariate and multivariate logistic regression analyses for all bacteraemic patients to investigate association between patient characteristics and recruitment to OPAT (469 patients, 555 bacteraemic patients)

	Univariate analysis		Multivariate analysis	
	OR (95% CI)	p Value*	OR (95% CI)	p Value*
Age (years)				
16–30	Reference	0.733	Reference	0.633
31–50	1.18 (0.23 to 6.06)		1.12 (0.22 to 5.80)	
51–70	1.02 (0.21 to 4.98)		0.91 (0.18 to 4.45)	
>70	0.61 (0.12 to 3.28)		0.51 (0.09 to 2.79)	
Gender				
Female	Reference	0.593	Reference	0.799
Male	0.79 (0.34 to 1.86)		0.89 (0.37 to 2.12)	
Specialty				
Medicine	Reference	0.254	Reference	0.237
Surgery	0.43 (0.10 to 1.83)		0.42 (0.10 to 1.78)	
Site of infection				
Urinary tract	Reference	0.415	Reference	0.349
Skin and soft tissue	1.64 (0.40 to 6.77)		1.54 (0.36 to 6.67)	
Other	0.67 (0.27 to 1.62)		0.61 (0.24 to 1.52)	

One patient with obstetrics and gynaecology specialty was excluded.
Generalised estimating equations were used to adjust for multiple episodes for some patients.
*Joint Wald test.
OPAT, outpatient parenteral antibiotic treatment.

Table 5 Univariate and multivariate logistic regression analyses for Gram-negative bacteraemic patients to investigate the association between patient characteristics, blood culture isolates and recruitment to OPAT (332 patients, 377 bacteraemic patients)

	Univariate analysis		Multivariate analysis	
	OR (95% CI)	p Value*	OR (95% CI)	p Value*
Age (years)				
16–30	Reference	0.464	Reference	0.547
31–50	1.56 (0.17 to 14.11)		1.67 (0.17 to 16.42)	
51–70	1.03 (0.12 to 8.94)		0.97 (0.10 to 9.12)	
>70	0.47 (0.05 to 4.77)		0.53 (0.05 to 5.76)	
Gender				
Female	Reference	0.442	Reference	0.614
Male	0.67 (0.24 to 1.88)		0.76 (0.25 to 2.25)	
Specialty				
Medicine	Reference	0.242	Reference	0.228
Surgery	0.30 (0.04 to 2.28)		0.28 (0.03 to 2.23)	
Site of infection				
Urinary tract	Reference	0.341	Reference	
Skin and soft tissue	4.69 (0.49 to 44.82)		5.94 (0.39 to 89.49)	
Other	0.85 (0.29 to 2.49)		0.73 (0.22 to 2.41)	0.344
Escherichia coli				
No	Reference	0.987	Reference	0.756
Yes	1.01 (0.36 to 2.83)		1.21 (0.37 to 3.95)	
ESBL production				
Negative	Reference	0.001	Reference	0.002
Positive	6.15 (2.13 to 17.75)		5.85 (1.94 to 17.62)	

One patient with obstetrics and gynaecology specialty was excluded.
Generalised estimating equations were used to adjust for multiple episodes for some patients.
*Joint Wald test.
ESBL, extended-spectrum β-lactamase; OPAT, outpatient parenteral antibiotic treatment.

require resuscitation in hospital. Also, many patients admitted from the community can be switched to oral alternatives and, in the absence of drug resistance, do not require prolonged intravenous therapy. Our data show that patients with community-onset and multidrug resistant (MDR) infections were most likely to be recruited to OPAT, and none of these patients were directly referred without prompting through the clinical referral system.

The most common sites of infection in patients recruited to OPAT were SSTIs and UTIs. A 2-year retrospective review of

patients treated with OPAT in one Scottish centre found the majority of infections were SSTIs, 125 (59%) of 212 episodes.[5] All were identified clinically and, in our study, we also found that these patients were predominantly recruited by clinical assessment rather than blood culture findings.

In contrast, the blood culture database was particularly useful in identifying patients with MDR UTIs, a condition that can't be diagnosed clinically, and with these infections a positive blood culture result triggered a clinical assessment which wouldn't have otherwise occurred. One paper retrospectively reviewed the use of OPAT to facilitate early discharge of patients with UTI caused by ESBL producing *Enterobacteriaceae*. In this small retrospective study, 11 patients with 25 treatment episodes, it is unclear whether any of these bacteraemic patients were identified and recruited following the validation of the blood culture result. The authors concluded that OPAT administration of ertapenem was effective and decreased costs associated with MDR UTIs,[15] a finding similar to ours.

The most common bacteraemic isolate in our OPAT cohort was *E. coli*. Enhanced surveillance of *E. coli* bacteraemia has been mandatory for NHS acute trusts since June 2011.[16] In England, the incidence of bacteraemia is 56/100 000 and ~12% are ESBL producers or MDR. In 2015, 37 275 bacteraemic episodes were reported and approximately 3000 bacteraemic episodes were either ESBL producers or required intravenous antibiotics due to resistance to all suitable oral agents. If, based on our data, a third of bacteraemic episodes could be treated out of hospital (~1000/annum) for an average of 5 days, then a possible 5000 hospital bed days could be saved in England each year.

Our blood culture database was also useful in identifying other medical conditions not normally treated with intravenous antibiotics out of hospital, including enteric fevers, biliary tract infections and central venous catheter-associated infections where line salvage was being attempted. In the absence of a blood culture result it is unlikely these patients would have been recruited to OPAT.

There were no deaths in the OPAT group with bacteraemia, despite bacteraemia being a marker of severe infection. Many of these patients were recruited after hospital admission and then stabilised before discharge on an intravenous antibiotic. In addition to reducing length of inpatient stay, our data demonstrate the safety of this approach. Among bacteraemic patients recruited to OPAT, all had community-onset infections. Hospital-acquired infections are generally medical device related or procedure related, and more commonly occur in patients in critical care areas,[17] so it is not surprising that the majority of patients recruited had community-acquired bacteraemia.

There were limitations to this study. Before and during this study, we did not record information on the proportion of unsuitable patients referred to OPAT, nor did we have prestudy data on our OPAT mix including bacteraemic patients. Because of our proactive approach, it is possible patients were identified before clinical teams had time to refer (which, in part, is dependent upon awareness of OPAT services within our NHS trust). The numbers of bacteraemic patients recruited to OPAT were small and as there were no deaths in the 'bacteraemic' and 'non-bacteraemic' groups, a survival analysis was not possible. In logistic regression analysis for bacteraemic patients, we were unable to include place of acquisition in the model as no patients with hospital-acquired infection were recruited. In a larger study, where there were patients with hospital-acquired infection, we could have tested the association between community-onset bacteraemia and OPAT recruitment. The sample size was, however, big enough to demonstrate significant differences in unadjusted and adjusted data.

In summary, our study demonstrates that a blood culture database provided a useful adjuvant to a clinical referral system for OPAT recruitment. The blood culture database was particularly useful for prompting the identification of patients with community-onset infections and MDR UTIs caused by ESBL-producing *E. coli*. Bacteraemic patients received treatment safely and all had good clinical outcomes. Within the UK, each year, clinical assessment of all patients with ESBL-producing *E. coli* bacteraemia could identify hundreds of hospitalised patients suitable for OPAT recruitment, with the potential to reduce length of inpatient stay without compromising patient safety and clinical outcomes.

Main messages

- As a blood culture database provides a useful adjuvant to a clinical referral system, an infection specialist (including a microbiologist) can prompt or make outpatient parenteral antibiotic treatment (OPAT) referrals.
- This is especially useful for community-onset, extended-spectrum β-lactamase (ESBL)-producing or multidrug resistant *Escherichia coli* urinary tract infections (UTIs) that cause bacteraemia.
- All bacteraemic patients recruited to OPAT received safe treatment and had good clinical outcomes.

Current research questions

- Would a standardised comment, appended to extended-spectrum β-lactamase (ESBL)-producing *Escherichia coli* blood culture reports, increase outpatient parenteral antibiotic treatment (OPAT) recruitment and safely decrease length of inpatient stay?
- What would be the national effect on length of inpatient stay if a standardised comment was automatically attached to ESBL-producing *E. coli* blood culture results in all UK NHS trusts?
- Other than blood cultures, how useful are significant microbiology results in prompting assessment for OPAT recruitment?

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Contributors MM collected and analysed data in conjunction with LMP. Statistical analysis was performed by CW.

Competing interests None declared.

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Provenance and peer review Not commissioned; externally peer reviewed.

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