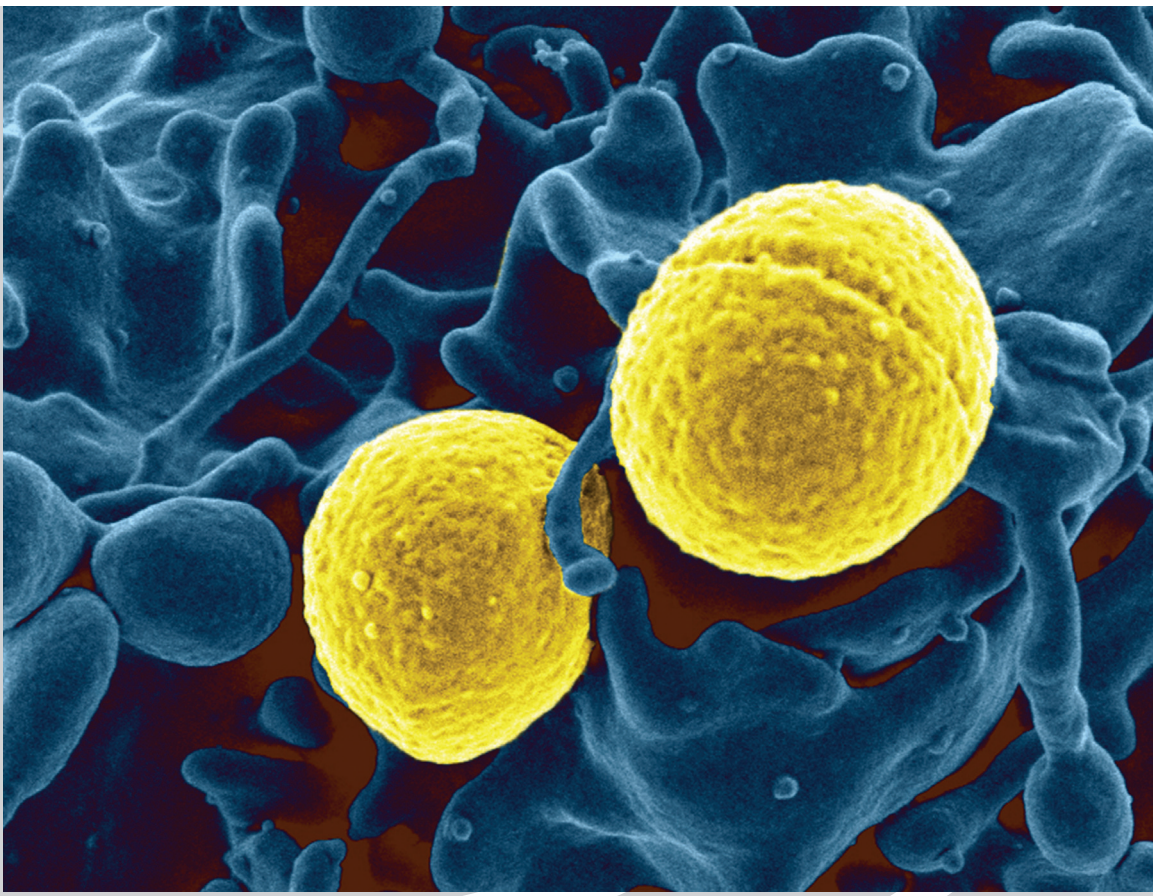
Just Say Sepsis!

A review of the process of care received by patients with sepsis



NCEPOD

Improving the quality of healthcare

Just Say Sepsis!

A review of the process of care received by patients with sepsis

A report by the National Confidential Enquiry into Patient Outcome and Death
(2015)

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Foreword

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This NCEPOD study addresses a huge subject, which sets it aside from those of our reports that have focused on Cinderella topics, parts of the NHS that have been previously overlooked. Sepsis, by which we mean the systemic inflammatory response to microbial infection, causing damage to organs then shock and ultimately death is a common problem: the international prevalence is estimated[1] at 300 per 100,000, suggesting that there are around 200,000 cases a year in the UK alone. To put this into the context of our recent studies, there are around 5,500 lower limb amputations, a similar number of subarachnoid haemorrhages, 8,000 or so aortic aneurysms, 9,000 deaths from alcohol-related liver disease, 10,000 tracheostomies and 11,600 bariatric procedures performed per year. Sepsis eclipses even the 90,000 patients treated for gastrointestinal bleeding.

Sepsis is important because it is a major cause of avoidable death in our hospitals. According to the same source[1], the current mortality from sepsis is greater than that from myocardial infarction in the 1960's. We are told that the survival from sepsis-induced hypotension is over 75% if it is recognised promptly, but that every hour's delay causes that figure to fall by over 7%,[2] implying that the mortality increases by about 30%. Since we found that longer delays in treatment are commonplace, the results of this study should make everyone sit up and take notice.

Sepsis is also important because it has become more difficult to manage. It used to be viewed as a disease invariably caused by gram-negative bacteria, but the picture has changed over the last 30 years. In over 60% of the cases we reviewed, no pathogen was ever identified and where bacteria were implicated, the majority were gram-positive bacteria that either refused to be cultured or to disclose their sensitivities when they are cultured made up a majority of the pathogens these physicians had to treat. Our experts also tell us that in a significant number of cases the culprit now turns out to be viral or fungal, although that did not seem to be so in the cases we studied.

The laity are well aware that medicine is constantly evolving as new interventions are introduced. To discover that the bugs are doing the same takes a bit of getting used to: these are not necessarily bacteria that are developing new resistances or sharing their resistances to individual antibiotics through species-jumping, although no doubt that is adding to the problem. Here the nature of the disease is becoming both more complicated and more elusive. Critics must acknowledge that medicine has never been easy and here it is getting more difficult.

Finally, this is a significant study precisely because the importance of the issue has been recognised by others, including ongoing work at NHS England and the '1000 Lives Plus' national improvement programme in Wales. The role of this report is not to draw attention to an unrecognised problem but to examine an acknowledged problem much more closely than before and to demonstrate how these patients are being let down. Here you will learn the nature of the malady and the remedies our peer reviewers prescribe.

The first thing that strikes me is that being a big subject has enormous advantages. Since the problem is so common, the NHS can justify providing appropriate resources to cater for it. That is not as easy as it sounds because it also commonly presents in the community. Nevertheless it is straightforward to provide the protocols and resources needed in a network across the nation. If it happens well over 100,000 times a year and the patients remain in hospital for some time, there will at least be no shortage of cases in most of our acute hospitals, so there should be plenty of opportunities to train clinicians to recognise and deal with the condition.

1 *National Clinical Effectiveness Committee of Ireland – Nov 2014 No 6 - Sepsis*
2 *See page 81*

It should also be relatively easy to put the armamentarium at the disposal of the clinicians to enable them to manage the initial interventions effectively. I was struck by how very simple are the components of good first line treatment, which in many cases will hold the key to optimising survival. The Sepsis Six is a well-known set of 3 investigations and 3 initial therapies, none of which are remotely surprising: start the patient on high flow oxygen and take blood for culture before treatment starts: put up intravenous fluids and give intravenous antimicrobials and later change them if the cultures suggest they are wrong; measure the lactate, do a full blood count, and monitor the urine output. None of these first line interventions are beyond the competence of juniors or the resources of the departments in which they work. Of course the management of the later onset of multi organ failure is extraordinarily difficult and will usually require sub-specialist involvement, as will the management of culture-negative organisms, but a good outcome for many appears to depend primarily on recognising the problem and doing the simple things right and promptly.

Sadly that is not what is happening in the majority of our cases: about one third received good care in the opinion of our peer reviewers, who are mainstream healthcare professionals treating this condition on a regular basis. They asked themselves a simple question: is this a standard of care that I would accept from my own team, or is there room for improvement? These are not harsh or exacting standards posed by a critic trying to score a point. NCEPOD takes enormous care to ensure that our reports are not skewed, either by unrealistic enthusiasts for a cause or by dyed-in-the-wool defenders of a status quo that they expect to be mediocre. Having agreed on what they are looking for before they start, our peer reviewers have to explain and defend their conclusions to the group of colleagues with whom they are studying the cases in our offices in every case.

We believe that by this process we articulate the views of the mainstream professions treating this disease on a daily basis. The value of the vignettes is that they spell out to the rest of us what the peer reviewers mean when they say something is good practice or leaves room for improvement in terms that all of us can understand.

The reasons why poor practice is occurring more often than we would hope are varied but they will not come as any surprise to readers of recent NCEPOD reports, because at root the themes are familiar. Sick patients have to be identified by their families and carers, then assessed by clinicians and nurses who are able to recognise the diagnosis because they have seen it before. In the Emergency Departments cases of sepsis have to be distinguished from the other 99% of the 24 million new cases now coming to our hospitals every year.[3] Those cases that occur amongst existing inpatients may be even harder to spot because the onset may be insidious and the assessment of the problem may be less analytical on the part of those who are managing an existing condition.

One broad underlying problem is that the recognition of illness often requires more experience than junior members of staff can draw upon. To mitigate this problem, first NCEPOD and subsequently the Royal Colleges and NHS England have called for all acute admissions to be seen by a consultant within 12 or 14 hours. Although welcome as an initiative to improve patient care, this will inevitably diminish the importance of the assessment by the juniors and the experience they are acquiring, which will need to be factored into future training.

However according to this report neither the subtlety of the disease nor the inexperience of the doctors seems to be the mainspring of the problem. It may be very difficult to make the diagnosis of sepsis in some cases, but if you are confronted with a suspected infection and do not measure the vital signs you are not enhancing your chances. This is the first study where we have looked at events in general practice and we must be tentative in advising colleagues: here we only had three GP peer reviewers looking at a handful of sets of notes: I know from my own work that GPs still vary more than hospital doctors in the ways in which they record events. There were 129 cases and in 52 of them our peer reviewers sensibly decided that there was too little data for them to be able to say whether the diagnosis had been missed.

We can all understand that it may be difficult for a GP to know whether to give an antimicrobial intravenously, especially if they do not carry the equipment to take

3 NHS Health and Social Care Information Centre

blood for culture at the same time. But in one third of the cases we reviewed, not one of the four basic vital signs of temperature, pulse, blood pressure and respiratory rate had been recorded.[4] When patients were sent in to hospital no referral letter was available in 43% of cases.[5]

As I say, our authors and peer reviewers are well aware that they have to get used to a new environment and to develop an understanding of the variety of different ways in which GPs work, but it looks to me as if NCEPOD has found a rich field in which they can contribute the insights of their colleagues to GPs up and down the country.

Furthermore, when these patients reached the Emergency Department things did not always improve very much. The number of measurements went up, but a full set of vital signs were recorded in only 40% of cases. For the most part the diagnosis was not made when it should have been and when it was made, the presumed source of infection was not recorded. In a significant minority of cases, no proper record of obligatory first line investigations was made. Of course this may reflect that they had been noted to be normal and the clinicians caring for them were too busy to make a written record of normal findings. Unfortunately, as I so often have to tell my clients, the default position is that if it was not written down, broadly speaking it did not happen. Furthermore, in this disease more than most, a change in the vital signs can be a sensitive pointer to a change in the patient's condition, however busy the doctor is at the time.

Given that this is a progressive disease it is not surprising that the clinicians found it easier to recognise that their patients were ill when their condition had evolved and the severity had become more obvious. But that is precisely why the protocols and pathways are designed to elicit the subtle gradations that may reveal a downward trend in time to make the difference between life and death. They are there to help the inexperienced who understandably find it harder to recognise the sick patient, but the evidence seems to be that they are not being used consistently.

Treatment seems to be no more disciplined than diagnosis. I was astonished to read that the majority of patients do not receive antimicrobial drugs within an hour of the diagnosis of *severe* sepsis. Given that delay may increase the mortality by 30% if the patient has progressed to hypotension, it is a "golden hour" for these sepsis patients just as much as it is for the patient with a coronary thrombosis or stroke. Today we have a national network of primary angioplasty centres served by teams in which paramedics have been trained to play a key part, all dedicated to the proposition that every minute lost represents the loss of cardiac muscle. The same sort of progress is being made in stroke services, with Hyperacute Stroke Units being supported in the same ways so that appropriate therapies can be delivered within very narrow windows of opportunity. Despite the high profile attention, it seems that infection still does not get the same priority in practice.

This study is unusual in that our peer reviewers found far less to criticise in the organisation of care than they did in the clinical delivery of that care. This reflects the fact that the organisation can be so much simpler than in other diseases. The administration of an antibiotic and fluids intravenously takes a fraction of the resources needed to maintain a primary angioplasty service or a Hyperacute Stroke Unit. If the treatment can be delivered at every Emergency Department, there is less need to train the paramedics to make the diagnosis so as to take their patients to the optimal location. However, one of the most disturbing tables in this remarkable report concerns the baseline therapies started by the hospitals before they transferred patients, having presumably recognised that they needed specialist care.[6] Knowing that the patient is being moved because they are acutely ill and will often take several golden hours before they have been settled and assessed by another doctor it seems obvious that they should be started on an antimicrobial (which entails that blood samples must first be taken for culture) and given IV fluids and oxygen to support them during the transfer period when there may be no doctor with them. How could that not happen in the majority of cases? It is hard to escape the conclusion that an appropriate sense of urgency is lacking in far too many cases.

This is the 13th and last report I will have the privilege of presenting. I have been working with NCEPOD for 11 years, for the last 6 as its Chair and it is time to hand over. I do

4 See Table 3.22
5 Table 3.23
6 Table 2.19

not know how the organisation will change in the future, but if the past is anything to go by, NCEPOD will continue to adapt to meet changes from outside, always providing the profession's contribution with constructive criticism of what goes on within and increasingly beyond our hospitals. Because it depends primarily on the old-fashioned altruism and professionalism of clinicians who want to find out how to do better for their patients, it is the one aspect of the NHS whose cost has not spiralled out of control. As medicine has become more complicated to deliver at the same time as our tolerance of variability has diminished, the need for that professionalism has increased. In most cases we cannot make medicine, the most altruistic and unforgiving of professions, better by regulation or by bringing in the criminal law. The mainstay of treatment must be to set the professionals free and to give them the information that will enable them to do better by their patients: that is all any of them want to do, and the existence of NCEPOD – a nationwide organised process of self criticism that is composed of representatives of the professions - is evidence of their determination to improve what happens to all of us when we are ill.

It remains only for me to thank all those who have contributed to this study. The UK Sepsis Trust who asked us to look at the subject, the study advisory group who devised the detail of the study and told us what questions to ask; the Local Reporters and study contacts who spotted the cases and collected the notes and the clinicians who filled in the questionnaires; back at base the peer reviewers who did the heavy lifting of scrutinising the case notes and the co-ordinators who supervised them; then the research team at NCEPOD who collated and analysed the data, the authors who wrote up the report you are holding in your hands or reading on screen and the Steering Group of Royal College and Specialty Association nominees and others who are the members of NCEPOD and who provided our peer review, criticising the raw data when it was presented to them and the report when early drafts were circulated.

As it is my last report I may also be allowed to mention all my fellow Trustees that I have worked with over the years: they have all been a pleasure to work with and the leadership they provide to the debates at the Steering Group has been especially stimulating. We have been a strongly united group, all believing without any reservation in the work and effectiveness of the organisation. This is partly because we have no doubt that we got the most important single decision in my 11 years right, when we chose Dr Marisa Mason to be Chief Executive: she has been a superb leader and with Dr Neil Smith as her Deputy, and the excellent NCEPOD staff behind them, this is a team that will go from strength to strength.

Bertie Leigh
NCEPOD Chair

Principal recommendations

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All hospitals should have a formal protocol for the early identification and immediate management of patients with sepsis. The protocol should be easily available to all clinical staff, who should receive training in its use. Compliance with the protocol should be regularly audited. This protocol should be updated in line with changes to national and international guidelines and local antimicrobial policies. *(Medical Directors)*

An early warning score, such as the National Early Warning Score (NEWS) should be used in both primary care and secondary care for patients where sepsis is suspected. This will aid the recognition of the severity of sepsis and can be used to prioritise urgency of care. *(General Practitioners, Ambulance Trusts, Health Boards, NHSE, Clinical Directors, Royal Colleges)*

On arrival in the emergency department a full set of vital signs, as stated in the Royal College of Emergency Medicine standards for sepsis and septic shock should be undertaken. *(Emergency Medicine Physicians, Clinical Directors, Nursing Directors)*

In line with previous NCEPOD and other national reports' recommendations on recognising and caring for the acutely deteriorating patients, hospitals should ensure that their staffing and resources enable:

a. All acutely ill patients to be reviewed by a consultant within the recommended national timeframes (max of 14 hours after admission)
b. Formal arrangements for handover
c. Access to critical care facilities if escalation is required; and
d. Hospitals with critical care facilities to provide a Critical Care Outreach service (or equivalent) 24/7. *(Medical Directors, Nursing Directors, Commissioners)*

All patients diagnosed with sepsis should benefit from management on a care bundle as part of their care pathway. The implementation of this bundle should be audited and reported on regularly. Trusts/Health Boards should aim to reach 100% compliance and this should be encouraged by local and national commissioning arrangements. *(Medical Directors, Clinical Directors, Commissioners)*

See the full list of recommendations on page 107

Introduction

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Sepsis is defined as an overwhelming response to infection in which the immune system initiates a potentially damaging systemic inflammatory response syndrome (SIRS) which can manifest in a number of physiological changes, recognised by worsening vital signs or 'SIRS criteria' (temperature, respiratory rate, heart rate). Severe sepsis is defined as sepsis leading to dysfunction of one or more organ systems according to current criteria.[1] This year, international consensus definitions will be amended to focus on physiological changes of organ dysfunction, including hypotension, tachypnoea and altered mental state.[2] Sepsis is already recognised as difficult to diagnose and it can only be hoped that a new definition will aid this process. However, whichever definition is used it is the wider consideration given to sepsis by healthcare professionals that is important.

Over 70% of cases of sepsis are believed to arise in the community.[3] General practitioners and other pre-hospital services present key opportunities for prompt recognition and treatment of sepsis. Patients requiring hospital care may be admitted through emergency departments or admissions units, where the same issue of prompt recognition is equally important. In 2011, the Royal College of Emergency Medicine conducted an audit of compliance with sepsis management standards in emergency departments. Compliance was found to be suboptimal at 27-47%.[4] A repeat audit in 2013-14 showed mixed results with marginal improvement.[5]

Sepsis can also occur in patients already in hospital who acquire infections and whose condition deteriorates. In 2005 NCEPOD reported that acutely ill patients were languishing in wards not being recognised nor escalated quickly enough.[6] Since then there have been National Institute for Health Excellence and Care (NICE) guidelines produced (CG50)[7] and work undertaken by the National Patient Safety Agency (NPSA as it was) around recognition of the critically ill patient.[8] Sepsis is part of that severely ill/deteriorating patient scenario and it is relevant to all specialties. When a patient has worsening vital signs they need to be recognised and acted upon and whilst early warning scores such as NEWS are increasingly used[9], the possibility of sepsis should form part of that process. In 2010, the Scottish Trauma Audit Group (STAG) conducted an audit of sepsis within acute hospital settings. 1.7% of new admissions developed criteria for sepsis within 2 days of attendance; 34% of these patients met the criteria for severe sepsis, with a mortality of 24% in this group.[10]

Treatment of the infection in patients with sepsis is paramount. In 2010, the International Surviving Sepsis Campaign (SSC) published results in over 15,000 episodes showing that delivery of early antibiotics (at that stage within 3 hours) was independently associated with survival, but was achieved in only 67% of cases.[11] The recommendation has since been changed to delivery of antibiotics within 1 hour of severe sepsis being identified.[1] However, the importance of administering antimicrobials in an era when doctors are being advised not to over-prescribe them is somewhat confusing and this is an area that needs attention to ensure that patients are treated effectively but that there is robust antimicrobial stewardship.[12,13]

One systematic issue that hinders the knowledge about sepsis is its limited coding. Within the United Kingdom there is believed to be an underestimate of the incidence of sepsis as coding guidelines prioritise the source of infection over sepsis as a primary coded term. The incidence of severe sepsis depends on how acute organ dysfunction is defined and on whether that dysfunction is attributed to an underlying infection. Organ dysfunction is often defined by the need and provision of supportive therapy (e.g. mechanical ventilation), and epidemiologic studies thus only count the cases in which treatment is undertaken. This under reporting of sepsis will mean that as a condition it will be under resourced, and there will be limitations in the opportunity to audit it and learn from the cases at mortality reviews. In the UK an estimated 37,000 patients die with

sepsis per year[14] and a further estimate of 65,000 people per year survive episodes of severe sepsis, often with serious long-term complications: amputation, muscular contraction, irreversible damage to lungs, heart and kidneys, neuro-psychiatric disorders such as cognitive dysfunction and post-traumatic stress disorder. Early recognition is therefore vital.

There is an increasing focus on sepsis from health and political organisations with a will to improve the care of patients with sepsis. NHS England has identified tackling sepsis as a clinical priority for improving patient outcomes for 2015/16.[15] Sepsis has been linked to a new CQUIN in England.[16] NICE are currently developing sepsis guidelines.[17] A new study is assessing the 'Size of Sepsis in Wales'[18] following on from a point-prevalence study in 2014.[19] In 2014 MBRRACE-UK published a themed confidential enquiry which reviewed maternal mortality and morbidity due to sepsis.[20] In 2013 the Parliamentary and Health service Ombudsman published her first clinical report "Time to Act" identifying common themes in 10 case studies of patients who died following sepsis.[21] This report identified failings throughout the patient pathway: from carrying out a timely initial assessment and identifying the source of infection to adequate monitoring and timely initiation of treatment. This NCEPOD study similarly looks in detail at individual cases to identify common themes. 2013 also saw the formation of the All Party Parliamentary Group (APPG) on sepsis which has recently published 10 recommendations in a report highlighting similar themes to those presented here.[22]

Sepsis is a major cause of avoidable mortality and morbidity. This study, whilst considering the plethora of other work in this important area, sets out to identify in greater detail, remediable factors which if addressed would improve the quality of care of patients with sepsis.

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Method and Data Returns

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Method

Study Advisory Group

The Study Advisory Group comprised a multidisciplinary group of senior clinicians from the following specialties: acute medicine, emergency medicine, general surgery, obstetrics and gynaecology, microbiology, critical care medicine, pathology, public health strategy, general practice, critical care outreach nursing and patient representation.

Study aim

The aim of the study was to identify and explore remediable factors in the process of care for patients with sepsis.

Objectives

- To examine organisational structures, processes, protocols and care pathways for sepsis recognition and management in hospitals from admission through to discharge or death.
- To identify avoidable and remediable factors in the management of the care for a representative sample of adult patients with sepsis, throughout the patient pathway from presentation to primary care (if applicable), throughout secondary care to discharge or death, focusing on the following areas of care:
  - Evaluation of the use of systems and processes that are in place within hospitals to facilitate timely identification, escalation and appropriate treatment of infection, including transfer to high dependency and intensive care units where appropriate
  - Examining the recognition of sepsis and early signs of septic shock across the entire patient pathway
  - Investigating the appropriate management of sepsis
  - Reviewing whether there was a multidisciplinary team approach
  - Assessing the adequacy of communication with families and carers, as could be ascertained from the case notes
  - Examining the management of the end of life pathway and ceilings of treatment

Hospital participation

National Health Service hospitals in England, Wales and Northern Ireland were expected to participate as well as hospitals in the independent sector and public hospitals in the Isle of Man, Guernsey and Jersey. Within each hospital, a named contact, referred to as the NCEPOD Local Reporter, acted as a link between NCEPOD and the hospital staff, facilitating case identification, dissemination of questionnaires and data collation.

Population

Adult patients, ≥16 years old, identified as being seen by the Critical Care Outreach Team or equivalent, or who were admitted directly to critical care during the study period with a diagnosis of sepsis, based on presence of infection, documented or suspected, and two or more of the following:

- Fever (> 38.3°C)/hypothermia (core temperature < 36°C)
- Heart rate > 90/min – 1 or more than two standard deviations above the normal value for age
- Tachypnoea (respiratory rate >20 breaths/minute)
- Acutely altered mental status
- Arterial hypotension (systolic blood pressure < 90 mmHg, mean arterial pressure < 70 mmHg, or a systolic blood pressure decrease > 40 mmHg or less than two standard deviations below normal for age)
- Hyperglycemia (plasma glucose > 140 mg/dL or 7.7 mmol/L) in the absence of diabetes
- Leukocytosis (white blood cell count > 12,000 μL^{-1}) or Leukopenia (white blood cell count < 4000 μL^{-1}) (or normal white blood cell count with >10% immature forms)

Adapted from: Signs & symptoms of infection highlighted in Surviving Sepsis Campaign Sepsis Screening Tool.[1]

From the cases identified, a sample of 5 cases per hospital was randomly selected to be included in the study.

Exclusions

- Immunosuppressed neutropaenic patients on chemotherapy, immunosuppressant drugs or patients with solid organ transplant
- Pregnant women up to 6 weeks post-partum (covered by MBRRACE-UK maternal sepsis morbidity study)[20]
- Patients on an end of life care pathway at the time of diagnosis, or a consultant-led decision made not to escalate (prior to entry into the study)
- Patients who developed sepsis after 48 hours on critical care

Case identification

During the two-week data collection period, 6th-20th May 2014, all patients who met the inclusion criteria were identified prospectively by nominated study contacts in critical care and on the Critical Care Outreach Team.

Whilst it was assumed that prospectively identifying patients with sepsis is more effective than relying on a retrospective identification through ICD10 coding, it is possible that the Study Contacts on critical care and the Critical Care Outreach Team may not have identified every possible patient that was eligible for the study. However, this would not have affected the sampling as the peer reviewed sample was limited to a maximum of five cases per hospital anyway. This study is a snapshot of the care provided to patients with sepsis.

Furthermore, this study was designed to examine the care of patients who were more unwell with sepsis, by only including patients who were either admitted to critical care or who were reviewed by the Critical Care Outreach Team. The study was not therefore able to comment on the care of patients who died in the community or in the emergency department, or who died before being reviewed by the Critical Care Outreach Team. Nor can comment be made on those patients who were never escalated to the Critical Care Outreach Team or critical care, either because they had timely interventions and did not deteriorate sufficiently or because they had treatment limitation decisions made early in their pathway or those patients who were never recognised as having sepsis.

Questionnaires and case notes

Two questionnaires were disseminated to collect data for this study; a clinician questionnaire relating to each patient included and an organisational questionnaire for each hospital participating in the study, regardless of whether they had patients included in the study. Questionnaires were designed with input from the Study Advisory Group.

Clinician questionnaire

This questionnaire was sent to the named consultant responsible for the patient prior to admission to critical care/ review by the Critical Care Outreach Team. If the consultant was not the most suitable person to complete the questionnaire then they were asked to identify a more appropriate consultant. This questionnaire was used to collect data on the care of the patient throughout their pathway of care from presentation with sepsis to death, discharge or remaining in hospital 30 days after admission.

Organisational questionnaire

The organisational questionnaire was sent to the NCEPOD Local Reporter to be completed with the help of relevant specialty leads. Data were requested on the policies and protocols in place at each hospital, on the availability of services, facilities and staffing relevant to patients with sepsis. Information was also collected on any sepsis care quality improvement initiatives.

In addition to the acute hospitals to which patients with sepsis would be admitted for treatment, community and independent hospitals were also included in the organisational part of the study, despite the fact that they may not have patients with sepsis admitted to them. This was to see if there were organisational structures in place to manage the initial care of patients who may develop sepsis as an inpatient.

Case notes

Photocopied case note extracts were requested for each case that was to be peer reviewed. For the entire admission:

- All inpatient annotations/medical notes
- Nursing notes
- Critical care notes
- Operation/procedure notes
- Anaesthetic charts
- Observation charts
- Haematology/biochemistry/microbiology results
- Fluid balance charts
- Drug charts
- Consent forms
- Discharge letter/summary
- Autopsy report if applicable

General practitioner (GP) case notes

For cases where it was recorded on the clinician questionnaire that the patient had been seen by their GP in relation to the hospital admission for sepsis (regardless of whether or not the GP referred the patient to hospital), the details of the GP were extracted from the case notes and copies of the GP case notes for the two-week period prior to the hospital admission were requested.

Peer review

A multidisciplinary group of Reviewers was recruited to peer review the case notes and associated clinician questionnaires. The group of Reviewers comprised consultants, associate specialists, trainees and clinical nurse specialists, from the following specialties: acute medicine, emergency medicine, general medicine, nephrology, critical care outreach, anaesthesia, intensive care medicine, respiratory medicine, microbiology and general and plastic surgery. In addition general practitioners were recruited to review the GP case notes separately.

Questionnaires and case notes were anonymised by the non-clinical staff at NCEPOD prior to peer review. After being anonymised each case was reviewed by at least one Reviewer within a multidisciplinary group. At regular intervals throughout the meeting, the Chair allowed a period of discussion for each Reviewer to summarise their cases and ask for opinions from other specialties or raise aspects of the case for discussion.

Reviewers answered a number of specific questions by direct entry into a database, and were also encouraged to enter free text commentary at various points.

The grading system below was used by the Reviewers to grade the overall care each patient received:

Good practice: A standard that you would accept from yourself, your trainees and your institution.
Room for improvement: Aspects of **clinical** care that could have been better.
Room for improvement: Aspects of **organisational** care that could have been better.
Room for improvement: Aspects of both **clinical and organisational** care that could have been better.
Less than satisfactory: Several aspects of clinical and/or organisational care that were well below that you would accept from yourself, your trainees and your institution.
Insufficient data: Insufficient information submitted to NCEPOD to assess the quality of care.

Quality and confidentiality

Each case was given a unique NCEPOD number. The data from all questionnaires received were electronically scanned into a preset database. Prior to any analysis taking place, the dataset was cleaned to ensure that there were no duplicate records and that erroneous data had not been entered during scanning. Any fields containing data that could not be validated were removed. Section 251 approval had been granted for this study.

Data analysis

Following cleaning of the quantitative data, descriptive data summaries have been produced. The qualitative data collected from the Reviewers' opinions and free text answers in the clinician questionnaires were coded, where applicable, according to content to allow quantitative analysis. The data were reviewed by NCEPOD Clinical Co-ordinators, a Clinical Researcher and a Researcher, to identify the nature and frequency of recurring themes.

Case studies have been used throughout this report to illustrate particular themes.

All data were analysed using Microsoft Access™ and Excel™ by the research staff at NCEPOD.

The findings of this report were reviewed by the Study Advisory Group, Reviewers, NCEPOD Clinical Co-ordinators and the NCEPOD Steering Group prior to publication.

Data returns

In total 3,363 patients from 305 hospitals were identified as meeting the study inclusion criteria during the two-week case identification period (Figure 1). When the sampling criterion of 5 cases per hospital was applied, 884 cases were selected for inclusion. A total of 710/884 (80.3%) completed clinician questionnaires and 657 sets of case notes were returned to NCEPOD. The Reviewers were able to assess 551 cases, the remainder of the returned case note extracts were either too incomplete for assessment or were returned after the final deadline and last case reviewer meeting. There were 129 cases identified where the patient saw their GP in relation to the admission (which did not necessarily lead to a referral to hospital). Of these, 60 sets of GP notes were received and 54 were suitable for review.

Study sample denominator by chapter

Within this study the denominator will change for each chapter and occasionally within each chapter. This is because data have been taken from different sources depending on the analysis required. For example, in some cases the data presented will be a total from a question taken from the clinician questionnaire only, whereas some analysis may have required the clinician questionnaire and the Reviewers' view taken from the case notes.

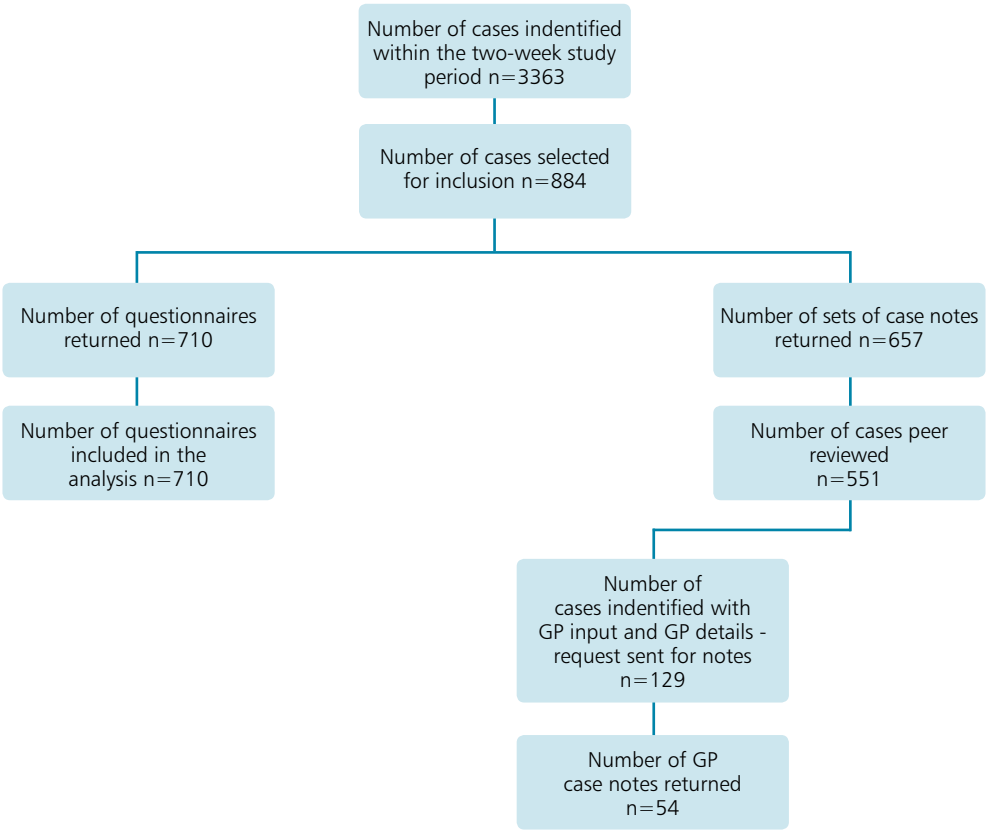

Figure 1 Data returns

2

Organisational data

Back to contents

An organisational questionnaire was sent to all participating hospitals to understand the systems and processes in place to manage patients with sepsis. In all, 549 hospitals responded (Table 2.1) with 162 (29.5%) hospitals identified as District General Hospitals (DGH) and 53 (10%) as University Teaching Hospitals (UTH). There was also a good response from those identified as independent and community hospitals (however, it can be seen later that these hospitals contributed few patients to this study since only hospitals with on-site critical care facilities participated in the case review part of the study). The remaining hospitals from which a response was received were described as a non-acute peripheral or satellite hospital within an acute Trust/ Health Board or a rehabilitation hospital.

Of the hospitals from which a response was received, 201 hospitals reported that they had an emergency department (ED). They comprised 149 DGHs and 40 UTHs (Table 2.2).

Table 2.1 Hospital type

Type	Number of hospitals	%
District General Hospital (DGH) ≤ 500 beds	102	18.6
District General Hospital (DGH) > 500 beds	60	10.9
University Teaching Hospital (UTH)	53	9.7
Tertiary Specialist Centre (TSC) – stand alone	28	5.1
Independent Hospital (IH)	83	15.1
Community or Cottage Hospital (CH)	204	37.2
Peripheral Hospital (PH)	6	1.1
Rehabilitation Hospital (RH)	13	2.4
Total	**549**	

Table 2.2 Availability of an emergency department

Available	Yes	No	Subtotal	Not answered	Total
District General Hospital (DGH) ≤ 500 beds	90	11	**101**	1	**102**
District General Hospital (DGH) > 500 beds	59	1	**60**	0	**60**
University Teaching Hospital (UTH)	40	13	**53**	0	**53**
Tertiary Specialist Centre (TSC) – stand alone	5	23	**28**	0	**28**
Independent Hospital (IH)	1	77	**78**	5	**83**
Community or Cottage Hospital (CH)	5	171	**176**	28	**204**
Peripheral Hospital (PH)	1	5	**6**	0	**6**
Rehabilitation Hospital (RH)	0	11	**11**	2	**13**
Total	**201** (39.2%)	**312** (60.8%)	**513**	**36**	**549**

Table 2.3 Opening hours of the emergency department

Opening hours	Number of hospitals	%
24 hours/day, 7 days/week	192	96.0
Normal working hours (8am-6pm) 7 days/week	1	<1
Other hours	7	3.5
Subtotal	**200**	
Not answered	1	
Total	**201**	

A large majority of hospitals reported they had an ED which provided a 24/7 service (Table 2.3). The seven hospitals that did not provide such services were all community hospitals that provided extended twilight cover usually up to 8pm or 10pm.

Protocols for identification and management of sepsis

Early recognition and management of sepsis leads to reduction in morbidity and mortality[23,24] and administration of an effective antimicrobial within the first hour of hypotension has been associated with a survival rate of 79.9%.[25,26]

Care bundles and protocols have made a major impact in management of time sensitive medical conditions like stroke and heart attacks.[27] Such protocols and bundles have also been shown to help with the early identification and management of sepsis.[28] They will be discussed later in the report at the patient level, but at an organisational level 360/544 (66%) hospitals reported that they had a sepsis protocol. Within a subgroup of DGHs and UTHs 194/212 (92%) had a protocol, while 50% of the other hospitals had one (Table 2.4).

Table 2.4 Presence of a specific protocol/care pathway/ bundle for recognition and management of patients with sepsis

Sepsis protocol	Yes	No	Subtotal	Not answered	Total
District General Hospital (DGH) ≤ 500 beds	91	10	**101**	1	**102**
District General Hospital (DGH) > 500 beds	55	5	**60**	0	**60**
University Teaching Hospital (UTH)	48	3	**51**	2	**53**
Tertiary Specialist Centre (TSC) – stand alone	18	9	**27**	1	**28**
Independent Hospital (IH)	54	29	**83**	0	**83**
Community or Cottage Hospital (CH)	79	124	**203**	1	**204**
Peripheral Hospital (PH)	4	2	**6**	0	**6**
Rehabilitation Hospital (RH)	11	2	**13**	0	**13**
Total	**360** (66.1%)	**184** (33.8%)	**544**	**5**	**549**

Table 2.5 Source of protocol

Source of protocol	Number of hospitals	%
Taken directly from national/ international guidelines	92	26.8
Modified version of national/ international guidelines	208	60.6
Locally developed protocol/care pathway/ bundle	66	19.2

Answers may be multiple n=343; not answered in 17

There was some uniformity in what was included in hospital protocols and 4 out of 5 hospitals drew on national and international guidance to produce their local protocols (Table 2.5).

Table 2.6 Details of protocol

Actions included:	Yes	%	No	%	Subtotal	Not answered	Total
Administering IV fluids	330	94.3	19	5.4	**349**	11	**360**
Administering IV antimicrobials	323	95.3	16	4.7	**339**	21	**360**
Blood cultures to be taken before antimicrobials administered	320	93.6	22	6.4	**342**	18	**360**
Administering oxygen therapy	328	95.1	17	4.9	**345**	15	**360**
Early lactate measurement	307	91.4	29	8.6	**336**	24	**360**
Catheterisation/urine output measurement	323	93.9	21	6.1	**344**	16	**360**

Answers may be multiple

Table 2.6 shows some of the details found in the protocol, the 16 hospitals whose protocol did not include administering IV antimicrobials were all community hospitals.

The questionnaire collated data on whether a time frame was specified for completing these early actions detailed in the protocols (Table 2.7).[1]

Table 2.7 Specified time frame for actions listed in sepsis protocol

Time frame	Number of hospitals	%
Yes	325	94.2
No	20	5.8
Subtotal	**345**	
Not answered	15	
Total	**360**	

Table 2.8 Time frame for actions listed in sepsis protocol

Time frame	Number of hospitals	%
0 - 1 hours	305	95.0
> 1 - 6 hours	16	5.0
Subtotal	**321**	
Not answered	4	
Total	**325**	

Most protocols did specify a timeframe for actions to be taken on identifying sepsis. All hospitals responded that the actions would be completed within six hours and the majority actually set this to less than one hour (Table 2.8).[1]

Of note is that 11 of the 184 hospitals that reported that they did not have a protocol for identifying and managing sepsis did not have a more general protocol for management of the deteriorating patient. These included one DGH, two TSCs, one IH and seven CHs (Table 2.9).

Table 2.9 Availability of a general protocol for the management of deteriorating patients in hospitals with no sepsis protocol

General protocol	Number of hospitals	%
Yes	154	93.3
No	11	6.7
Subtotal	**165**	
Not answered	19	
Total	**184**	

Since easy access to hospital protocols is important, respondents were asked about the availability/ accessibility of protocols, policies and guidelines. In 97% (518/532) of hospitals the protocols, policies and guidelines were available on the hospital intranet and therefore easily accessible during all hours (Table 2.10 overleaf). However, despite the reported easy availability, when reviewing how the antimicrobial therapy was chosen (discussed in detail in Chapter 7); only 36% of patients received the drug specified by the local hospital policy.

Table 2.10 Access to protocols

Availability	Number of hospitals	%
Printed copies stored in relevant locations	253	47.6
Electronic copies on hospital intranet	518	97.4
Internet	91	17.1
Other	8	1.5

Answers may be multiple n=532; not answered in 6

If hospitals have a protocol to aid the recognition and early management of sepsis, the education of staff members in its use is vital. The majority of hospitals reported that some form of sepsis training for new members of medical and nursing staff was provided, but less commonly outside of the emergency department. (Table 2.11)

Table 2.11 Provision of education around sepsis recognition and management, including the use of the protocol for hospital staff

Education regarding sepsis	Medical staff				Nursing staff			
	Emergency department	%	Other wards	%	Emergency department	%	Other wards	%
Yes	149	84.2	240	78.7	150	83.3	228	72.6
No	28	15.8	65	21.3	30	16.7	86	27.4
Subtotal	**177**		**305**		**180**		**314**	
Not answered	32		55		143		46	
Not applicable	151		0		37		0	
Total	**360**		**360**		**360**		**360**	

Table 2.12 Early warning score linked to escalation protocols

Early warning score linked to escalation	Number of hospitals	%
Yes	516	97.9
No	11	2.1
Subtotal	**527**	
Not answered	3	
Total	**530**	

Escalation of care

The vast majority of respondents (530/538; 99%) reported that some form of track and trigger tool was employed to monitor deteriorating patients (data not shown), and most stated that their early warning scoring systems were linked to their escalation protocols (Table 2.12). This is consistent with previous NCEPOD findings.[29]

Table 2.13 details the actions triggered by the escalation protocol. In 233/515 (45%) hospitals there appeared to be a system in place to provide critical care expertise to the treating team in the event of the escalation protocol being triggered, either from the Critical Care Outreach Team or through a direct referral to critical care or both (data not shown).

Table 2.13 Detail of escalation protocol

Escalation protocols involve:	(n/100) DGH ≤ 500 beds	(n/57) DGH > 500 beds	(n/49) UTH	(n/26) TSC	(n/80) IH	(n/184) CH	(n/6) PH	(n/13) RH	Total
Call to critical care outreach team	73	48	32	19	16	4	4	0	**196** 38.1%
Call to rapid response team	5	5	8	3	3	0	0	0	**24** 4.7%
Level 3 referral	58	29	29	12	19	7	3	0	**157** 30.5%
Call to medical emergency team	29	21	16	7	14	11	3	3	**104** 20.2%
Call to cardiac arrest team	30	19	18	9	26	11	3	1	**117** 22.7%
Transfer to other hospital	8	2	6	8	39	157	3	6	**229** 44.5%
Review by patient's own medical team	91	49	46	21	69	117	5	11	**410** 79.6%
Other	11	7	7	4	19	60	1	5	**115** 22.3%

Answers may be multiple n=515; not answered=1

Table 2.14 Pre-alert system for incoming sepsis patients

Pre-alert system	Yes	No	Subtotal	Not answered	Total
District General Hospital (DGH) ≤ 500 beds	44	39	**83**	10	**93**
District General Hospital (DGH) > 500 beds	25	30	**55**	5	**60**
University Teaching Hospital (UTH)	24	17	**41**	8	**49**
Tertiary Specialist Centre (TSC) – stand alone	2	5	**7**	17	**24**
Total	**95** (51.1%)	**91** (48.9%)	**186**	**40**	**226**

Respondents were also asked if there was a system where a pre-hospital alert could be sent by a GP or ambulance crew, warning of the arrival of a patient with suspected sepsis in order that their management could be expedited. Of the 186 hospitals from which a response was received, 95 (51%) reported that such a system existed (Table 2.14). These data are displayed for the 226 acute hospitals to which patients could have been admitted as an emergency.

Table 2.15 Microbiology input (Acute hospitals)

Clinical microbiology ward rounds - locations and frequency	Level 3	Level 2	General medical ward	General surgical ward	Other inpatient ward
Daily	**139**	**115**	**20**	**13**	**18**
%	68.1	57.2	10.3	6.6	9.0
Bi-weekly	**26**	**26**	**17**	**17**	**19**
%	12.7	12.9	8.8	8.7	9.5
Weekly	**12**	**16**	**35**	**32**	**44**
%	5.9	8.0	18.0	16.3	22.1
Telephone support only	**3**	**16**	**50**	**56**	**50**
%	1.5	8.0	25.8	28.6	25.1
Other	**23**	**25**	**49**	**49**	**46**
%	11.3	12.4	25.3	25.0	23.1
No microbiology ward round	**1**	**3**	**23**	**29**	**22**
%	0.5	1.5	11.9	14.8	11.1
Subtotal	**204**	**201**	**194**	**196**	**199**
N/A	15	11	16	13	-
Not answered	7	14	16	17	27
Total	**226**	**226**	**226**	**226**	**226**

Administration of antimicrobials

Early identification of infection and administration of appropriate antimicrobials is vital in managing sepsis. Regular review and de-escalation of treatment (antimicrobial stewardship) also plays an important role in preventing complications and improving recovery. Hospitals were asked about the availability of microbiology input available (Table 2.15).

The 23 hospitals falling under the group 'other' included seven that had a weekday service only, 12 provided ward rounds three times per week, and two had four ward rounds each week. Two other hospitals had provision for microbiology input as required but did not have formal ward rounds.

The vast majority of acute hospitals (224/226) had a policy for antimicrobial use (data not shown). Respondents were also asked if there was a policy on who was able to administer intravenous antimicrobials (Table 2.16).

Table 2.16 Policy for staff that can administer antimicrobials

Policy	Yes	No	Subtotal	Not answered	Total
District General Hospital (DGH) ≤ 500 beds	69	20	**89**	4	**93**
District General Hospital (DGH) > 500 beds	47	12	**59**	1	**60**
University Teaching Hospital (UTH)	33	12	**45**	4	**49**
Tertiary Specialist Centre (TSC) – stand alone	16	7	**23**	1	**24**
Total	**165** (76.4%)	**51** (23.6%)	**216**	**10**	**226**

Of the 216 acute hospitals from which a response was received, 165 (76.4%) had a policy for the administration of IV antimicrobials (Table 2.16). Multiple staff members were able to give antimicrobials, with staff nurses being the most common group (Table 2.17).

Table 2.17 Detail of staff who can administer intravenous antimicrobials (Acute hospitals only)

Staff	Number of hospitals	%
Senior doctor (ST3 or above)	133	81.1
Junior doctor (below ST3)	135	82.3
Other healthcare worker	37	22.6
Senior nurse (senior staff nurse or above)	140	85.4
Staff nurse	125	76.2
Healthcare assistant	3	1.8

Answers may be multiple n=164; not answered in 1

Transfer to critical care

Of the 272 hospitals that did not have critical care facilities on site 22% did not have formal arrangements to transfer critically ill patients, almost all of them were community hospitals (Table 2.18).

For those hospitals where the policy was to transfer patients with sepsis to another hospital for management, we aimed to assess the duration of an average journey in the middle of the day. Only in five hospitals was the time greater than one hour. The majority reported that the time was less than 30 minutes (Figure 2.1 overleaf).

In cases where the patients had to be transferred to an alternative site for critical care, the clinical interventions undertaken prior to transfer were assessed. The 'Surviving Sepsis Campaign' and others have recommended the use of the early resuscitation bundle. The steps taken prior to transfer are summarised in Table 2.19 overleaf. These were routinely undertaken in only half of the hospitals.

Table 2.18 Hospitals without critical care on-site – critical care transfer arrangement exists with nearby hospital(s)

Critical care transfer arrangement	Yes	No	Subtotal	Not answered	Total
District General Hospital (DGH) ≤ 500 beds	11	0	**11**	0	**11**
University Teaching Hospital (UTH)	4	0	**4**	0	**4**
Tertiary specialist centre (TSC) – stand alone	5	1	**6**	0	**6**
Independent Hospital (IH)	33	1	**34**	0	**34**
Community or Cottage Hospital (CH)	130	55	**185**	14	**199**
Peripheral Hospital (PH)	5	0	**5**	0	**5**
Rehabilitation Hospital (RH)	13	0	**13**	0	**13**
Total	**201** (77.9%)	**57** (22.1%)	**258**	**14**	**272**

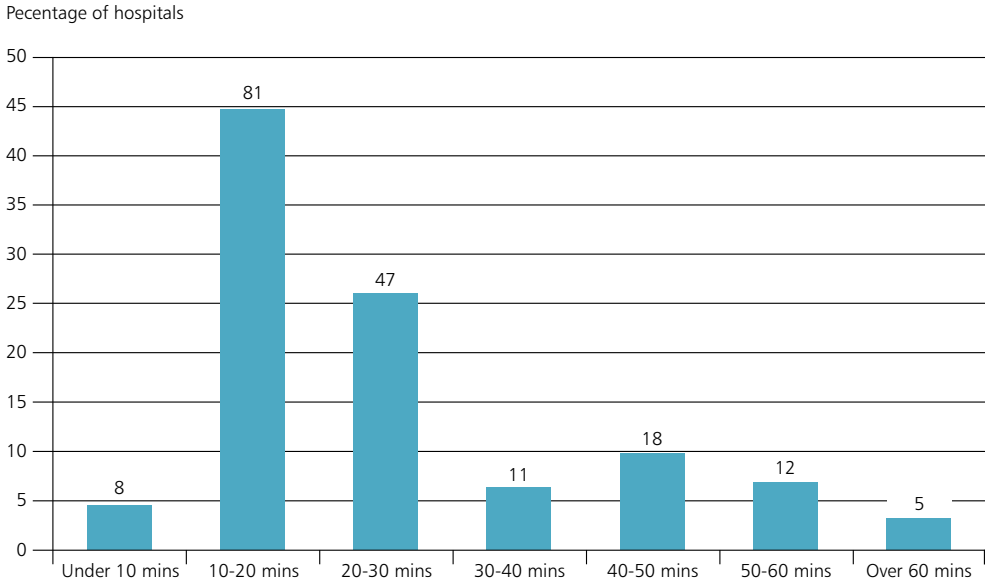

Figure 2.1 Time to transfer to critical care if critical care was not on-site (n=182, missing data in 90)

Table 2.19 Steps performed prior to transfer for off-site critical care

Steps taken	(n/11) DGH ≤ 500 beds	(n/4) UTH	(n/5) TSC	(n/33) IH	(n/130) CH	(n/5) PH	(n/13) RH	Total	
Take blood cultures	5	3	4	27	52	4	4	**99**	56.9%
Administer antimicrobials	6	3	4	20	42	4	5	**84**	48.3%
Administer oxygen therapy	7	3	5	28	84	4	5	**136**	78.2%
Haemodynamically stabilise the patient (fluids)	7	3	4	26	34	4	3	**81**	46.6%
Measure lactate	4	3	3	17	7	3	1	**38**	21.8%
Attempt to isolate the source of infection	1	2	3	9	31	1	3	**50**	28.7%
Monitor urine output	6	3	4	27	57	4	4	**105**	60.3%
Other	0	0	0	4	19	0	1	**24**	13.8%
None	1	0	0	2	25	0	2	**30**	17.2%

Answers may be multiple n=174; not answered in 27

Table 2.20 Specific proforma to monitor progress of patients with sepsis (Acute hospitals only)

Sepsis proforma	Yes	No	Subtotal	Not answered	Total
District General Hospital (DGH) ≤ 500 beds	28	61	**89**	4	**93**
District General Hospital (DGH) > 500 beds	14	45	**59**	1	**60**
University Teaching Hospital (UTH)	10	34	**44**	5	**49**
Tertiary Specialist Centre (TSC) – stand alone	3	20	**23**	1	**24**
Total	**55** (25.6%)	**160** (74.4%)	**215**	**11**	**226**

Table 2.21 Hospital had a care bundle for source isolation/control

Care bundle for source control	Yes	No	Subtotal	NA - source control not carried out	Not answered	Total
District General Hospital (DGH) ≤ 500 beds	16	71	**87**	9	6	**102**
District General Hospital (DGH) > 500 beds	8	44	**52**	1	7	**60**
University Teaching Hospital (UTH)	8	37	**45**	0	8	**53**
Tertiary specialist centre (TSC) – stand alone	5	17	**22**	4	2	**28**
Independent Hospital (IH)	12	28	**40**	30	13	**83**
Community or Cottage Hospital (CH)	31	68	**99**	84	21	**204**
Peripheral Hospital (PH)	1	3	**4**	1	1	**6**
Rehabilitation Hospital (RH)	1	7	**8**	4	1	**13**
Total	**82** (23%)	**275** (77%)	**357**	**133**	**59**	**549**

Since there is evidence that using checklists, protocols and proformas improve the safety and quality of care, respondents were asked if they used a proforma to monitor progress once sepsis was diagnosed (Table 2.20). Only 55 of the acute hospitals that responded (26%) reported that such a proforma was being used.

Identifying the source of infection

Identifying and treating the source of infection is one of the definitive measures in the medical management of sepsis after initial resuscitation. Only 82/357 hospitals (23%) confirmed that a care bundle/protocol existed for this purpose. Of the DGHs and UTHs, 32/184 (17%) had such a protocol (Table 2.21).

Handovers

Good communication, safe and efficient handovers are important factors in improving quality of care. Over 40% of hospitals reported that they did not have a policy on handovers (Table 2.22).

Table 2.22 Policy for staff handover (All hospitals)

Policy	Yes	No	Subtotal	Not answered	Total
DGH ≤ 500 beds	70	27	**97**	5	**102**
DGH > 500 beds	39	17	**56**	4	**60**
University teaching hospital	33	13	**46**	7	**53**
Tertiary specialist centre - stand alone	17	9	**26**	2	**28**
Independent hospital	36	43	**79**	4	**83**
Community or cottage hospital	93	95	**188**	16	**204**
Peripheral Hospital (PH)	6	0	**6**	0	**6**
Rehabilitation Hospital (RH)	6	7	**13**	0	**13**
Total	**300** (58.7%)	**211** (41.3%)	**511**	**38**	**549**

Table 2.23 Details of the staff handover policy

Policy includes	Clear escalation plan		Structured proforma for handover		Time set aside for face to face handover	
	Number of hospitals	%	Number of hospitals	%	Number of hospitals	%
Yes	212	74.9	230	78.5	270	94.1
No	71	25.1	63	21.5	17	5.9
Subtotal	**283**		**293**		**287**	
Not answered	17		7		13	
Total	**300**		**300**		**300**	

Table 2.24 Patients provided with printed information about sepsis (All hospitals)

Patients information about sepsis	Number of hospitals	%
Yes	29	5.6
No	490	94.4
Subtotal	**519**	
Not answered	30	
Total	**549**	

Of the acute hospitals, 63/226 (28%) did not have a policy (data not shown). However, for those hospitals that had a policy, there was a good level of detail (Table 2.23).

On enquiring about discharge process, especially information provided to patients, it was of note that fewer than 6% (29/519) of hospitals had a robust system to ensure that useful information relevant to sepsis was provided (Table 2.24).

Table 2.25 Follow-up service for patients post discharge (Acute hospitals only)

Follow-up service	Yes	No	Subtotal	Not answered	Total
DGH ≤ 500 beds	32	59	**91**	2	**93**
DGH > 500 beds	21	39	**60**	0	**60**
University Teaching Hospital	20	21	**41**	8	**49**
Tertiary Specialist Centre - stand alone	5	18	**23**	1	**24**
Total	**78** (36.3%)	**137** (63.7%)	**215**	**11**	**226**

Follow-up

Sepsis is recognised to lead to long-term physical and neuropsychological conditions.[30] A follow-up service would therefore be of benefit to patients and has been recommended by NICE Clinical Guideline 83 for the follow-up of critical care discharges.[31] Only 78/215 (36.3%) respondents confirmed that they provided a follow-up service (Table 2.25).

Critical Care Outreach Teams

The NCEPOD report "An Acute Problem?" was published in 2005[6] and reported on the care of medical patients referred to critical care units. The report showed that only 92 of 208 (44.2%) hospitals studied had Critical Care Outreach Teams and recommended that they should be available round the clock each day in all hospitals. It is of note therefore in this study that Critical Care Outreach Teams were available in 199 of 223 (89%) hospitals with critical care from which a response was received (Table 2.26).

Table 2.26 Critical Care Outreach Team or equivalent (Hospitals with critical care)

Critical care outreach team or equivalent	Number of hospitals	%
Yes	199	89.2
No	24	10.8
Subtotal	**223**	
Not answered	1	
Total	**224**	

Hospitals in which a Critical Care Outreach Team (24/223) was not employed, included both small and large hospitals (Figure 2.2).

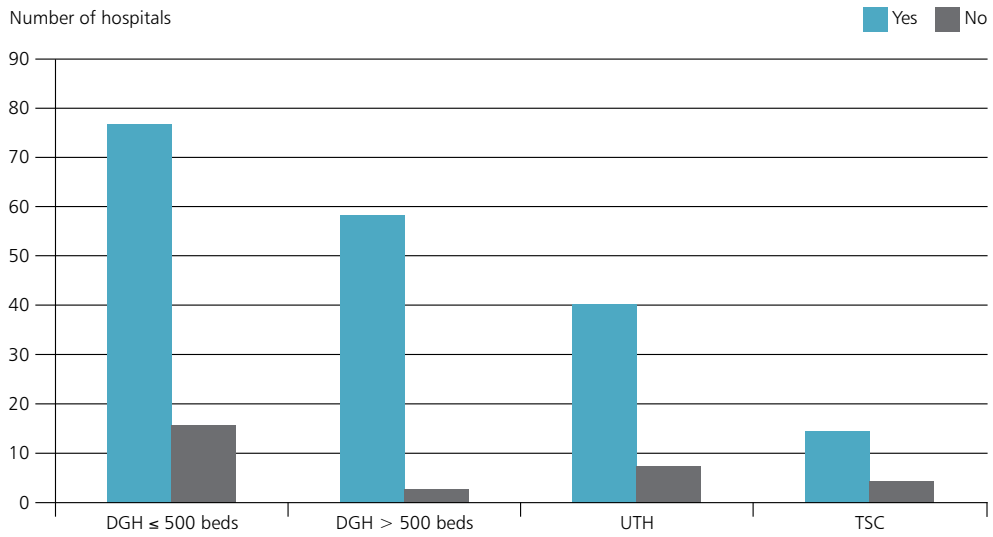

Figure 2.2 Hospital type and presence of a Critical Care Outreach Team

Of the 199 hospitals that stated a Critical Care Outreach Team was present, the teams were staffed primarily with nurses from the critical care environment (Table 2.27).

Table 2.27 Grade of clinicians in the Critical Care Outreach Team (Acute hospitals)

Grade	Number of hospitals	%
Consultant	56	28.4
Trainee	24	12.1
Nurses	192	97.4

Answers may be multiple n=197; not answered in 2

Over a quarter (28%) included a consultant, and a smaller number (12%) had trainees (Table 2.28).

Table 2.28 Specialty of clinicians in the Critical Care Outreach Teams (or equivalent)

Speciality	Number of hospitals	%
Critical care	156	89.7
Acute care	31	17.8
Other	19	10.9

Answers may be multiple n=174; not answered in 25

The system of coverage provided by Critical Care Outreach Teams varied across hospitals with 49% (96/196) providing a service 24/7 (Table 2.29).

Table 2.29 Availability of Critical Care Outreach Teams (or equivalent)

Availability	Number of hospitals	%
24 hours, 7 days/week	96	49.0
Normal working hours (8am-6pm) 7 days/week	26	13.3
Normal working hours (8am-6pm) Mon-Fri	14	7.1
Extended working hours, 7 days/week	45	23.0
Extended working hours, Mon-Fri	3	1.5
Extended working hours, Mon-Fri + reduced cover on weekends	2	1.0
Other	10	5.1
Subtotal	**196**	
Not answered	3	
Total	**199**	

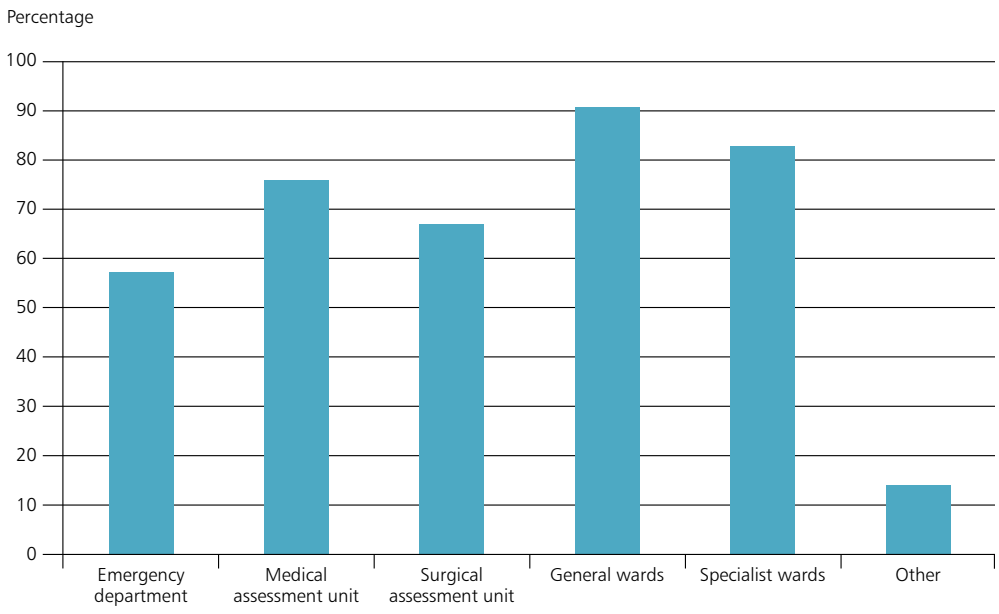

Figure 2.3 Areas covered by the Critical Care Outreach Team (n=197; not answered in 2)

The Critical Care Outreach Teams were found to provide their services to most clinical inpatient areas within the hospital (Figure 2.3). 'Other' areas covered included the cardiac catheterisation laboratory (4), and day surgery and recovery units (2).

Table 2.30 Trigger to call the Critical Care Outreach Team or equivalent

Call trigger	Number of hospitals	%
Automated system linked to monitoring	28	14.1
Concern expressed by medical staff	189	95.5
Concern expressed by nursing staff	187	94.4
Early warning score	184	82.9
Other	31	15.7

Answers may be multiple n=198; not answered=1

Critical Care Outreach Teams were also reported to take referrals through automated systems triggered by early warning score thresholds (Table 2.30). For the 'other' group, the Critical Care Outreach Team took referrals from staff on the ward, both medical and nursing.

Consultant review

There is increasing evidence that the presence of a consultant improves early identification and management of serious illness.[32] Figure 2.4 summarises the consultant cover in different areas of the hospital. Some respondents stated that they had consultant presence on-site 24 hours a day in the acute and critical care environment. Many other hospitals also provided extended cover by a consultant over the evenings and weekends.

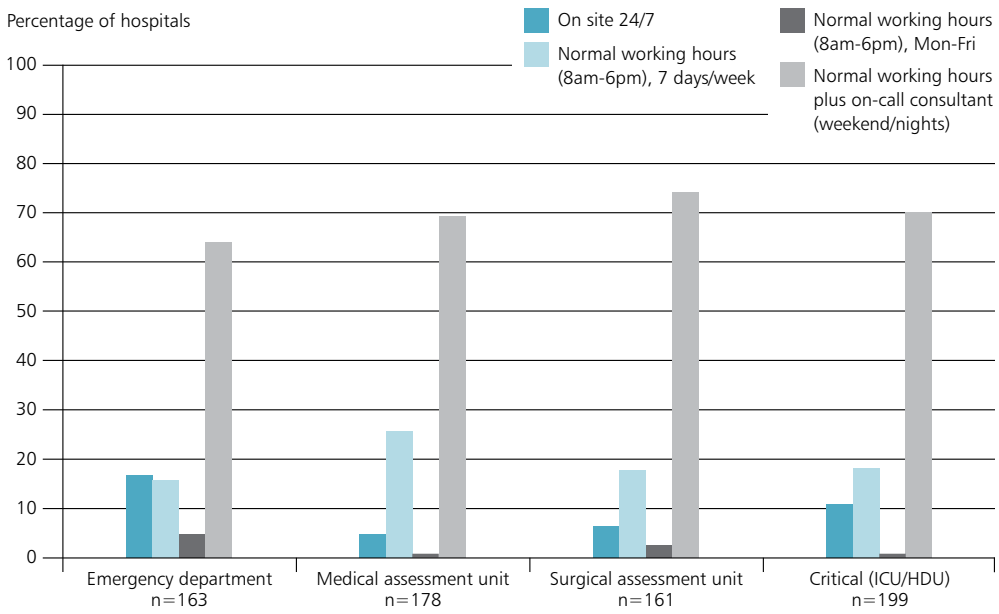

Figure 2.4 Consultant cover in different areas of the hospital (All hospitals)

Table 2.31 Lead clinician responsible for improving care of patients with sepsis (All hospitals)

Lead clinician for sepsis	Yes	No	Subtotal	Not answered	Total
District General Hospital (DGH) ≤ 500 beds	51	28	**79**	14	**93**
District General Hospital (DGH) > 500 beds	39	17	**56**	3	**59**
University Teaching Hospital (UTH)	28	16	**44**	1	**45**
Tertiary specialist centre (TSC) – stand alone	3	8	**11**	6	**17**
Independent Hospital (IH)	3	27	**30**	16	**46**
Community or Cottage Hospital (CH)	37	54	**91**	44	**135**
Peripheral Hospital (PH)	2	2	**4**	1	**5**
Rehabilitation Hospital (RH)	3	4	**7**	1	**8**
Total	**166** (51.6%)	**156** (48.4%)	**322**	**86**	**408**

From the returned questionnaires it could be seen that 408/549 hospitals had some form of quality improvement activity for sepsis. Clinical champions are beneficial in improving quality of care and over half the hospitals in the study (166/322; 52%) had appointed a Lead Clinician for sepsis (Table 2.31) and just over 10% (38/355) had a designated sepsis nurse (Table 2.32).

Table 2.32 Designated sepsis nurse

Sepsis nurse	Number of hospitals	%
Yes	38	10.7
No	317	89.3
Subtotal	**355**	
Not answered	53	
Total	**408**	

Sepsis response kit

The use of a sepsis response kit, bag or trolley can help deliver the sepsis early care bundle in the shortest time possible. A total of 112 hospitals reported that a sepsis response kit, bag or trolley was being used (Table 2.33). The kits were located in the ED in 89% of hospitals, acute wards in 69% and general wards in 79% of hospitals (data not shown).

Table 2.33 Sepsis response kit, bag or trolley (All hospitals)

Sepsis trolley	Yes	No	Subtotal	Not answered	Total
District General Hospital (DGH) ≤ 500 beds	35	55	**90**	3	**93**
District General Hospital (DGH) > 500 beds	21	38	**59**	0	**59**
University Teaching Hospital (UTH)	22	23	**45**	0	**45**
Tertiary Specialist Centre (TSC) – stand alone	5	10	**15**	2	**17**
Independent Hospital (IH)	15	31	**46**	0	**46**
Community or Cottage Hospital (CH)	11	121	**132**	3	**135**
Peripheral Hospital (PH)	1	4	**5**	0	**5**
Rehabilitation Hospital (RH)	2	6	**8**	0	**8**
Total	**112** (28.0%)	**288** (72.0%)	**400**	**8**	**408**

Table 2.34 Number of serious incidents involving an episode of severe sepsis (All hospitals)

Number of serious incidents	0	1-10	Subtotal	Not answered	Total
District General Hospital (DGH) ≤ 500 beds	20	15	**35**	67	**102**
District General Hospital (DGH) > 500 beds	5	17	**22**	38	**60**
University Teaching Hospital (UTH)	14	14	**28**	25	**53**
Tertiary Specialist Centre (TSC) – stand alone	10	4	**14**	14	**28**
Independent Hospital (IH)	62	3	**65**	18	**83**
Community or Cottage Hospital (CH)	49	1	**50**	154	**204**
Peripheral Hospital (PH)	1	1	**2**	4	**6**
Rehabilitation Hospital (RH)	6	0	**6**	7	**13**
Total	**167** (75.2%)	**55** (24.8%)	**222**	**327**	**549**

Serious incidents

The term Serious Incident (SI) is an incident that results in unexpected or avoidable death or severe harm. Investigating such incidents can help in improving hospital systems and prevent recurrence of harm by ensuring that key lessons are identified and learned.

Respondents were asked how many SIs, where sepsis was thought to have contributed, had been recorded between April 2013 to March 2014. This question was frequently not answered (n=327), and overall the number of sepsis related SIs was low. The low number is likely to be due to the poor documentation of sepsis or severe sepsis as a diagnosis which would be improved with better coding. These data therefore, should not be over-interpreted (Table 2.34).

Audit

Information was collected on whether there was an audit in acute hospitals of the number of episodes of sepsis where antimicrobials were received within one hour of diagnosis of sepsis (Table 2.35). Less than 50% of acute hospitals that responded carried out such audits.

Table 2.35 Audit of antimicrobial delivery (Acute hospitals)

Hospital audits number of episodes of sepsis where patient receives antimicrobials within the first hour of:	Yes	%	No	%	Subtotal	Not answered	Total
Severe sepsis identification	90	44.1%	114	55.9%	**204**	22	**226**
Sepsis identification	75	36.9%	128	63.1%	**203**	23	**226**
Other identification	32	24.2%	100	75.8%	**132**	94	**226**

Answers may be multiple

In addition, about 20% of respondents reported that they had a system in place to record incidents of sepsis and its severity. The way data were collected varied in these hospitals, with multiple systems being used in some of them. The most common mechanism was through clinical coding (n=21), adverse incident reporting systems (n=15), hospital audit or database (n=13), using the ICNARC reporting system (n=10) or monitoring microbiology results (n=3). Some hospitals reported that there was more than one mechanism of recording sepsis related information (Table 2.36).

Table 2.36 Hospital mechanism to centrally record all incidents of sepsis

Recorded	Yes	%	No	%	Subtotal	Not answered	Total
Sepsis	46	21.2	171	78.8	**217**	9	**226**
Severe sepsis	43	19.8	174	80.2	**217**	9	**226**
Septic shock	46	22.0	163	78.0	**209**	17	**226**
Septicaemia	52	25.2	154	74.8	**206**	20	**226**

2

Key Findings

- 184/544 (33.8%) hospitals in this study had no formal sepsis protocol
- 309/343 (90.1%) hospitals with sepsis protocols had based them on published guidelines
- Most hospitals with protocols (305/321; 95%) stipulated that action should be taken within one hour of diagnosis of sepsis
- Of hospitals with protocols for recognition and management of sepsis, there was no formal education in the use of the protocol on general wards for medical staff in 65/305 (21.3%) and nursing staff in 86/314 (27.4%)
- In 518/532 (97.4%) hospitals, the hospital protocol policies and guidelines were immediately available on the hospital intranet
- The majority of hospitals without sepsis protocols (154/165; 93.3%) did have protocols for the identification of the deteriorating patient
- 95/186 (51.1%) acute hospitals stated that there was a system in place for receiving a pre-alert for patients arriving to the emergency department with sepsis
- The vast majority (530/538; 98.5%) of hospitals have track and trigger systems for monitoring sick patients and these were uniformly linked to escalation protocols (516/527; 97.9%)
- 199/223 (89.2%) hospitals with critical care facilities had a Critical Care Outreach Team or equivalent and 96/196 (49%) of these were available 24/7
- One in five hospitals (57/258; 22.1%) without critical care facilities did not have formal arrangements for the transfer of patients needing critical care
- 55/215 (25.6%) acute hospitals utilised specialised proformas to identify and monitor patients with sepsis
- 63/212 (29.7%) acute hospitals stated that there was no policy in place covering staff handovers. However, 270/287 (94.1%) hospitals with a policy set aside time for the formal handover of patients between doctors' shifts
- The vast majority of acute hospitals (224/226; 99%) had an antimicrobial policy and although 139/204 (68.1%) of acute hospitals had daily microbiology ward rounds on ICU (level 3), only 20/194 (10.3%) and 13/196 (6.6%) of acute hospitals reported having daily microbiology ward rounds on general medical or surgical wards (respectively).
- Only 29/519 (5.6%) hospitals in the study had leaflets to give to patients to provide information about sepsis
- Only 78/215 (36.3%) acute hospitals had any form of follow-up service for patients with sepsis
- Half of the hospitals in the study (166/322; 51.6%) had appointed a lead clinician for sepsis
- Less than half of acute hospitals (90/204; 44%) were carrying out audit of the timely treatment of severe sepsis
- 43/217 (20%) hospitals had a means of centrally recording incidents of severe sepsis

3

Patient population and pre-hospital care

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Demographics

The patient age distribution in the study was slightly older than the general population; about two-thirds of the patients were above the age of 60. Male patients comprised 56.2% of the study population (Figure 3.1). Similar demographic patterns have been noted in other studies involving patients in critical care units with or without sepsis.[32] The distribution of Body Mass Index in the study group was also very similar to the general population.[33]

Co-morbidities

In this study 513 patients of a total of 569 (90%) had co-morbidities on admission. This could be explained by the age distribution of patients included in the study and that the inclusion criteria involved input from critical care. Figure 3.2, overleaf, shows the top ten co-morbidities noted in this study population, most of which are expected to predispose to infection and/or sepsis. Many patients had more than one co-morbidity and 254/569 (44.6%) had one or more of: diabetes mellitus, kidney disease and/or heart failure. The older age of the patient population in this study is the most likely explanation for the high prevalence of observed hypertension. The prevalence of hypertension in patients above the age of 65 is >50%.[34]

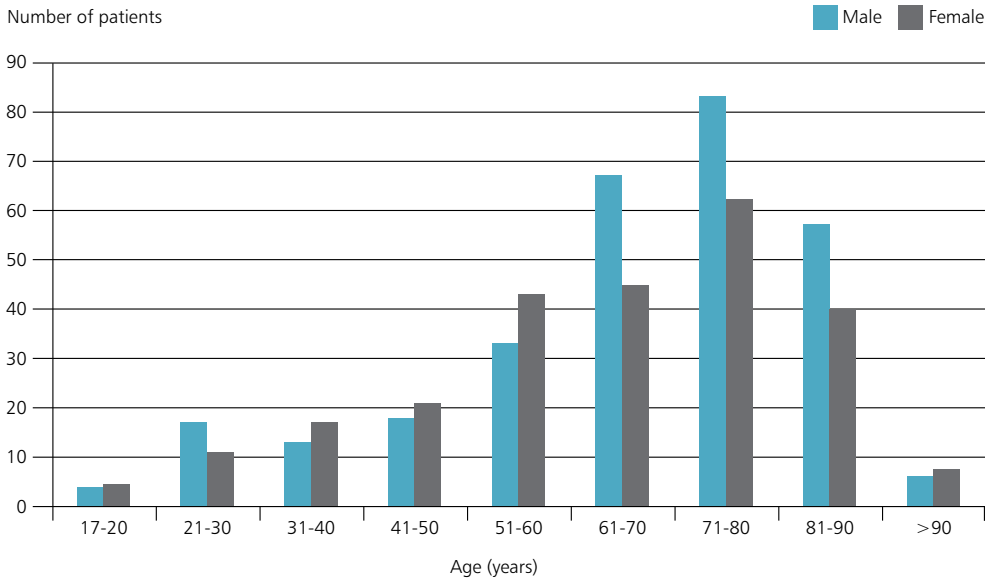

Figure 3.1 Age and gender of the study population

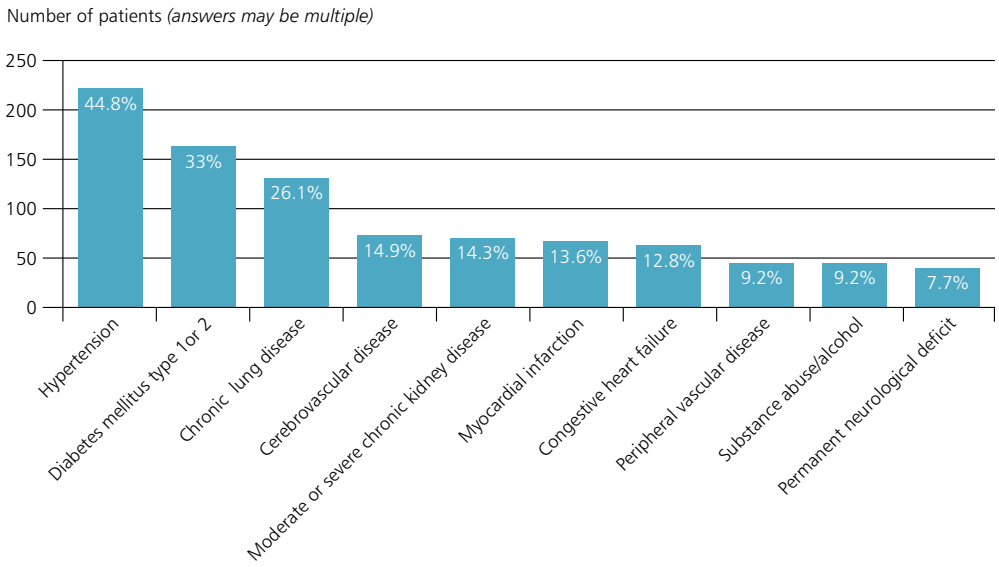

Figure 3.2 Top ten co-morbidities on admission (Clinician questionnaire n=513)

Smoking

Of the 541 patients in whom smoking history was available 197 (36.4%) had never smoked. This is less than the proportion in the general population (58%)[34] (Table 3.1).

Table 3.1 Smoking history – Clinician questionnaire

Smoking history	Number of patients	%
Current smoker	143	26.4
Ex-smoker (<5 years)	68	12.6
Ex-smoker (>5 years)	133	24.6
Never smoked	197	36.4
Subtotal	**541**	
Unknown	151	
Not answered	18	
Total	**710**	

Previous admission with sepsis

The treating clinicians reported a previous admission with sepsis in just over one quarter of the patients in this study. Since we know that the diagnosis of sepsis can be missed and is often poorly documented, it is possible that more patients in our study had previously suffered an episode of sepsis (Table 3.2).

Table 3.2 Patient previously been admitted with sepsis – Clinician questionnaire

Previous admission	Number of patients	%
Yes	192	27.4
No	510	72.6
Subtotal	**702**	
Insufficient data	8	
Total	**710**	

Of the 192 patients who had documented evidence of sepsis in the past, the treating clinician was also able to note how long prior to the current admission the most recent admission occurred. Just over two-thirds had been admitted within the past year. Data were not available to estimate whether this may have been recurrence of the same infection or inadequately treated sepsis (Table 3.3).

Table 3.3 Length of time from previous admission – Clinician questionnaire

Time from previous admission	Number of patients	%
<1 month	39	22.5
1-6 months	56	32.4
>6 months-1 year	19	11.0
> 1 year	59	34.1
Subtotal	**173**	
Unknown	19	
Total	**192**	

Table 3.4 shows that a large majority of patients in this study (94.3%) were admitted as an emergency.

Table 3.4 Type of admission – Reviewers' opinion

Admission type	Number of patients	%
Emergency	477	94.3
Elective	29	5.7
Subtotal	**506**	
Unknown	45	
Total	**551**	

Route of presentation/ admission to hospital

Reviewers looked at the mode of admission to hospital. Over half of the admissions were brought to the hospital emergency department (ED) by ambulance. Another fifth were referred directly by general practitioners (GPs) (including out-of-hours GP services) to the ED or acute medical/ surgical units. Self-referral to a hospital ED formed 12.5% of the total admissions (Table 3.5). Some hospital admissions were not due to sepsis. These patients were included in the study because they developed sepsis whilst in hospital.

Table 3.5 Mode of admission to hospital – Reviewers' opinion

Mode of admission	Number of patients	%
Via the emergency department - ambulance/air evacuation	278	51.9
Via the emergency department - self referral	67	12.5
Via the emergency department - general practitioner referral	57	10.6
General practitioner referral - direct to ward	44	8.2
Transfer from another hospital	27	5.0
Elective admission	29	5.4
Transferred from out-patients clinic	15	2.8
Via the emergency department - out of hours GP/111 call	8	1.5
Transfer from psychiatric unit	4	0.7
Transfer from nursing home	4	0.7
Via emergency department - other	3	0.6
Subtotal	**536**	
Insufficient data	15	
Total	**551**	

Pre-hospital care

General practitioner notes – peer reviewed by general practitioners

A total of 129 patients were identified though their hospital case notes or on the clinician questionnaire that they had seen their GP prior to admission. The relevant GP surgery was contacted and asked to provide all records of these patients' previous 3 visits within the two-weeks prior to the admission to hospital. A total of 54 sets of GP case notes were suitable for review. They comprised 54 patient contacts immediately prior to hospital admission. In addition, 26 patients had notes for a second-to-last visit and 11 had third-to-last visit in the two-week period prior to hospital admission. The notes were anonymised and then peer reviewed by a panel of GPs as well as being used as part of the overall set of case notes reviewed by the wider panel of Reviewers.

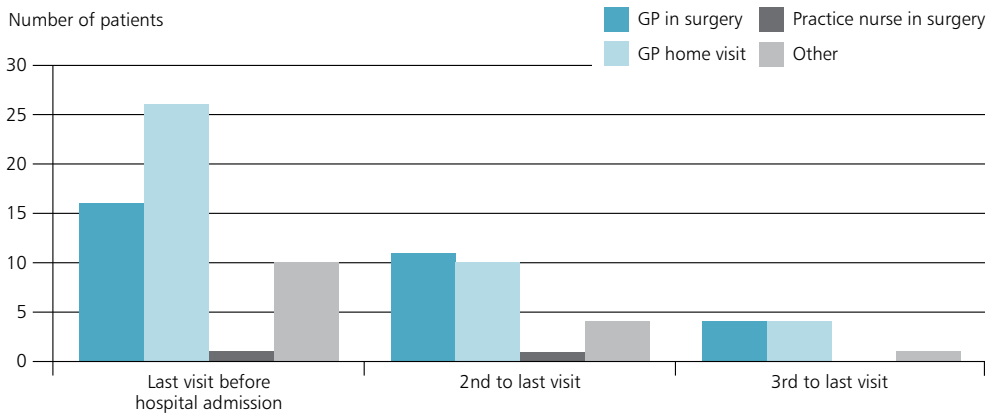

Figure 3.3 Type of visit to the surgery

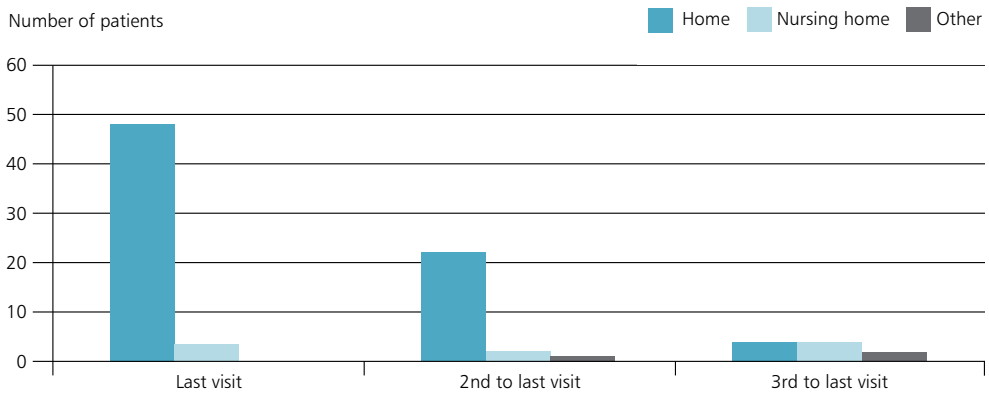

Figure 3.4 Location immediately prior to general practitioner visit

Where the patient saw the GP prior to admission

In this group of 54 patients seen prior to hospitalisation, half were seen at home, a quarter were seen in the surgery by the GP, and the remaining patients were consulted either on the phone or by an out-of-hours GP, practice nurse telephone consultation or a nursing home visit (Figure 3.3).

Location

A large majority of patients were living at home prior to admission, however 4/11 patients who required three visits by the GP were in a nursing home compared with 3/54 admissions at the first visit (Figure 3.4).

In the notes where data were available, 6 of 24 patients were seen by their GP on the day that they were admitted to hospital. Data were missing in a number of cases. Most NCEPOD reports have highlighted the lack of adequate documentation and it is seen here again that absence of precise times and dates has meant that the time of diagnosis of sepsis, and whether there was a delay was not available in a number of cases. However, where it was possible to establish timelines, delays were noted at different levels and on all visits, possibly emphasising the difficulty in making a diagnosis of early sepsis or judging its severity (Figure 3.5).

Telephone consultation

Where documentation of the telephone consultation was available, GP Reviewers checked whether appropriate advice had been given. It was found that on their last visit patients usually received appropriate advice, possibly because sepsis (and its severity) was easier to identify (Figure 3.6).

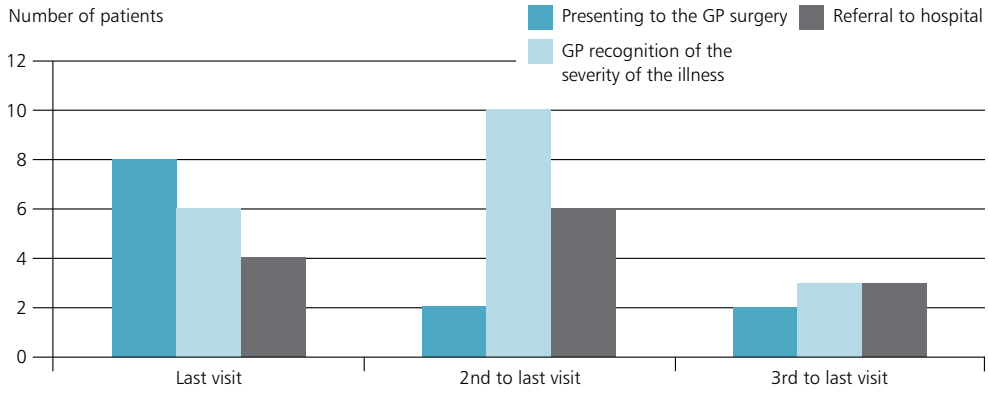

Figure 3.5 Delay in presentation/diagnosis

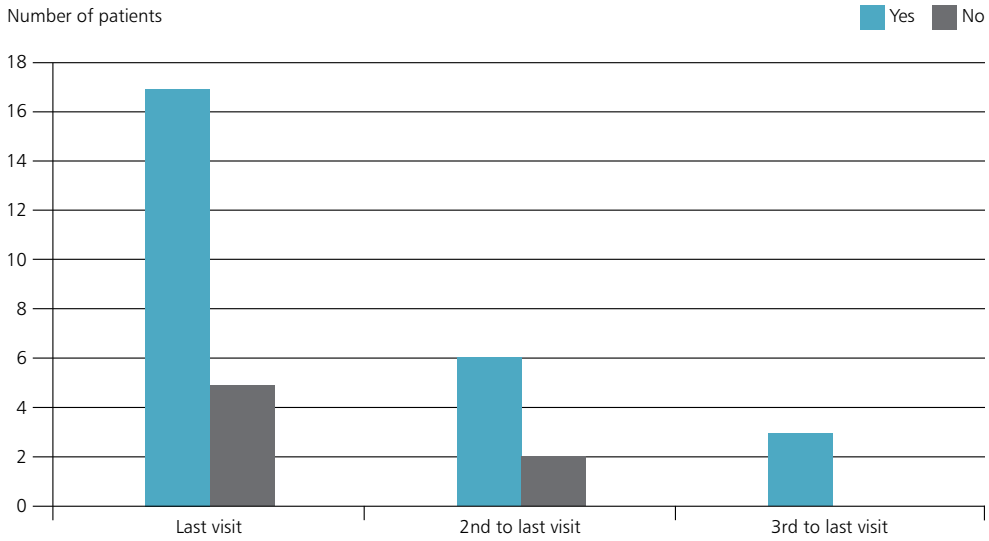

Figure 3.6 Appropriate advice given during the telephone consultation

The main area of concern from GP Reviewers was around the adequacy of safety netting. Safety netting was only evident in 9/54 cases (last visit), 10/26 cases (2nd to last visit) and 5/11 cases (3rd to last visit) (data not shown). Safety netting is a consultation technique used to ensure the timely re-appraisal of a patient whose status is uncertain or changeable. It should be part of any management plan where uncertainty exists in the diagnosis, or where there may be a recognised risk of deterioration or complications as the disease process evolves over time. It involves communicating clearly with the patient and their carers so they understand the existence of uncertainty in diagnosis, deterioration or complications. Red flag clinical features should be clearly explained with advice on when and how to seek help. Safety netting advice should also be documented in clinical notes.[36]

Assessments

Most physiological vital signs were not recorded consistently by primary care teams, temperature and blood pressure being noted in less than half of patients in this group. Blood glucose were was recorded. It is possible that the GP making the assessment did not have access to the equipment required to measure blood glucose. The vital signs were more consistently recorded in the final visit, possibly reflecting worsening clinical severity. Given that these measurements form part of the diagnostic criteria for sepsis they should be undertaken at each visit in acutely unwell patients to aid earlier diagnosis of sepsis (Tables 3.6 and 3.7).

Tables 3.6 Assessment of vital signs and the healthcare provider that recorded them

Last visit	Assessment done			Who made assessment				
	Yes	No	**Total**	GP	Nurse	Other	Unknown	**Total**
Heart rate	33	21	**54**	31	1	1	0	**33**
Blood pressure	23	31	**54**	19	1	0	3	**23**
Respiratory rate	10	44	**54**	8	1	0	1	**10**
Temperature	25	29	**54**	18	1	0	6	**25**
Mental state	8	46	**54**	6	1	0	1	**8**
Blood glucose	2	52	**54**	0	0	2	0	**2**
Other	16	38	**54**	5	0	0	11	**16**

Tables 3.7 Documentation of vital signs at each of the three visits to the general practitioner prior to hospital admission

Assessment	Last visit (n/54)	2nd to last visit (n/26)	3rd to last visit (n/11)
Heart rate	33	12	4
Blood pressure	23	8	2
Respiratory rate	10	4	4
Temperature	25	6	6
Mental state	8	3	1
Blood glucose	2	1	0
Other	16	3	5

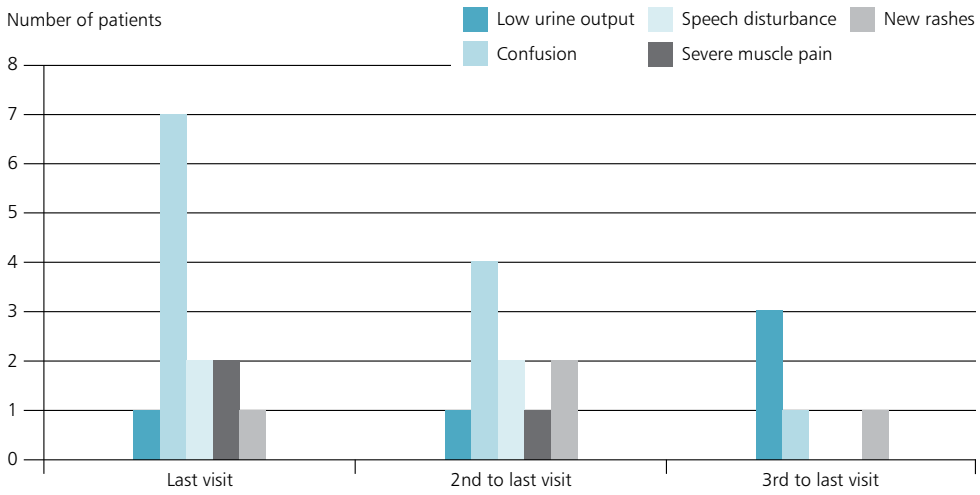

Figure 3.7 Symptoms of sepsis documented

Symptoms

GP case notes were also examined for documentation of symptoms commonly associated with sepsis. As seen in Figure 3.7, only a small number of patients had these symptoms documented. Where recorded, some patients had more than one symptom of sepsis. New or acute confusion is an important feature in sepsis and should be sought along with all the others mentioned below. When looked for, confusion appeared most frequently (Figure 3.7).

Diagnosis of sepsis missed/underestimated

Table 3.8 summarises the situations where, in the GP Reviewers' opinion, the diagnosis or assessing the severity of sepsis could be improved.

Early warning scores

No evidence was found in the case notes reviewed to demonstrate that an early warning score had been used to assess and monitor physiological parameters. The GP Reviewers were able to see the benefit of such a score in a large majority of patients, where it could have helped in grading the sepsis severity (Table 3.9).

Table 3.8 Sepsis diagnosis missed by the general practitioner – GP Reviewers' opinion

	Diagnosis of sepsis missed	Severity of sepsis underestimated
Last visit (n/54)	4	4
2nd to last visit (n/26)	4	1
3rd to last visit (n/11)	2	2

Table 3.9 An early warning score or track and trigger tool should have been used for this patient

	Yes	No	Subtotal	Insufficient data	Total
Last visit	30	13	**43**	11	**54**
2nd to last visit	19	4	**23**	3	**26**
3rd to last visit	6	1	**7**	4	**11**

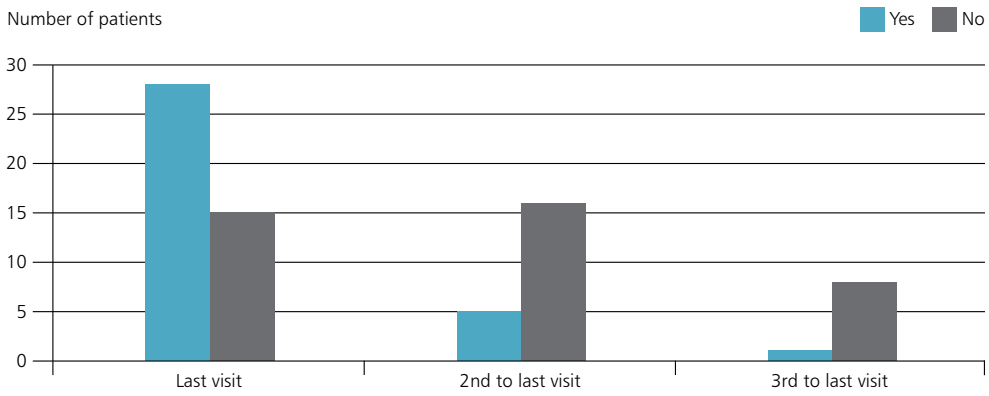

Figure 3.8 Adequacy of history taking – GP Reviewers' opinion

History taking

Reviewers assessed whether the history noted was adequate. Documentation was considered less than adequate in a third to half of cases but improved at the last visit, possibly as the clinical picture of sepsis became clearer, or the patient deteriorated further (Figure 3.8).

The themes emerging from comments made by Reviewers primarily related to absent documentation of symptoms like confusion, muscle aches and fever. Clinical signs and recording observations were also highlighted as missing. Reviewers did highlight good practice in communicating and collaboration with patients and family members/carers in decision making.

Documentation of co-morbidities were more frequently noted at the last visit before admission to hospital, which was appropriate. Patients displayed a wide spectrum of long-term conditions; predominantly cardiovascular and respiratory (Table 3.10).

Table 3.10 Co-morbidities documented by the general practitioner

Co-morbidities	Last visit	2nd to last visit	3rd to last visit
Cardiovascular	29	15	0
Respiratory	16	1	0
Gastrointestinal	7	0	0
Neurological	11	2	0
Urological	3	0	0
Gynaecological	3	0	0
Renal	4	0	0
Oncological	6	0	0
Connective tissue disease	4	0	0
Diabetes mellitus	13	2	0
Other	18	3	6
None	7	3	5

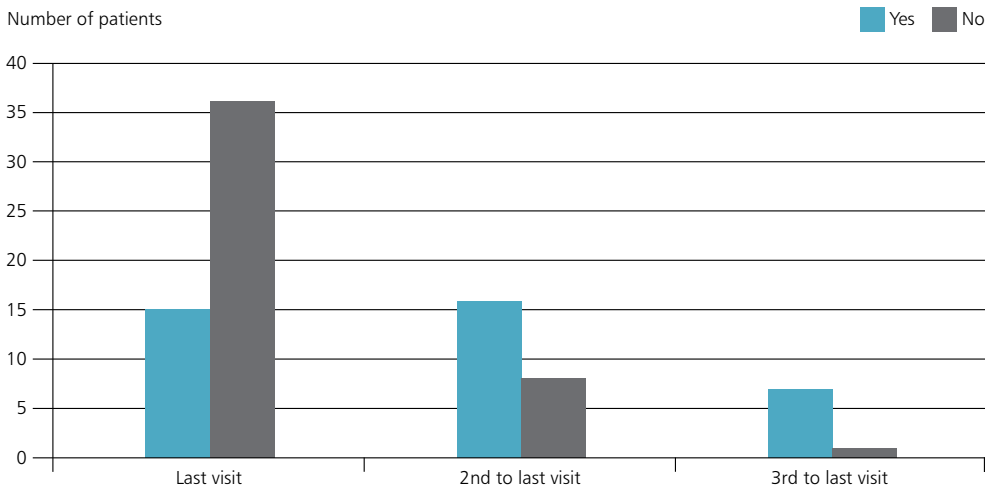

Figure 3.9 Treatment given

Given the importance of identifying the source of sepsis and instituting appropriate treatment, recognition and documentation of a possible source is essential. Reviewers identified only 22 case notes where a provisional source of sepsis was mentioned. Abdominal or pelvic infections formed the largest group, followed by respiratory infection and post-operative surgical causes (data not shown), although not all patients were commenced on treatment (Figure 3.9).

When treatment was started, the type of treatment varied, with some patients receiving more than one modality of therapy (Table 3.11). As was expected the most common treatment initiated was antimicrobial therapy, since it is not always feasible to administer and monitor intravenous fluids or oxygen in general practice.

GP Reviewers were asked to give their opinion on the management of the patients at each visit (Figure 3.10 overleaf). They were of the opinion that management was appropriate in a larger proportion of patients at the last visit when it was likely that the disease process had evolved. On the previous two visits, more patients received less than adequate management in terms of their assessment, monitoring and treatment. Areas of deficiency included the recording and monitoring of vital signs, maintaining adequate and legible records, delayed referrals, and relying on a telephone consultation, resulting in missed clues on diagnosis and severity. A thorough clinical assessment should have been done in person.

Table 3.11 Type of treatment given by the general practitioner

	Last visit		2nd to last visit		3rd to last visit	
Treatment given	n/54	Appropriate	n/26	Appropriate	n/11	Appropriate
IV fluids	N/A	N/A	N/A	N/A	N/A	N/A
Oxygen	1	1	0	N/A	0	N/A
Antimicrobials	12	9	14	8	6	5
Other	7	4	4	3	4	4

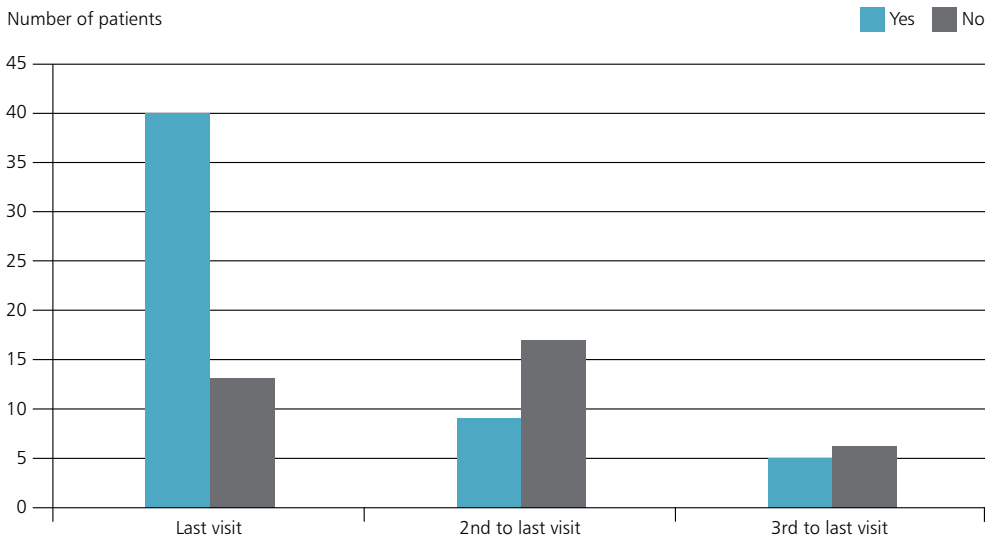

Figure 3.10 Appropriate management at the general practitioner visits – GP Reviewers' opinion

Outcome of visit

The majority of referrals to hospital were as an emergency after having multiple GP visits (Figure 3.11).

Reviewers felt that most referrals made were appropriate and timely, even when GPs may not have recognised the diagnosis or severity of sepsis in some patients (Table 3.12).

The details of the referral process are summarised in Table 3.13. The lack of information given to patients emerged as a theme. The extent of safety netting was also a concern; Reviewers stated that in the majority of cases where it was not put in place that it should have been (Table 3.13).

GP Reviewers were asked to provide their retrospective opinion on whether management in primary care might

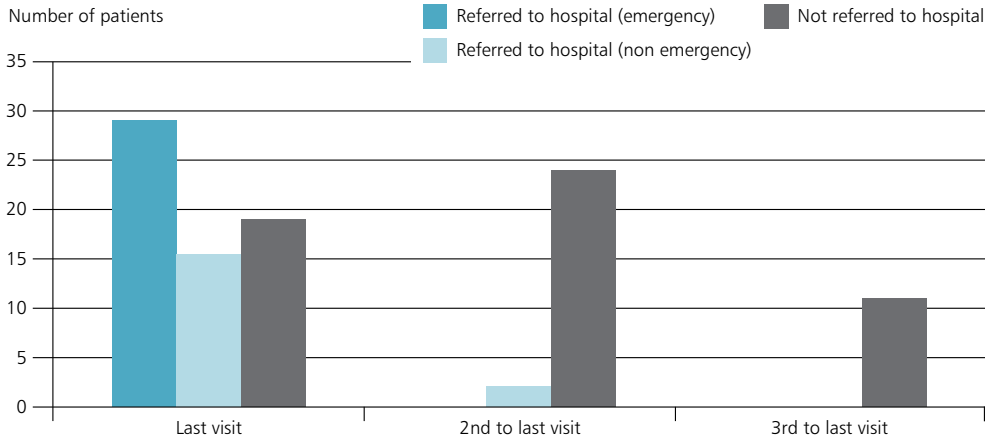

Figure 3.11 Outcome of visit to the general practitioner

Table 3.12 Appropriateness and timeliness of hospital referrals – GP Reviewers' opinion

	Last visit (n/34)		2nd to last visit (n/2)	
Referral	**Yes**	**No**	**Yes**	**No**
Appropriate	33	0	1	1
Timely	22	3	1	1
Successful	33	0	1	1

Table 3.13 Referral to hospital – GP Reviewers' opinion

	Last visit (n/19)			2nd to last visit (n/24)			3rd to last visit (n/11)		
	Yes	**No**	**ID**	**Yes**	**No**	**ID**	**Yes**	**No**	**ID**
Correct decision	5	1	13	8	2	14	5	2	4
Information sheet	0	19	0	0	24	0	1	10	0
Safety netting	9	9	1	12	10	2	5	6	0
If 'no' – should there have been safety netting?	8	0	11	8	1	17	4	2	0

ID = insufficient data

have affected clinical outcome. In 23 of 54 patients the data were inadequate to make a judgement. Of the remaining 31 patients, outcome was believed to be adversely affected in 12 patients. However, in two patients, outcome improved due to good practice (Table 3.14).

On making a global assessment of care provided in primary care, the GP Reviewers agreed that there was evidence of good practice in 19 of the 54 case notes reviewed (Figure 3.12). Of the remainder, a large group (21) required improvement in clinical care, nine required improvement in organisation of care alone or both clinical and organisational care. The reasons given for a less than good grading included failure to assess and record vital signs and missed/delayed diagnosis of sepsis.

Table 3.14 Management in primary care affected the patient's outcome – GP Reviewers' opinion

Management affected outcome	Number of patients
Yes	14
No	17
Subtotal	**31**
Insufficient data	23
Total	**54**

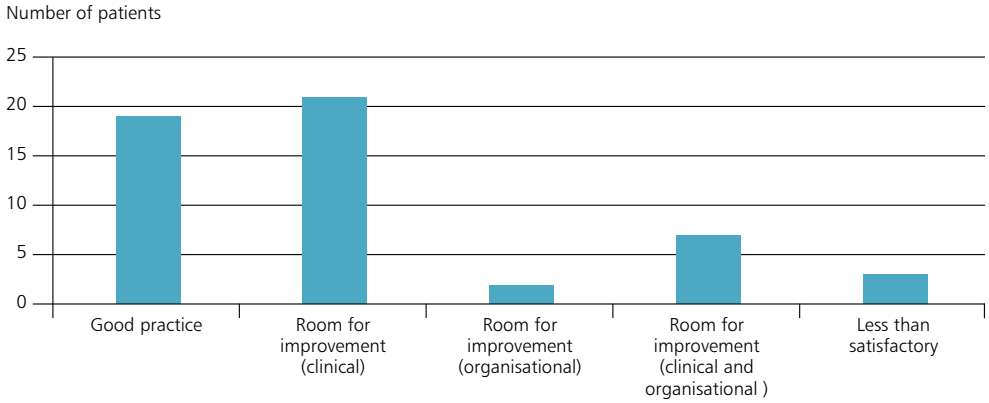

Figure 3.12 Overall quality of primary care – GP Reviewers' opinion

Primary care reviewed as part of the whole pathway from the secondary care perspective

From the hospital case notes, Reviewers were asked to give their opinion on whether the patient had evidence of infection only, sepsis, severe sepsis or septic shock as defined by the Surviving Sepsis Campaign sepsis screening tool[1] prior to their hospital admission (Table 3.15). The Reviewers considered that in 298 patients there was evidence of infection and/or sepsis prior to admission to hospital. In this group, the Reviewers considered that 98/298 (33%) patients had evidence of infection but not sepsis whilst 200 (67%) had sepsis, severe sepsis or septic shock.

Of those patients who were assessed in a pre-hospital setting prior to admission, Reviewers found that the majority were seen by a GP or paramedic (Table 3.16) and 52 patients were seen by both the GP and paramedics. 'Other' listed providers were primarily care home staff who accessed emergency services. Based on hospital case notes, Reviewers were of the opinion that the sepsis was missed by GPs in 28/77 (36%) patients and in a quarter (19/72) the severity was underestimated (Table 3.17).

The treating clinician at the hospital was asked whether there had been a delay in the patient presenting and being admitted to hospital. In their opinion, 112 patients (18%) should have been admitted to hospital sooner (Table 3.18).

Table 3.15 Sepsis severity prior to admission – Reviewers' opinion

Sepsis status	Number of patients	%
Infection only	98	32.9
Sepsis	120	40.2
Severe sepsis	61	20.5
Septic shock	19	6.4
Subtotal	**298**	
No evidence of infection prior to admission	73	
No available information on sepsis status prior to admission	180	
Total	**551**	

Table 3.16 Healthcare professionals who assessed the patient prior to admission

Healthcare professionals	Number of patients	%
Paramedic or equivalent	163	62.7
General practitioner	129	49.6
Out of hours general practitioner/ urgent care service	32	12.3
Telephone consultation/111	11	4.2
Other primary care provider	24	9.2

Answers may be multiple n=260, not answered in 38

Table 3.17 Room for improvement in pre-hospital care - Reviewers' opinion

Room for improvement	Yes	No	Subtotal	Not answered	Total
Diagnosis missed by general practitioner	28	49	**77**	52	**129**
Severity underestimated by general practitioner	19	53	**72**	57	**129**
General practitioner missed the opportunity to refer	28	49	**77**	52	**129**

Table 3.18 Delay in the patient presenting to/being admitted to hospital - treating clinicians' opinion

Delay	Number of patients	%
Yes	112	18.0
No	511	82.0
Subtotal	**623**	
Unknown	53	
Not answered	34	
Total	**710**	

Of the 112 patients considered to have experienced a delay in presentation/admission to hospital, the treating clinicians were of the opinion that a large majority were due to patients seeking advice later than they should have. Delays from the GP (13) and EDs (11) were the next most common reasons, followed by the mental health of the patient (6), the diagnosis being missed by staff in the nursing home (4) and lack of critical care beds (2) (Table 3.19).

Table 3.19 Reason for delayed presentation/ admission to hospital

Reason for delay	Number of patients	%
Patient did not seek medical help early enough	66	59.5
General practitioner	13	11.7
Admitting hospital emergency department	8	7.2
Other hospital emergency department	3	2.7
Urgent care centre	3	2.7
Community nurse	2	1.8
111 service	2	1.8
Ambulance control centre	0	0.0
Paramedic service	0	0.0
Other	13	11.7
None of the above	1	0.9

Answers may be multiple n=111, not answered in 1

When these reasons for delay were compared with the Reviewers' opinion on reasons for delay in diagnosis of sepsis in hospital inpatients, a similar theme of missed diagnosis appears. The diagnosis was missed in 55.4% patients with sepsis and up to 66% of patients with severe sepsis. The treating clinicians were of the opinion that 64/81 patients should have been admitted at least one day earlier (Table 3.20). These data highlight the need for better awareness and use of tools for the diagnosis of sepsis.

Table 3.20 Length of delay in arrival/admission to hospital

Length of delay	Number of patients	%
0-6 hours	9	11.1
>6-12 hours	6	7.4
>12-24 hours	2	2.5
>1-2 days	30	37.0
>2-4 days	16	19.8
>4-7 days	8	9.9
>7-14 days	8	9.9
>14 days	2	2.5
Subtotal	**81**	
Not answered	31	
Total	**112**	

CASE STUDY 1

A young patient presented to their GP with fever, lethargy and dizziness. A diagnosis of viral infection was made. The following day, the patient deteriorated and called an emergency ambulance. On arrival, their vital signs were recorded as pulse 124 bpm, BP 80/40 mmHg, respiratory rate 36/min and temperature 38.2 °C. A diagnosis of severe sepsis due to community acquired pneumonia was made following admission to hospital.

The Reviewers felt that a standardised approach to vital signs monitoring in primary care could have identified the low blood pressure at an earlier stage and helped to prevent deterioration.

CASE STUDY 2

A young patient developed fever with rigors, pain in their left flank and dysuria, but remained at home for 4 days before going to see their GP. The patient was initially diagnosed with a flu-like syndrome but advised to return if they did not start to feel better. The patient re-presented to the GP surgery two days later and was noted "to be sleepy" and have a fever. A urine test was suggestive of urinary tract infection and the patient was transferred to hospital for admission. The infection was managed with intravenous antibiotics by the Critical Care Outreach Team and the patient recovered in 3 days.

Reviewers were of the opinion that a urine test at first presentation to the GP may have diagnosed the urinary tract infection. Appropriate treatment at that stage might have prevented further deterioration, thus avoiding hospital admission. Drowsiness is an important indicator of the severity of sepsis, which was noticed on the second visit and resulted in a prompt transfer to hospital.

Of the 129 patients seen by a GP or out-of-hours GP, a pre-alert was sent to warn the emergency department or acute medical unit of the arrival of a patient with sepsis for only eight patients (Table 3.21). Given the importance of early recognition and treatment, there appears to be scope for further improvement in this area. In the organisational survey of hospitals 95/186 (51%) acute hospitals responded that there was a system of receiving pre-alerts for sepsis.

Table 3.21 Pre-alert sent to the hospital

Pre-alert sent	Number of patients	%
Yes	8	9.4
No	77	90.6
Subtotal	**85**	
Not applicable	4	
Insufficient data	44	
Total	**133**	

Vital signs and scores that use them (like the National Early Warning Score[9]) help with early recognition of severe illness and can improve care, by providing a consistent way of communicating a patient's condition as they move along a pathway of care and are transferred between individuals, organisations and teams. Whilst most hospitals have moved to routine use of early warning scores calculated from recorded vital signs, ambulance and other services also regularly employ scales such as 'alert, voice, pain, unresponsive (AVPU)' as a measure of level of alertness. Details of vital signs recorded by primary and pre-hospital care providers are shown in Table 3.22. Patients admitted by the paramedics had the most comprehensive record.

Table 3.22 Details of pre-hospital vital signs

Vital signs recorded	GP (n/129)	%	Paramedic (n/163)	%	Other (n/24)
Temperature	34	26.4	146	89.6	3
Blood pressure	32	24.8	157	96.3	5
Heart rate	40	31.0	163	100.0	6
Respiratory rate	8	6.2	159	97.5	2
Alert, voice, pain, unresponsive (AVPU)	8	6.2	144	88.3	1
Change in mental status	11	8.5	81	49.7	1
Blood glucose	3	2.3	129	79.1	1

Answers may be multiple

A total of 55/129 (43%) patients who saw their GP, or an out-of-hours GP, arrived in hospital with a referral letter from their GP. Of these 55 letters, 34 were considered to have all the relevant information (Table 3.23).

Table 3.23 Relevant information in referral letter from the general practitioner – GP Reviewers' opinion

Relevant information	Number of patients	%
Yes	34	63.0
No	20	37.0
Subtotal	**54**	
Insufficient data	1	
Total	**55**	

Urgently starting treatment for sepsis is recommended. Reviewers found that 127/223 (57%) patients received some treatment prior to arrival at hospital (Table 3.24)

Table 3.24 Pre-hospital treatment

Treatment commenced	Number of patients	%
Yes	127	57.0
No	96	43.0
Subtotal	**223**	
Unknown	51	
Not applicable	10	
Insufficient data	14	
Total	**298**	

Table 3.25 Healthcare professional providing treatment

Healthcare professional	Fluids	Oxygen	Antimicrobials	Other
General practitioner (129)	0	0	19	6
Paramedic (163)	26	65	0	56
Other (2)	1	2	2	0
Inappropriate therapy	9	12	5	2

Table 3.26 Room for improvement in pre-hospital care - Reviewers' opinion

Room for improvement	Number of patients	%
Yes	86	38.9
No	135	61.1
Subtotal	**221**	
Insufficient data	77	
Total	**298**	

Table 3.27 Details of room for improvement in pre-hospital care

Area in need of improvement	Number of patients	%
General practitioner	38	44.2
Paramedic	41	47.7
Other primary care provider	4	4.7
Other	13	15.1

Answers may be multiple n=86

In those patients given pre-hospital treatment, intravenous fluids and oxygen were administered primarily by paramedics and GPs more commonly administered antimicrobials before referring patients to hospital as IV fluids and oxygen are rarely feasible to administer in general practice (Table 3.25).

'Other' treatments initiated by paramedics included analgesia, nebulisers, glucose by mouth and anti-emetics. Inappropriate therapy included those cases where the healthcare professional was unable to cannulate the patient or inadequate dosage of antimicrobials, fluids or oxygen were administered.

The Reviewers considered that there was room for improvement in pre-hospital management in 86/221 (39%) of patients sent to hospital (Table 3.26).

The areas of improvement spanned all aspects of pre-hospital care and often involved multiple steps in one patient's journey (Table 3.27).

Reviewers were of the opinion that the clinical outcome was affected in six patients. The common reasons were delayed recognition of sepsis or of its severity and the resultant delay in timely intervention.

Reviewers suggested that delays in recognition and management contributed to the patient's deterioration and earlier intervention would have improved the patient's outcome.

The emergency department

A total of 369 patients were admitted through the hospital ED (Table 3.28) had sufficient notes to review the care in the ED. Table 3.29 shows the sepsis status of these patients at this point in their care pathway according to the Reviewers; the majority of patients were admitted with sepsis. The Reviewers also assessed the documented diagnosis at this stage of the patient pathway and compared this with whether they considered the diagnosis to be correct. For infection, sepsis, severe sepsis and septic shock the Reviewers were of the opinion that a number of cases were not documented and hence possibly missed in each group. Only 10/91 patients had the diagnosis of severe sepsis documented in their case notes (Table 3.29).

Table 3.28 Patients admitted via the emergency department

Emergency department admission	Number of patients	%
Yes	369	75.0
No	123	25.0
Subtotal	**492**	
Insufficient data	59	
Total	**551**	

Evaluation in most emergency departments normally involves initial assessment by a triage service and then an assessment by a senior clinician. Reviewers considered that there was a delay in initial triage in 27/294 (9.2%) patients, and in 112/279 (40%) patients there was a delay in senior review (Table 3.30). Eighteen of the patients delayed in triage were also delayed for senior review and 16 of these had sepsis, severe sepsis or septic shock at this time-point.

The healthcare professional who assessed patients in the ED at triage and first review are summarised in Figure 3.13. Consultants were involved at presentation in a quarter of patients but the majority of patients were reviewed by a specialist trainee or staff grade. Nurses were involved in triage in just over half the patients presenting with sepsis.

CASE STUDY 3

A young patient presented with a 2 day history of cough and worsening shortness of breath on a background of bronchial asthma. The patient was seen by their GP who diagnosed a chest infection and transferred the patient by ambulance to the emergency department. Reviewers were of the opinion that the patient should have received intravenous fluids and oxygen in the ambulance since they were manifesting early hypotension and hypoxia. On arrival in the emergency department the triage nurse considered the possibility of chest infection but the hospital sepsis proforma was not completed. Chest X-ray, antibiotics and initial assessment/management for sepsis was not initiated. An hour later the patient became profoundly hypotensive and drowsy at which time the patient was reviewed by a consultant who then initiated the sepsis care bundle. The patient required transfer to critical care for mechanical ventilation and their condition improved over the following 7 days. However, the ICU stay was complicated by ventilator associated pneumonia and peripheral gangrene of both feet. There was significant disability at discharge requiring prolonged rehabilitation.

Reviewers suggested that delays in recognition and management contributed to the patient's deterioration and earlier intervention would have improved the patient's outcome.

Table 3.29 Sepsis status in the emergency department

Sepsis status in the emergency department	Reviewer opinion - number of patients	% of emergency department population	Number of patients in each group documented in the case notes (%)
Infection only	48	14.0	30 (62.5)
Sepsis	142	41.4	76 (53.5)
Severe sepsis	91	26.5	10 (11.0)
Septic shock	45	13.1	15 (33.3)
None of the above	17	5.0	15 (88.2)
Subtotal	**343**		
Insufficient data	26		
Total	**369**		

Table 3.30 Delayed review in the emergency department

Delay	In triage - number of patients	%	In senior review - number of patients	%
Yes	27	9.2	112	40.1
No	267	90.8	167	59.9
Subtotal	**294**		**279**	
Insufficient data	75		90	
Total	**369**		**369**	

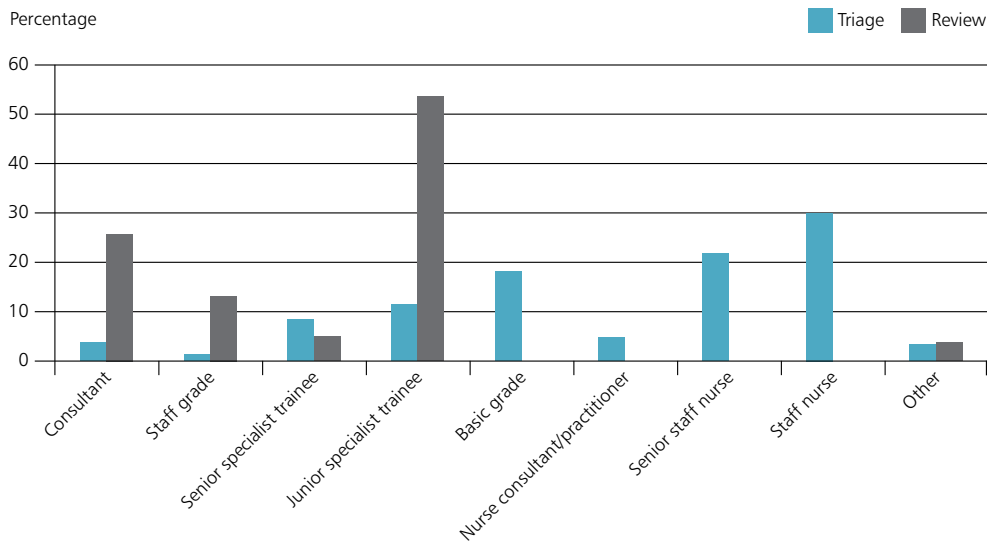

Figure 3.13 Grade of clinician who assessed the patient in the emergency department

Table 3.31 Appropriateness of the grade of clinician who assessed the patient in the emergency department

Appropriate	Triage grade	%	Senior grade	%
Yes	168	96.0	161	89.4
No	7	4.0	19	10.6
Subtotal	**175**		**180**	
Insufficient data	194		189	
Total	**369**		**369**	

Reviewers were of the opinion that an appropriate grade of staff triaged the patient in 168/175 (96%) cases and 161/180 (90%) patients were reviewed in the emergency department by a clinician of appropriate seniority (Table 3.31).

Having a clear and consistent record of vital signs is essential. It was found that none of the vital signs were recorded consistently in the notes. Given the importance of level of consciousness and mental status in the diagnosis of sepsis, this area needs improvement.

At triage there were 66 patients for whom none of the listed vital signs were recorded and 150 patients at the stage of ED senior review, and 37 cases where none of the listed vital signs were recorded at either assessment. At triage, 103 sets of case notes had all the listed vital signs recorded. For 152 cases there were a complete set of vital signs recorded between the two assessments (Table 3.32).

Many previous NCEPOD reports have commented on the importance of documentation yet it is an area that always needs improvement.

Confusion and delirium can be important indicators of developing or worsening sepsis and are easier to measure at the bedside compared to some vital signs that require an instrument. The common scores in use are 'AVPU' or the Glasgow Coma Scale. Despite their ease, they were recorded in only 69.4% of patients (Table 3.32).

It is known that identifying the source of sepsis and controlling it is vital in managing sepsis.[2] Reviewers noted that there were 173 cases at triage and 64 at the ED review, in whom the likely source of infection was not documented (Table 3.33). In half of the cases not documented at triage (59/120) and one third of those not documented at the ED review (17/51) the Reviewers felt that it should have been.

Table 3.32 Vital signs recorded in the emergency department

Vital signs recorded	At triage - number of patients	% of cases assessed at triage	Either at triage or emergency department review - number of patients	% of cases assessed either at triage or emergency department review
Temperature	279	75.6	306	82.9
Blood pressure	296	80.2	326	88.3
Heart rate	296	80.2	327	88.6
Respiratory rate	283	76.7	310	84.0
GCS/AVPU/mental status	217	58.8	256	69.4
Blood glucose	145	39.3	167	45.3

Answers may be multiple n=369

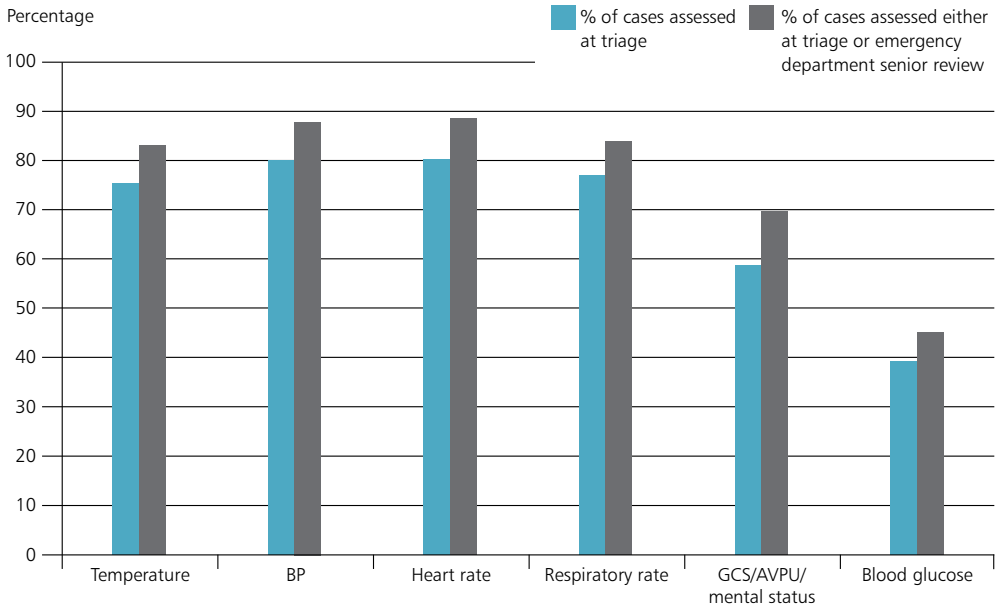

Figure 3.14 Vital signs assessed in the emergency department n=369

The likely source of infection/sepsis was documented at triage in 148/321 (46%) patients, which increased to 227/291 (78%) patients at senior review. It is important to consider the possible, or most likely, source of infection as it helps in selecting the most appropriate antimicrobial and any other intervention required to treat the source of infection.

For cases where the source of infection was not documented, Reviewers were of the opinion that there was adequate evidence for a provisional diagnosis of the source of infection in 59/120 patients at triage and 34/151 patients at senior review (Table 3.34).

Table 3.33 Likely source of infection was documented

Likely source of infection was documented	Triage	%	Review	%
Yes	148	46.1	227	78.0
No	173	53.9	64	22.0
Subtotal	**321**		**291**	
Insufficient data	48		78	
Total	**369**		**369**	

Table 3.34 If not documented, the likely source of infection should have been documented - Reviewers' opinion

Source should have been documented	Triage	%	Review	%
Yes	59	49.2	34	66.7
No	61	50.8	17	33.3
Subtotal	**120**		**51**	
Insufficient data	53		13	
Total	**173**		**64**	

The Reviewers considered the quality and completeness of the initial assessment process and stated that the history was often well documented, but that there was room for improvement in the investigations (95/369; 26%), treatment plans (117/369; 32%) and monitoring plans (136/369; 37%) (Table 3.35). The detail of missing information from the treatment and monitoring plans are shown in Table 3.36.

Table 3.35 Areas needing improvement in the initial assessment

Room for improvement	Number of patients	%
History taking	4	1.1
Investigations	95	25.7
Treatment plan	117	31.7
Monitoring plan	136	36.9

Answers may be multiple n=369

Table 3.36 Detail of missing information from treatment and monitoring plans

Treatment plan	Number of patients (n=117)	%
Oxygen	59	50.4
Fluids	39	33.3
Antibiotics	44	37.6
Others	21	17.9
Monitoring plan	**Number of patients (n=136)**	**%**
Urine output	106	77.9
Early warning score	75	55.1
Other	20	14.7

Answers may be multiple

There were eight patients for whom the treatment plan was missing for all three interventions: oxygen, fluids and antimicrobial therapy (Table 3.36). Prompt cultures, which are a key part of diagnosis and treatment, were missing in 37% cases (data not shown) and were inappropriately delayed in another 9.5%. Where other cultures were required 11.8% of these were incomplete. In the area of diagnostic imaging 20.6% CT scans were delayed (Figure 3.15).

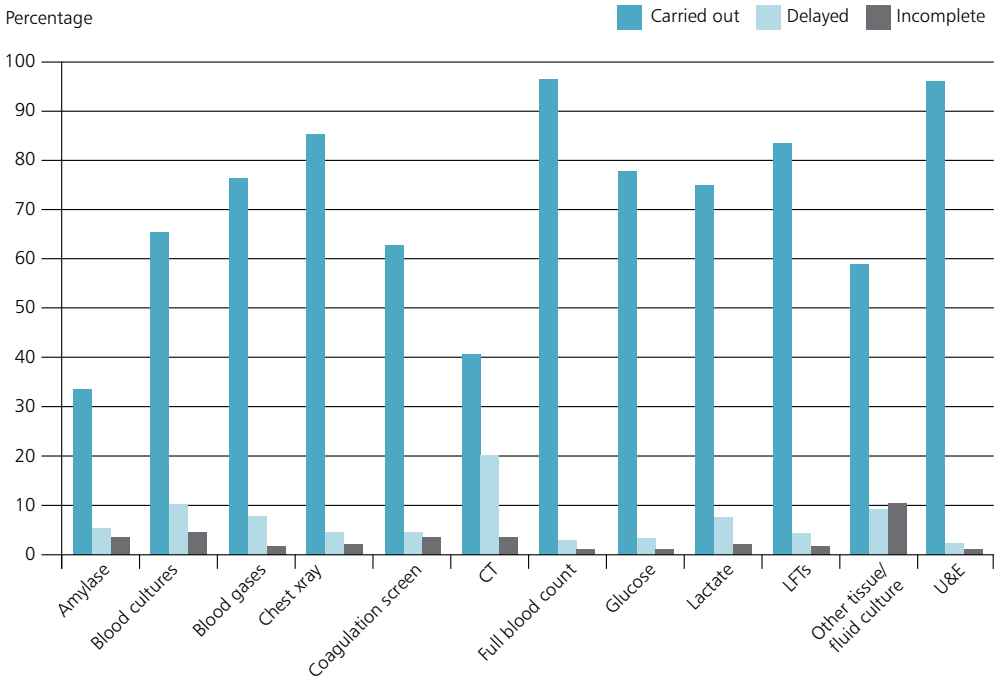

Figure 3.15 The percentage of cases for whom the listed investigations were carried out in the emergency department

Key Findings

- One quarter of patients (192/702; 27.4%) in this study had been admitted previously with an episode of sepsis
- 1 in 8 patients (67/536; 12.5%) self-referred to hospital with sepsis
- In only 8/85 (9.4%) patients seen by a GP (where the reviewers could answer) were pre-alerts sent to warn hospitals of the arrival of a patient with sepsis
- Both the secondary care Reviewers assessing hospital case notes and the GP Reviewers reviewing the GP notes found that there was a poor adherence to the recording of vital signs by GPs assessing patients. Less than half of patients had their temperature (25/54) or blood pressure (23/54) taken
- Evidence of safety netting was present in 9/54 cases (last visit), 10/26 cases (2nd to last visit) and 5/11 cases (3rd to last visit)
- For just over half (55/101) of the patients referred to hospital from the GP, the referral letter was included in the case note record
- There was room for improvement in 86/221 (38.9%) in the care provided to patients in the primary care setting
- No early warning score was used in any of the GP case notes reviewed
- Deficiencies in record keeping were present in both primary and secondary care
- The commonest reason for delay in arriving at the hospital emergency department was because the patient did not present to a clinician early enough (66/111; 59.4%)
- 267/294 (90.8%) patients admitted via the emergency department had appropriately timed triage assessment
- 112/279 (40.1%) patients did not have a timely review by a senior clinician
- There was inconsistency in the recording of vital signs in the emergency department with 66/369 (17.8%) having no vital signs recorded in their case notes
- A possible source of infection was only recorded at triage in 148/321 (46.1%) of patients admitted via the emergency department
- Reviewers considered that there was room for improvement in the emergency department in investigations (95/369; 25.7%), treatment planning (117/369; 31.7%) and monitoring plan (136/369; 36.9%)

Admission to hospital

Back to contents

There was no difference seen in the days of the week on which patients in the study were admitted to hospital. However, slightly more patients were admitted out of normal working hours (Figures 4.1 and 4.2).

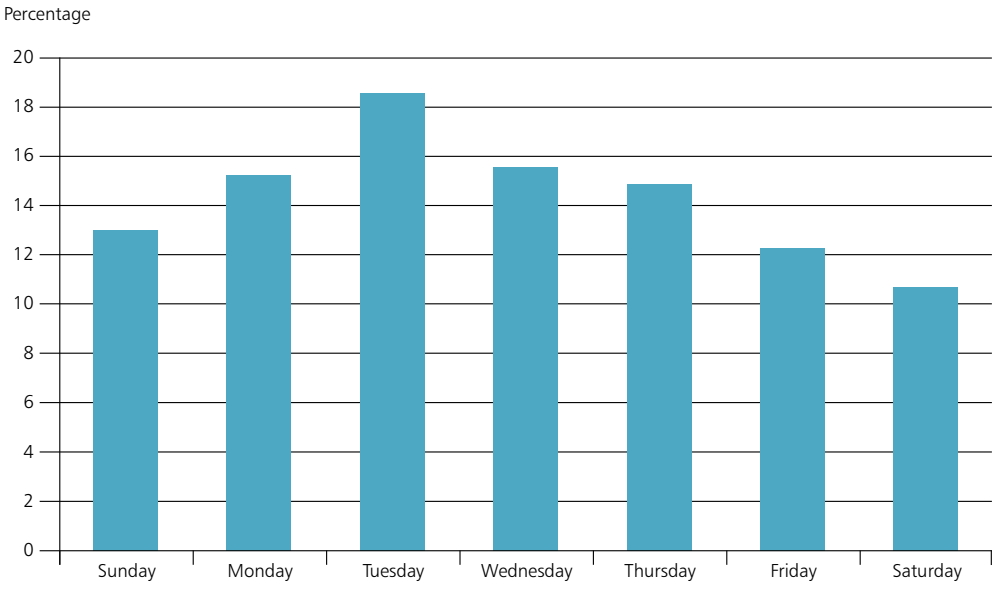

Figure 4.1 Day of admission to hospital

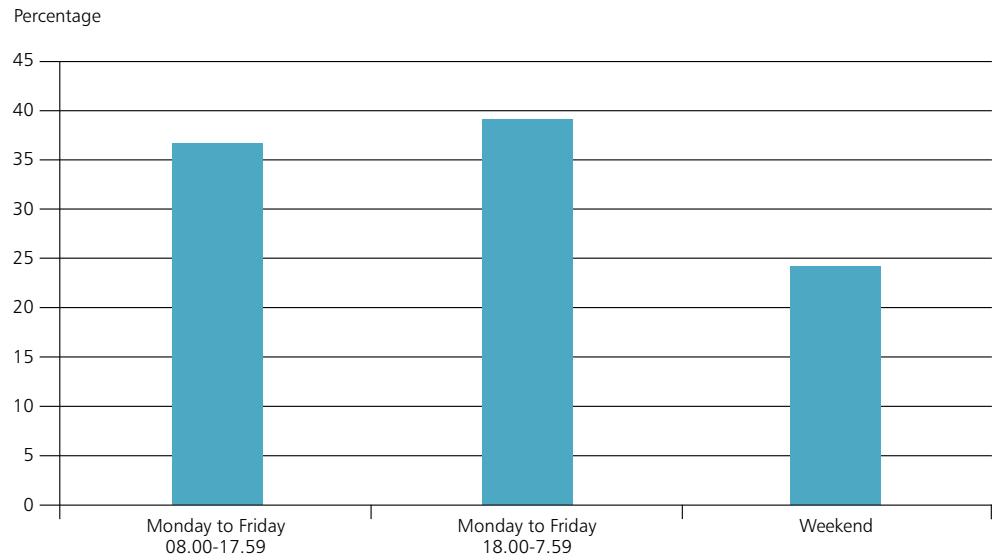

Figure 4.2 Time of admission to hospital

Table 4.1 Location to which the patient was first admitted

Location	Number of patients	%
Acute admissions unit	275	53.1
General ward	72	13.9
Specialist ward	75	14.5
Level 2	42	8.1
Level 3	44	8.5
Theatre	10	1.9
Subtotal	**518**	
Insufficient data	33	
Total	**551**	

Following assessment and triage, Table 4.1 shows the hospital location to which patients were first admitted.

Figure 4.3 demonstrates that as severity of sepsis increased the proportion of patients admitted to higher care areas also increased. This is entirely in line with what would and should be expected.

One in five patients were admitted to higher care areas. The Reviewers were of the opinion that in 93% (493/530) of cases this was the correct decision. Of the 37/530 patients considered to have been admitted to an incorrect area, 27 should have been admitted to a critical care facility for higher level care (Tables 4.2 and 4.3).

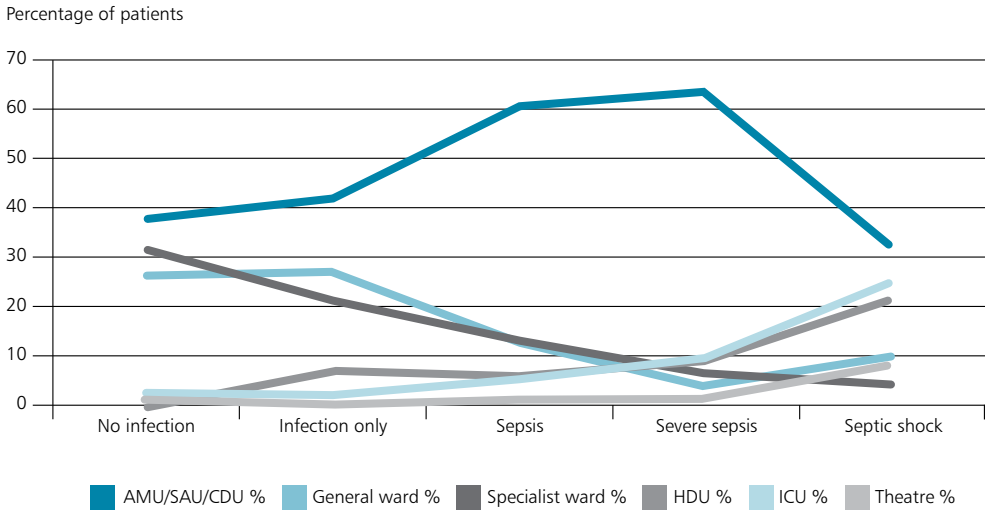

Figure 4.3 Location admitted to and severity of sepsis

Table 4.2 Correct location for the point admission – Reviewers' opinion

Correct location	Number of patients	%
Yes	493	93.0
No	37	7.0
Subtotal	**530**	
Insufficient data	21	
Total	**551**	

Table 4.3 If the patient was admitted to an inappropriate location – level of care to which the patient should have been admitted to?

Level of care	Number of patients
Level 0/1	9
Level 2	26
Level 3	1
Subtotal	**36**
Insufficient data	1
Total	**37**

The Reviewers considered that 49/361 (13.6%) patients experienced a delay in their admission to a hospital bed (Table 4.4).

Table 4.4 Admission to the ward was delayed – Reviewers' opinion

Admission delayed	Number of patients	%
Yes	49	13.6
No	312	86.4
Subtotal	**361**	
Insufficient data	190	
Total	**551**	

The principal reason for the delay to admit to a ward is shown in Table 4.5. In 16/30 cases this was due to a lack of beds.

Table 4.5 Reason for delay to admit to a ward – Reviewers' opinion

Reason admission to ward was delayed	Number of patients
Lack of beds	16
Delays in the emergency department	8
Portering delay	2
Clinical reason	2
Delayed investigations	1
Lack of staff	1
Subtotal	**30**
Not answered	19
Total	**49**

The Reviewers were of the opinion that the delay in admission to the ward affected the outcome in 7/37 patients (Table 4.6), four of whom died.

Table 4.6 Outcome affected by the delay in admission to hospital – Reviewers' opinion

Outcome	Number of patients
Yes	7
No	30
Subtotal	**37**
Insufficient data	12
Total	**49**

There were 80/466 (18%) patients who were not reviewed by a consultant within an adequate time frame in the view of the Reviewers (Table 4.7). Royal College of Physicians of London guidelines state that all emergency admissions must be seen and have a thorough clinical assessment by a suitable consultant as soon as possible but at the latest within 14 hours from the time of arrival at hospital. This is also the standard set by NHS England on 7 day services.[37,38]

Table 4.7 Timeliness of first consultant review – Reviewers' opinion

Timely consultant review	Number of patients	%
Yes	366	82.1
No	80	17.9
Subtotal	**446**	
Insufficient data	105	
Total	**551**	

Assessing the time frame from admission to consultant review 20% (116/571) of patients were reviewed by a consultant more than 14 hours after admission (Table 4.8).

Table 4.8 Time from admission to consultant review – Clinician questionnaire

Time from admission to consultant review	Number of patients	%
Negative time - seen in the emergency department before admission	42	7.4
0-1 hours	80	14.0
>1-4 hours	107	18.7
>4-6 hours	69	12.1
>6-8 hours	48	8.4
>8-12 hours	88	15.4
>12-14 hours	21	3.7
>14-24 hours	86	15.1
>24 hours	30	5.3
Subtotal	**571**	
Missing data	139	
Total	**710**	

Focusing on the data for those patients who arrived at hospital with sepsis (filtering out those that developed sepsis in hospital), the proportion of patients seen by a consultant after 14 hours is the same (95/471; 20%).

Of those patients who had a delayed (more than 14 hours) consultant review, 65/116 (56%) were admitted out-of-hours or on the weekend. Only 9/116 (8%) patients in this group were admitted directly to critical care.

Successive NCEPOD reports have highlighted the benefits of consultant review for acutely unwell patients, as has the recent Ombudsman report into sepsis.[21] In this study a consultant did not review 18% of patients in a timely manner. In view of the fact that changes were made to the patients' management in 62% of cases following consultant review (Table 4.9) and following this review 66% of these patients had a change in the treatment plan, it remains important that patients receive prompt consultant input.

Table 4.9 Changes made following the first consultant review – Reviewers' opinion

Changes made	Number of patients	%
Yes	281	61.5
No	176	38.5
Subtotal	**457**	
Insufficient data	94	
Total	**551**	

The principal changes made by consultants were to the investigations ordered and the treatment plans (Table 4.10). Consultant involvement for patients considered 'high risk' (with a high risk of mortality, or where a patient is unstable and not responding to treatment as expected) should be within one hour. Numerous reviews have concluded that patients have increased morbidity and mortality when there is a delay in the involvement in their care of consultants. This has been seen across a wide range of specialties including in acute medicine and acute surgery, emergency medicine, trauma, anaesthetics and obstetrics.[39]

Table 4.10 Changes made to patient care following a consultant review – Reviewers' opinion

Changes made	Number of patients	%
Diagnosis of sepsis	38	13.5
Documentation of diagnosis of sepsis	34	12.1
Documentation of severity of sepsis	22	7.8
Investigations	154	54.8
Other	62	22.1
Treatment plan	185	65.8
Starting care bundle	7	2.5
Monitoring plan	76	27.0

Answers may be multiple n=281

CASE STUDY 4

An elderly patient was admitted to a small district general hospital with abdominal pain and vomiting. The patient was diagnosed with gallstone pancreatitis and was given antibiotics and supportive treatment. The inpatient notes for the admission were poor and there was no evidence of senior input. After two weeks the patient was transferred to a tertiary unit with a necrotic pancreas for percutaneous drainage of a peripancreatic collection. Over the next two weeks the patient's condition slowly deteriorated and the patient died.

The Reviewers were of the opinion that there had been inadequate senior review, there was no clear management plan and that initial fluid resuscitation had been inadequate. Earlier structured treatment may have produced a better outcome.

4

Key Findings

- In the Reviewers' opinion, 493/530 (93.0%) patients were admitted to the correct location
- In the Reviewers' opinion, 49/361 (13.6%) of patients were delayed in their admission to a definitive hospital bed. The principal reason for delay (16/30) was a lack of beds
- The delay in admission to hospital affected the outcome in 7/37 patients
- 80/446 (17.9%) patients were not reviewed by a consultant within an adequate time frame according to Reviewers
- 116/571 (20.3%) patients in this study were not seen by a consultant within 14 hours, even for those who arrived in hospital with sepsis (95/471; 20%)
- 281/457 (61.5%) patients had changes made to their care following consultant review

5

Patients with hospital-acquired infections

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The Health Protection Agency identified the prevalence of hospital-acquired infections to be 6.4% in 2011 compared to 8.2% in 2006.[40] The most frequent hospital-acquired infections detected were respiratory tract, urinary tract and surgical site infections. The prevalence of hospital-acquired infections and device use was highest in intensive care units, which relates in part to the complexity and vulnerability of patients in this setting. In the current study, according to the Reviewers 115/498 patients developed their infection in hospital (Table 5.1). Hospital-acquired infections of the respiratory tract and relating (either directly or indirectly) to a surgical procedure formed the majority of cases, where it was possible to identify the source of infection (Table 5.2).

Table 5.1 Patient developed the infection that caused the episode of sepsis whilst in hospital – Reviewers' opinion

Hospital-acquired infection	Number of patients	%
Yes	115	23.1
No	383	76.9
Subtotal	**498**	
Not answered	53	
Total	**551**	

More than half of these patients (73/115; 63%) appear to have acquired their infection following an invasive procedure (Table 5.3).

The commonest procedure resulting in sepsis was a procedure involving the abdomen (29 cases). In 15 cases where antimicrobials were not given prophylactically, the Reviewers considered that they should have been in only one case (Table 5.4).

Table 5.2 Source of the hospital-acquired infection

Source of infection	Number of patients
Chest infection/hospital-acquired pneumonia/aspiration pneumonia	38
Directly related to a procedure	30
Related to the post-op care following a procedure	10
Catheter	8
Ventilator acquired pneumonia	5
Gastrointestinal	4
Cellulitis	3
Infected pressure sores	2
Cannula	2
Urinary	2
Norovirus	2
Intravascular device	1
Insufficient data	20

Answers may be multiple n=115

Table 5.3 Infection occurred following an invasive procedure

Infection	Number of patients	%
Yes	73	63.5
No	42	36.5
Total	**115**	

Table 5.4 Prophylactic use of antimicrobials

Prophylactic antimicrobials given	Number of patients	%
Yes	43	74.1
No	15	25.9
Subtotal	**58**	
Insufficient data	15	
Total	**73**	

It has been demonstrated that increased compliance with sepsis performance bundles is associated with better outcomes, and this must include attempts at prevention as well as cure.[41] In this study there was no evidence in nine patients out of 39 that a surgical site bundle was used (Table 5.5).

Table 5.5 Evidence that a surgical site bundle was used

Evidence of surgical site bundle	Number of patients
Yes	30
No	9
Subtotal	**39**
Insufficient data	34
Total	**73**

The majority of surgical site infections are preventable. Measures may be taken throughout the surgical pathway to reduce the risk of infection. NICE Clinical Guideline 74 makes recommendations for the prevention and management of surgical infections based on best available published evidence and the use of a bundle of care.[42]

It can be seen in Table 5.6 that for those patients who developed infection/sepsis following surgery, sepsis was first recorded within one week of the procedure, in the majority of cases.

The Reviewers considered that in 10/88 patients who acquired an infection in hospital that it might have been preventable (Table 5.7).

Table 5.6 Time from surgery to infection

Days	Number of patients	%
Same day	8	11.9
1-2	26	38.8
3-7	19	28.4
8-14	9	13.4
15-21	1	1.5
22-30	2	3.0
>30	2	3.0
Subtotal	**67**	
Missing data	6	
Total	**73**	

Table 5.7 Preventable hospital-acquired infection – Reviewers' opinion

Preventable infection	Number of patients	%
Yes	10	11.4
No	78	88.6
Subtotal	**88**	
Insufficient data	27	
Total	**115**	

Table 5.8 shows the details of themes of these cases. It appears that most of these cases were failures in basic care and recognition of a deteriorating patient.

The Reviewers found evidence in the majority of cases (71/83) with hospital-acquired infections that patients were monitored using an early warning scoring system (Table 5.9). The Reviewers considered that the frequency

Table 5.8 Details of 'preventable' hospital-acquired infections

"Possibly preventable as the patient had come in from a nursing home with pressure sores - developed gangrenous pressure sores in hospital. No mention of specialist mattresses etc being used on the acute ward."
"There was an unusual plan of initial prolonged post-operative bed rest which probably contributed to post-operative pneumonia."
"Long line inserted using 'aseptic technique' but should have been a sterile procedure."
"There is no evidence that I can see that pre-op/ intra-op antibiotics were administered - this is unusual I would say for a patient having an emergency laparotomy."
"Possibly preventable by pre-op MSU screening. The organism isolated later likely to be resistant to prophylaxis used."

of monitoring during the 24 hours before sepsis was documented was appropriate in 90% (69/77) of patients who developed a hospital-acquired infection (Table 5.10).

Table 5.9 Use of early warning scores in patients who developed hospital-acquired infections

Early warning score used	Number of patients	%
Yes	71	85.5
No	12	14.5
Subtotal	**83**	
Insufficient data	32	
Total	**115**	

NICE Clinical Guideline 50, on the recognition and response to acute illness in adults in hospital states that, "physiology track and trigger systems should be used to monitor all adult patients in acute hospital settings. Physiological observations should be monitored at least every 12 hours. The frequency of monitoring should increase if abnormal physiology is detected".[47] In the current study, plotting the frequency of monitoring against the Reviewers' opinion on its appropriateness (Figure 5.1), it can be seen that although the frequency of monitoring was considered to be largely adequate; where it was considered to be inappropriate, the Reviewers were of the opinion that for a patient with sepsis, the monitoring should have occurred more frequently than the standard 6 or 12 hourly observations.

Table 5.10 Adequacy of the frequency of monitoring during the 24 hours in hospital prior to sepsis being first documented - Reviewers' opinion

Adequate monitoring	Number of patients	%
Yes	69	89.6
No	8	10.4
Subtotal	**77**	
Insufficient data	38	
Total	**115**	

The Reviewers considered that 23/95 patients who acquired an infection in hospital could have been identified sooner, and 24/95 should have been treated in a more appropriate manner. In the group considered by Reviewers to have been treated inappropriately, the commonest reason for being classified as such was the choice of an inappropriate antimicrobial therapy and/or an inappropriate dose.

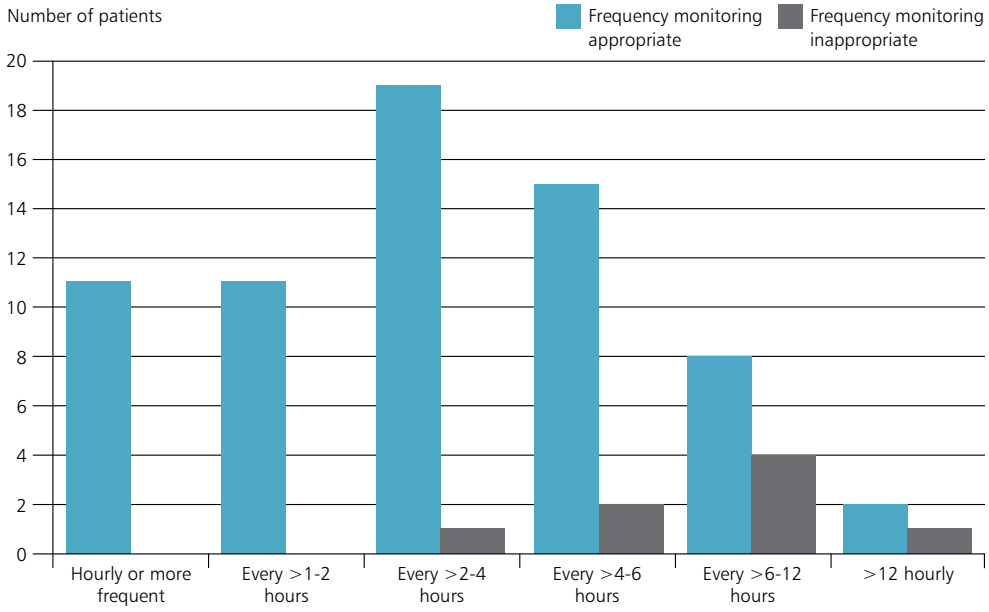

Figure 5.1 Frequency and appropriateness of monitoring in the 24 hours before sepsis was diagnosed

Key Findings

- 115/498 (23%) patients acquired their infection whilst in hospital. In half of these patients 73/115 (63.5%) the infection was diagnosed following an invasive procedure
- A surgical site bundle was utilised in 30/73 (41.1%) invasive procedures
- In 10/88 (11.4%) patients with hospital-acquired infection, the Reviewers stated that the infection was preventable
- 23/95 (24.2%) patients could have had their infection identified sooner and 23/63 (36.8%) should have commenced treatment sooner in the opinion of Reviewers

First identification of sepsis

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The systemic inflammatory response syndrome (SIRS) was first described 23 years ago as a clinical expression of the immune system's response to an infection. In the presence of symptoms meeting two or more of the SIRS criteria, severe sepsis was seen as evolving from infection to sepsis, severe sepsis, and septic shock, in order of increasing severity. However, the need for patients to meet two or more SIRS criteria has been widely criticised because of a low specificity for infection within 24 hours after admission. Moreover, some patients (the elderly and those taking medications that affect heart rate, respiratory rate, or body temperature) may not have symptoms meeting two or more SIRS criteria, despite having infection and organ failure.[43] The incidence of SIRS criteria and organ dysfunction at the time of sepsis diagnosis, identified from the patient's notes is listed in Table 6.1.

The Reviewers considered that there had been a delay in identifying sepsis in 182/505 (36.0%) patients. There was a delay in identifying severe sepsis in half (167/324; 51.5%) the patients and in one third of those with septic shock (63/193; 32.6%) (Figure 6.1 overleaf).

The median delay in identifying sepsis was 9 hours and the mode 3 hours. A graph of the length of delay in identifying sepsis, severe sepsis and septic shock and the cumulative percentage of patients is seen in Figure 6.2 overleaf. These data may add support to the difficulty healthcare professionals may encounter in identifying sepsis, and it is only as it becomes severe and moves to septic shock that diagnosis is made easier.

Table 6.1 Positive SIRS criteria and organ dysfunction at time of sepsis diagnosis – Clinician questionnaire

Positive SIRS criteria	Number of patients	%
Tachycardia (>90bpm)	513	72.3
Leukocytosis (WBC>12000)	446	62.8
Tachypnoea (>20bpm)	415	58.5
Hyperthermia (>38.3°C)	324	45.6
Measures of organ dysfunction		
Lactate (>2mmol/L)	271	38.2
Altered mental status	246	34.6
Systolic BP <90mmHg/MAP <65mmHg	230	32.4
Creatinine (>178μMol/L)	165	23.2
Hypothermia	101	14.2
Platelet count (<100000μl)	98	13.8
Coagulopathy (INR>1.5)	91	12.8
Hyperglycaemia (plasma glucose >7.7mmol/L)	90	12.7
Bilirubin (>34.2mmol/L)	87	12.3
Acute lung injury	82	11.5
Systolic BP decrease (>40mmHg from baseline)	63	8.9
Leukopaenia (WBC <4000)	33	4.6

Answers may be multiple n=710

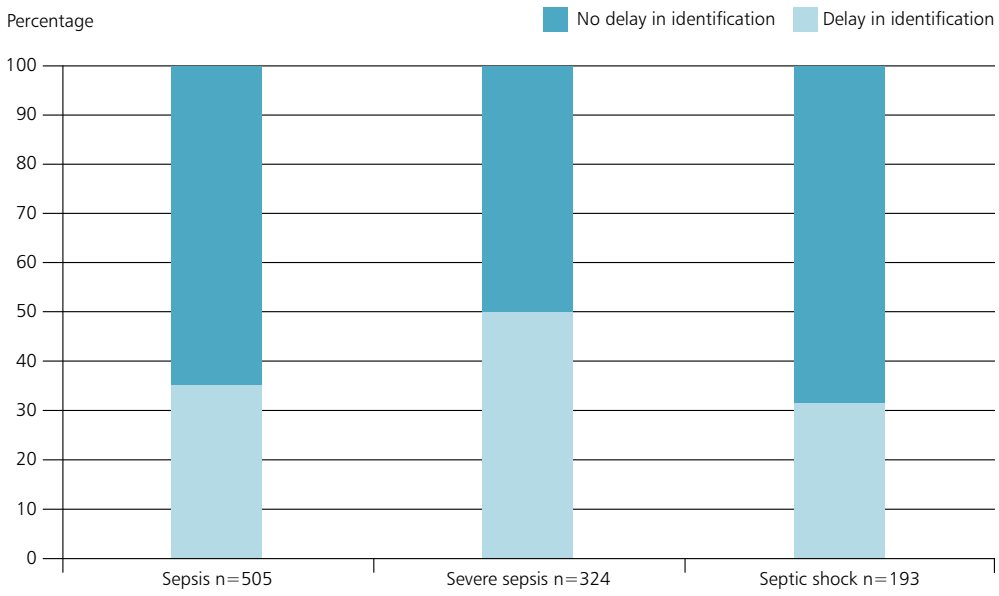

Figure 6.1 Delay in identifying sepsis, severe sepsis and septic shock – Reviewers' opinion

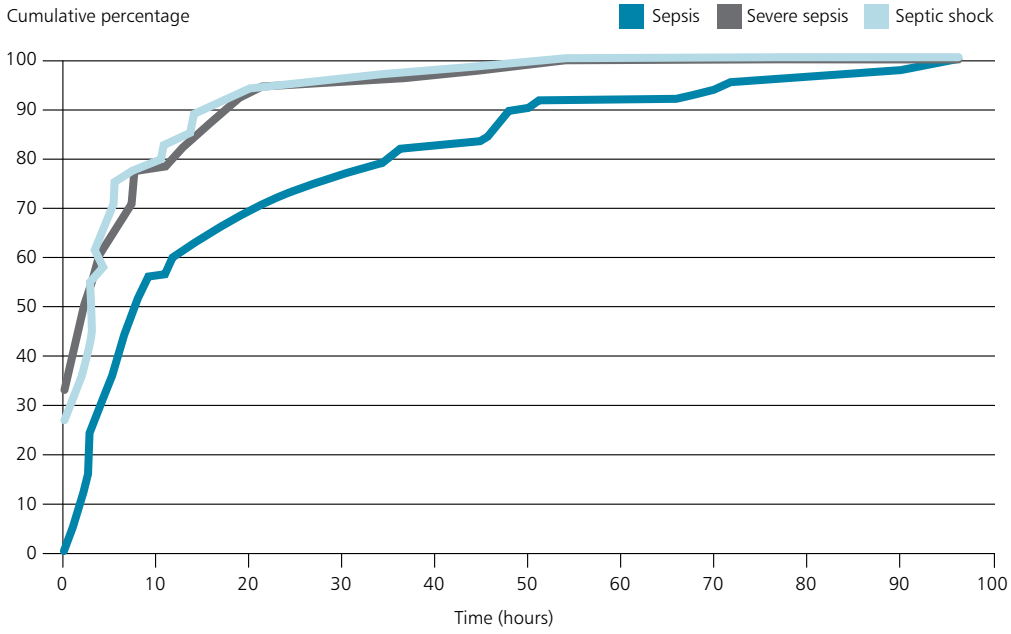

Figure 6.2 Cumulative percentage of time delay in diagnosing sepsis, severe sepsis and septic shock

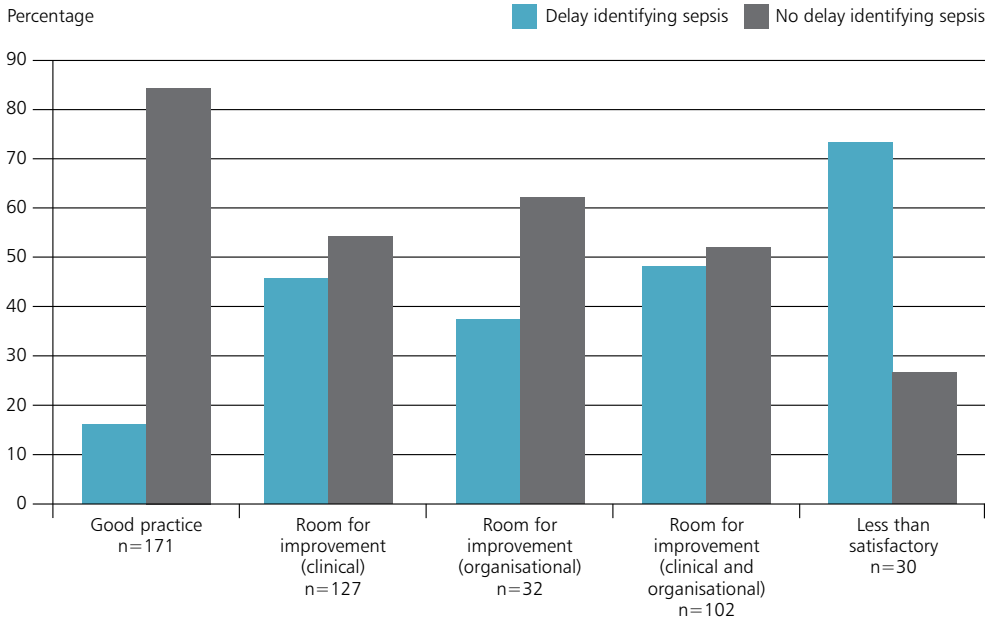

Figure 6.3 Overall quality of care and delay in diagnosis

Delay in identifying sepsis and the Reviewers' opinion on overall quality of care seemed to be linked (Figure 6.3). As the rated quality of care decreases with recognised room for improvement, the proportion of each group with a delayed diagnosis increases. It is not surprising that the delay in diagnosis would be a key contributor to the quality of care rating as a delay in diagnosis of sepsis leads on to a delay in all subsequent management steps.

Table 6.2 Reason for the delay in diagnosis of sepsis

Reason for delay in diagnosis:	Sepsis: Number of patients	%	Severe sepsis: Number of patients	%	Septic shock: Number of patients	%
Incorrect calculation of early warning score	3	1.7	1	0.6	0	0
Missed by reviewing clinician	97	55.4	105	66.0	36	62.1
Lack of senior review	18	10.3	10	6.3	6	10.3
Insufficient frequency of clinical review	7	4.0	5	3.1	4	6.9
Insufficient monitoring/investigations	6	3.4	9	5.7	0	0
Other	44	25.1	29	18.2	12	20.7
Subtotal	**175**		**159**		**58**	
Not answered	7		8		5	
Total	**182**		**167**		**63**	

The reasons for delay in diagnosis are summarised in Table 6.2. The most common reason for delay in diagnosis of sepsis, severe sepsis and septic shock in the Reviewer's opinion was that clinicians were missing the diagnosis on review. Clinicians should be more alert to the possible diagnosis of sepsis in unwell patients. Senior clinical input has an important part to play as does increasing awareness through training and education of staff. There may also be an argument for the wider use of tests/markers of sepsis such as procalcitonin. In the current study, procalcitonin was only used in 11/710 (1.5%) of patients (data not shown). The procalcitonin test is relatively new, but it is beginning to be used in UK hospitals. Recent studies have shown that it may help to discover whether a seriously ill person is developing sepsis. It has been studied mainly in emergency departments or critical care in patients who have symptoms that may be due to sepsis. For diagnosis, procalcitonin is best used on the first day the patient is seen. It may be used later on to follow how the patient responds to treatment. However, there is important evidence that having robust systems in place to increase awareness, support the decision making process and expedite correct treatment, which encompass all of the above is key to driving improvement. A formal bundle/pathway for sepsis that includes a screening tool for identifying patients and an early warning scoring system linked to escalation protocols for the management of the deteriorating patient would be a part of such a system.

Table 6.3 Use of sepsis screening tool to diagnose sepsis

Diagnosis made using	Number of patients	%
Sepsis screening tool	62	12.9
Other track & trigger tool	15	3.1
National early warning score (NEWS)	51	10.6
None of the above - clinical signs only	351	73.3
Subtotal	**479**	
Insufficient data	72	
Total	**551**	

CASE STUDY 5

An elderly patient with type 2 diabetes and hypertension presented to the emergency department with a two-day history of hip pain. They were discharged home with anti-inflammatory medication. Two days later the patient presented again with hip pain and generalised body pain. They were referred to the surgeons as they had some abdominal pain and a lactate of 9.4. The surgeon organised an abdominal ultrasound and referred the patient to the physicians suggesting a diagnosis of arthritis and possible sepsis. The junior physician considered sepsis or vasculitis as a diagnosis. Senior review shortly after this, resulted in a diagnosis of severe sepsis secondary to septic arthritis. The patient was transferred to a high dependency unit and developed multiple-organ failure, requiring renal support. A long inpatient stay followed but they were discharged home with difficulty walking requiring extensive rehabilitation.

The Reviewers were of the opinion that this case demonstrated that the identification of sepsis can be difficult despite being seen by multiple specialties. This case also demonstrates the value of early senior input for acutely ill patients.

According to the Reviewers, 128/479 (26.7%) patients with sepsis were identified using formalised screening tools or scoring systems designed to detect sepsis or physiological deterioration (Table 6.3).

However, according to the treating clinicians completing the questionnaire, 344/580 (59%) were monitored on early warning scoring systems at the time of sepsis identification (data not shown); the difference is likely to reflect issues with documentation.

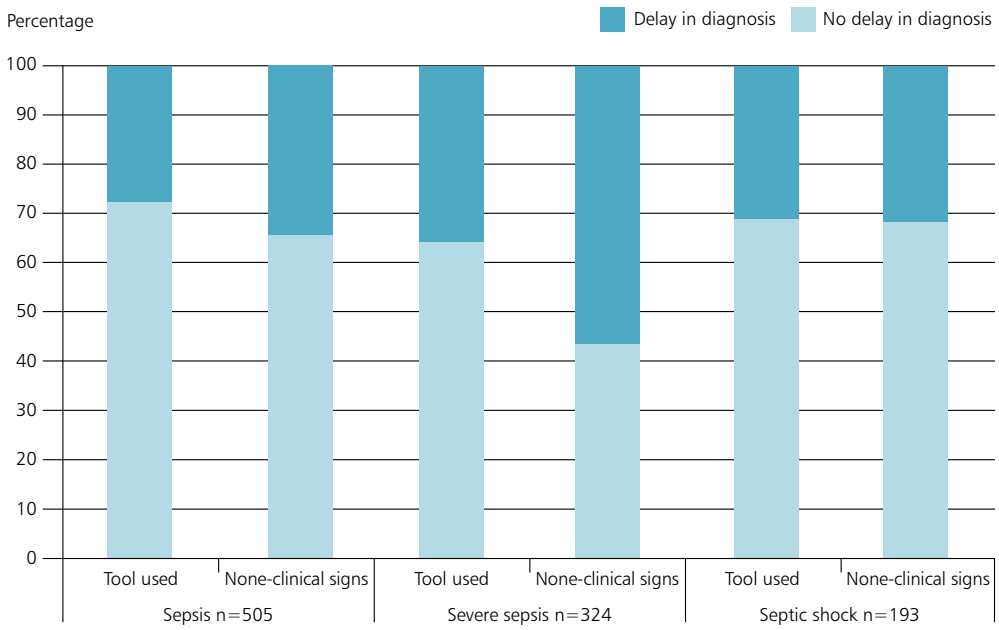

Figure 6.4 Effect of using a screening tool on the delay in diagnosis of sepsis

Figure 6.4 explores the relationship between the use of screening tools/early warning scores and delay, in the Reviewers' opinion, for the identification of sepsis, severe sepsis and septic shock. In those patients with severe sepsis there appeared to be an association between failure to use a screening tool/ early warning score and delay in making a diagnosis. However, there appeared to be no difference in the identification of septic shock. This could be because the symptoms of septic shock are more obvious to the reviewing clinician. It should be noted that even when a screening tool/ early warning score was employed there was a delay in diagnosing 35% of the severe sepsis cases. The use of screening tools or early warning scores would be just one of a series of measures to help improve the sepsis pathway of care.

Clinical algorithms have proved useful in expediting the diagnosis (and subsequent management) of a number of acute conditions (for example, in the management of acute chest pain) and the use of a sepsis bundle that includes a screening tool may be beneficial. The impact of a sepsis bundle on management of patients with sepsis will be explored in more detail in the next section.

In common with previous NCEPOD reports the Reviewers commented on the poor standard of documentation with over 70% of the dataset having less than good documentation of sepsis (Table 6.4). Lack of documentation has been previously shown to be associated with poor outcomes,[44] and clear clinical pathways are associated with reduced in-hospital complications and improved documentation without negatively impacting on length of stay.[45] It was of note therefore, that in those patients in whom the Reviewers considered the documentation of sepsis to be good, there was less delay in the diagnosis of sepsis.

Table 6.4 Documentation of 'sepsis' in the case notes – Reviewers' opinion

Sepsis documentation	Number of patients	%
Good	152	29.0
Adequate	212	40.5
Poor	160	30.5
Subtotal	**524**	
Insufficient data	27	
Total	**551**	

CASE STUDY 6

A patient developed a hospital-acquired pneumonia following a laparotomy for bowel obstruction. Although there was prompt identification of the pneumonia, key microbiological investigations and arterial blood gases were omitted. There was also no mention of triggering the sepsis pathway or utilising a care bundle. Sepsis was diagnosed by the Critical Care Outreach Team 12 hours later. The patient died one day later.

The Reviewers were of the opinion that had a diagnosis of sepsis been considered and documented the patient's care might have been more comprehensive and quicker.

It should be expected that observations would be frequent once a diagnosis of sepsis had been made, and in the vast majority of cases, vital signs were monitored to some extent (507/525; 97%; Table 6.5).

Table 6.5 Vital signs taken at time of sepsis identification

Vital signs	Number of patients	%
Yes	507	96.6
No	18	3.4
Subtotal	**525**	
Insufficient data	26	
Total	**551**	

However, review of the detail of observations taken showed that the patients in this study appeared not to have had adequate observations made (Table 6.6). The Glasgow Coma Score and AVPU scale are simple means of assessing a patient's conscious level. A reduction in conscious level and state of mind is a sign of worsening sepsis. Only 50% of patients had their conscious level assessed at the time of diagnosis. Equally concerning is that 1 in 4 patients did not have their respiratory rate recorded.

Table 6.6 Detail of vital signs measured and recorded

Vital signs taken	Number of patients	%
GCS/AVPU	218	52.9
Temperature	378	91.7
Blood pressure	364	88.3
Heart rate	387	93.9
Respiratory rate	344	83.5

Answers may be multiple n=412; 57 not answered

Investigations

Blood cultures were taken in 366/477 (77%) patients (Table 6.7). Of those patients who had blood cultures taken the Reviewers considered there to be delays in 52/298 (17%) patients (Table 6.8). Tissue cultures and fluid cultures were taken in 43/268 (16%) and 307/449 (68.3%) of patients respectively.

Table 6.7 Blood cultures taken

Blood cultures	Number of patients	%
Yes	366	76.7
No	111	23.3
Subtotal	**477**	
Insufficient data	74	
Total	**551**	

Table 6.8 Delay in blood cultures being taken – Reviewers' opinion

Delay in blood cultures	Number of patients	%
Yes	52	17.4
No	246	82.6
Subtotal	**298**	
Insufficient data	68	
Total	**366**	

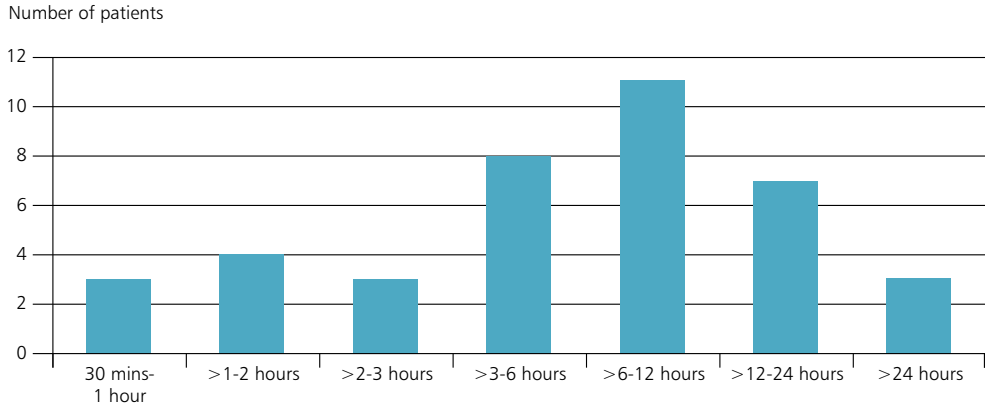

Figure 6.5 Time delay from sepsis diagnosis to blood cultures being taken – Clinician questionnaire

The time duration from sepsis diagnosis to blood cultures for those cases where the Reviewers considered that there was a delay in them being taken is shown in Figure 6.5. Most of these patients 36/39 had blood cultures taken outside the one hour standard set for administration of antimicrobials in patients with sepsis.[1] Blood cultures are more likely to identify a pathogen if they are taken before the administration of antimicrobials.

Of the 111 patients who did not have blood cultures taken, 48 had fluid cultures and 43 had tissue cultures. The Reviewers noted three patients who did not have any cultures taken and there was insufficient data to comment for the remaining 20.

Table 6.9 Tissue cultures taken

Tissue cultures	Number of patients	%
Yes	43	16.0
No	225	84.0
Subtotal	**268**	
Insufficient data	283	
Total	**551**	

At the time sepsis was diagnosed, blood gases were taken from 375/509 (74%) patients in the study (Table 6.10). Table 6.11 shows the time frame when blood gases were taken.

Table 6.10 Blood gases taken

Blood gases	Number of patients	%
Yes	375	73.7
No	134	26.3
Subtotal	**509**	
Insufficient data	42	
Total	**551**	

Table 6.11 Time frame for taking blood gases

Hours	Number of patients	%
Immediately	132	52.0
within 1 hour	69	27.2
>1-4 hours	24	9.4
>4-8 hours	8	3.1
>8-12 hours	10	3.9
>12-24 hours	6	2.4
>24 hours	5	2.0
Subtotal	**254**	
Not answered	121	
Total	**375**	

Table 6.12 shows investigations carried out at the time sepsis was diagnosed according to the Reviewers. The 'Sepsis Six' is a set of interventions that if delivered in the first hour of care can lead to improved outcome.[23] Within these interventions the measurement of serum lactate and haemoglobin are included. The majority of patients had haemoglobin measured as part of a full blood count. However, only 322/522 (62%) had lactate recorded, despite 74% of patients having blood gases that would normally include lactate measurement.

Table 6.12 Investigations carried out

Investigations carried out	Number of patients	%
Full blood count	490	93.9
Urea and electrolytes	491	94.1
Liver function tests	388	74.3
Amylase	114	21.8
CRP	396	75.9
Ultrasound	29	5.6
Urine analysis	234	44.8
CT scan	101	19.3
Lactate	322	61.7
Estimated glomerular filtration rate	174	33.3
Chest X-ray	364	69.7
Coagulation screening	230	44.1
Other	48	9.2

Answers may be multiple n=522

The Reviewers considered that there were investigations missed in 198/506 (39%) patients (Table 6.13) and delayed in 190/496 patients (38%) (Table 6.14). Appropriate diagnosis and treatment are dependent on a full array of investigations.

Table 6.13 Investigations missed – Reviewers' opinion

Investigations missed	Number of patients	%
Yes	198	39.1
No	308	60.9
Subtotal	**506**	
Insufficient data	45	
Total	**551**	

Table 6.14 Investigations delayed – Reviewers' opinion

Investigations delayed	Number of patients	%
Yes	190	38.3
No	306	61.7
Subtotal	**496**	
Insufficient data	55	
Total	**551**	

Table 6.15 shows the detail of the 246 (44%) cases where investigations were either missed or delayed in the opinion of the Reviewers.

Table 6.15 Missed/delayed investigations

Investigation	Number of patients	%
Imaging	42	17.1
Urine analysis	23	9.3
Blood cultures	27	11.0
Sputum culture and analysis	11	4.5
Arterial blood gases	7	2.8
Wound swabs	6	2.4
Lactate	4	1.6
Lumbar puncture	3	1.2
Urinary output	2	<1
Physical examination of specific area	1	<1
Amylase	1	<1

Answers may be multiple n=246

By far the most commonly delayed or missed investigation was radiological imaging. In contrast with the Reviewers, the treating clinicians at the hospital considered that only 12% (80/649) of patients had had an investigation delayed or omitted (Table 6.16).

Table 6.16 Investigations omitted/delayed at the time sepsis was identified - opinion of the treating clinician

Omitted or delayed investigations	Number of patients	%
Yes	80	12.3
No	569	87.7
Subtotal	**649**	
Insufficient data	61	
Total	**710**	

Reviewers were of the opinion that there were delays in the investigations carried out to identify the source of infection and sepsis in 101/505 (20%) patients and that there were investigations to identify the source of infection omitted that should have been performed in 113/495 (23%) patients (Table 6.17, Table 6.18). Early source identification is important if sepsis is to be treated promptly.

Table 6.17 Delay in investigations to identify the source of sepsis – Reviewers' opinion

Delay in investigations	Number of patients	%
Yes	101	20.0
No	404	80.0
Subtotal	**505**	
Not applicable	5	
Insufficient data	41	
Total	**551**	

Table 6.18 Investigations not done to identify source of sepsis that should have been

Investigations omitted	Number of patients	%
Yes	113	22.8
No	382	77.2
Subtotal	**495**	
Insufficient data	56	
Total	**551**	

In 163/551 (29%) patients, the Reviewers believed that investigations carried out to identify the source of sepsis were either delayed or not done. The source of sepsis was successfully identified in 434/493 (88%) patients (Table 6.19). Of these it was stated by the Reviewers that it was identified within an appropriate time frame in 340/421 (81%) cases (Table 6.20).

Table 6.19 Source of sepsis identified

Identified	Number of patients	%
Yes	434	88.0
No	59	12.0
Subtotal	**493**	
Insufficient data	58	
Total	**551**	

Table 6.20 Sepsis source identified within appropriate timeframe – Reviewers' opinion

Timely identification	Number of patients	%
Yes	340	80.8
No	81	19.2
Subtotal	**421**	
Not applicable	1	
Insufficient data	12	
Total	**434**	

CASE STUDY 7

An elderly patient was admitted to hospital following a minor trauma and developed a large retroperitoneal haematoma. The patient was on warfarin for atrial fibrillation and it was subsequently found that their INR was >8. Whilst in hospital the patient developed a hospital-acquired pneumonia. The patient became hypotensive and oliguric and it was 24 hours before any recognition of their condition was acknowledged. Documentation was poor and sepsis was not mentioned in the case notes despite clear evidence from physiological observations and blood results that this patient had severe sepsis. Despite the delay in recognition and treatment the patient was discharged home from hospital, but with significant cognitive impairment.

The Reviewers commented on the delay in recognition, poor documentation and failure to mention the word 'sepsis'. They considered that the clinical care could have been greatly improved.

Key Findings

- There was a delay in identifying sepsis in 182/505 (36%) of cases, severe sepsis in 167/324 (51.5%) cases and septic shock in 63/193 (32.6%) cases according to the Reviewers
- According to the Reviewers 128/479 (26.7%) patients had an EWS screening tool used to aid the diagnosis of sepsis
- The use of a screening tool/ EWS was associated with fewer delays in identifying severe sepsis (55% without vs. 35% with)
- Only 52.9% (218/412) patients had their GCS/AVPU assessed at the time of diagnosis
- Only 322/522 (61.7%) patients had a record in the notes that lactate had been measured
- Investigations considered essential in the diagnosis of sepsis were missed in 198/506 (39.1%) patients and delayed in 190/496 (38.3%)

7

Initial management of sepsis

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The clinical teams overseeing management of the patients with sepsis are listed in Table 7.1. As was to be expected acute medical teams predominantly managed the patients with sepsis in this study.

Table 7.1 Specialty of team overseeing management of the patient following diagnosis

Specialty	Number of patients	%
Acute/general medicine	270	50.1
Other specialist medical team	43	8.0
General surgery	88	16.3
Other specialist surgery	37	6.9
Emergency medicine	57	10.6
Critical care outreach	76	14.1
Critical care - Level 2	69	12.8
Critical care - Level 3	79	14.7
Other	33	6.1

Answers may be multiple n=539

The Reviewers considered that 406/504 (80.6%) patients had timely escalation of care following diagnosis (Table 7.2). In those for whom the escalation was not timely the Reviewers considered the patient to have deteriorated in 51/86 cases (Table 7.3) and that the final outcome was affected in 20/39 patients (Table 7.4); 12/20 of these patients died prior to discharge. Although there is insufficient evidence presented here to determine a causal link between a lack of timely escalation and deterioration, the message that timely treatment of sepsis is paramount should be reinforced.

Table 7.2 Timely escalation/commencement of treatment – Reviewers' opinion

Timely escalation/ commencement of treatment	Number of patients	%
Yes	406	80.6
No	98	19.4
Subtotal	**504**	
Insufficient data	47	
Total	**551**	

Table 7.3 If not timely – patient deteriorated whilst waiting for treatment

Patient deteriorated	Number of patients	%
Yes	51	59.3
No	35	40.7
Subtotal	**86**	
Insufficient data	12	
Total	**98**	

Table 7.4 Outcome affected by a delay in escalation/ treatment – Reviewers' opinion

Outcome affected	Total
Yes	20
No	19
Subtotal	**39**
Insufficient data	12
Total	**51**

Fluid resuscitation is another pillar of the 'Sepsis Six' approach to managing sepsis. The Reviewers identified that 9 out of 10 patients required fluids. Of those requiring fluids 82.8% (341/412) received fluids promptly, in 11.9% (49/412) administration was delayed and 5.3% (22/412) received no intravenous fluids. Contemporary understanding of the pathophysiology of sepsis supports intensive fluid resuscitation in the initial phase. SIRS and sepsis incite widespread inflammatory responses at tissue and cellular levels altering homeostasis. Resultant circulatory abnormalities lead to an imbalance between oxygen delivery and demand, worsening end organ injury and failure. Although adequate fluid resuscitation makes physiological sense, the optimal amount, and type of fluid remain unclear.[46] Whichever fluid is chosen, resuscitation should combine clinical assessment, such as signs of tissue perfusion with haemodynamic monitoring.

Table 7.5 IV fluid resuscitation required

Fluid required	Number of patients	%
Fluid resuscitation required	453	89.9
Fluid resuscitation not required	51	10.1
Subtotal	**504**	
Insufficient data	47	
Total	**551**	

Table 7.6 Delivery of the fluids administered

Delivery	Number of patients	%
Promptly received	341	82.8
Received but delayed	49	11.9
Not received	22	5.3
Subtotal	**412**	
Insufficient data	41	
Total	**453**	

Fluid balance charts aid the appropriate resuscitation of patients with sepsis. However the Reviewers were of the opinion that there was room for improvement in the patients' fluid management in 203/447 (45.4%) cases (Table 7.7) and in half the patients, where there was room for improvement, the reason for improvement was poor documentation of fluid balance (Table 7.8).

Table 7.7 Room for improvement in fluid management – Reviewers' opinion

Room for improvement	Number of patients	%
Yes	203	45.4
No	244	54.6
Subtotal	**447**	
Insufficient data	104	
Total	**551**	

Table 7.8 Principal reasons for room for improvement in fluid management

Reason	Number of patients	%
Documentation of fluid balance	95	51.6
Delay in commencing fluid resuscitation	71	38.6
Monitoring-frequency/type	58	31.5
Type of fluid	20	10.9
Too slow rate of IV fluids	13	7.1
Delay commencing vasopressors	11	6.0
Overloading with fluids	5	2.7
Catheterisation	5	2.7
Other documentation	5	2.7
Blood products	3	1.6
Lack of planning for fluid management	3	1.6
Other	41	22.3

Answers may be multiple n=184; 19 not answered

The Reviewers considered that in those cases where there was room for improvement in fluid balance, the final outcome could have been affected in 1 in 5 patients (Table 7.9).

Table 7.9 Patient's outcome have been affected by poor fluid balance – Reviewers' opinion

Outcome affected	Number of patients	%
Yes	29	20.7
No	111	79.3
Subtotal	**140**	
Insufficient data	52	
Total	**192**	

The administration of oxygen is another of the interventions of the 'Sepsis Six'. Despite a diagnosis of sepsis the Reviewers considered that 20% (100/502) of patients did not require oxygen (Table 7.10).

Table 7.10 Oxygen requirement

Oxygen required	Number of patients	%
Oxygen therapy required	402	80.1
Oxygen therapy not required	100	19.9
Subtotal	**502**	
Insufficient data	49	
Total	**551**	

Of those who required oxygen 334/371 (90%) received it promptly, in 24/371 (6.5%) administration was delayed and in 13/371 (4%) no oxygen was administered (Table 7.11).

Table 7.11 Oxygen delivery when required – Reviewers' opinion

Delivery	Number of patients	%
Promptly received	334	90.0
Delayed	24	6.5
Not received	13	3.5
Subtotal	**371**	
Insufficient data	31	
Total	**402**	

Clinicians who cared for the patients identified the top ten sources of infection as seen in Table 7.12. Respiratory and urinary tract were at the top of the possible causes, which is in line with published data.

Table 7.12 Presumed source of infection – Clinician questionnaire

Infection	Number of patients	%
Respiratory tract	297	42.8
Urinary tract	168	24.2
Acute abdominal/upper gastrointestinal tract	127	18.3
Skin/soft tissue	65	9.4
Post operative	43	6.2
Intracranial/ear, nose and throat	21	3.0
Perianal/ischio-rectal/ lower gastrointestinal tract	17	2.4
Bone/joint	11	1.6
Endocarditis	9	1.3
Implantable device	8	1.2
Gynaecological/sexually transmitted infection	7	1.0
Other	41	5.9

Answers may be multiple n=694; not answered in 16

In this study a pathogen was identified in 198/481 (41%) patients (Table 7.13) and the commonest pathogens are shown in Figure 7.1 overleaf.

Table 7.13 Pathogen identified

Pathogen	Number of patients	%
Yes	198	41.2
No	283	58.8
Subtotal	**481**	
Insufficient data	70	
Total	**551**	

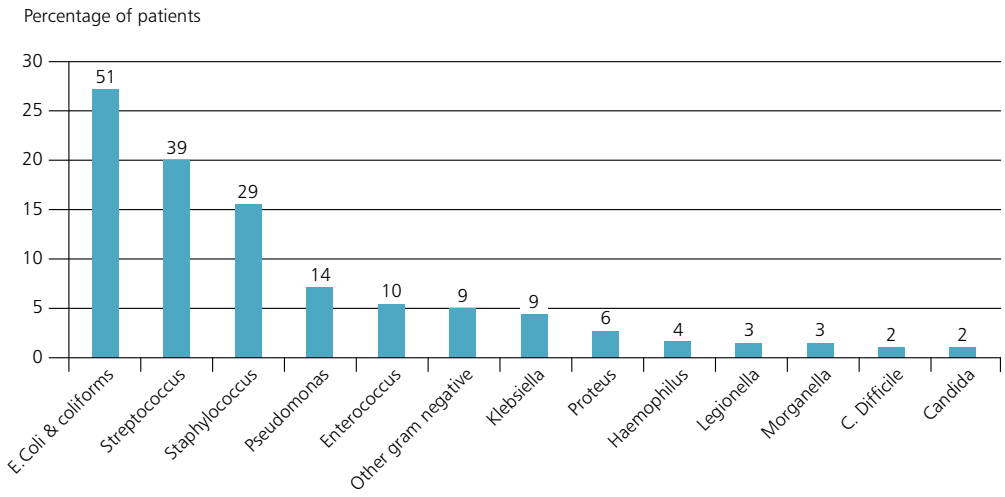

Figure 7.1 Top 13 pathogens identified in patients in the study

Escherichia coli and other coliform bacteria were the most commonly isolated pathogen followed by streptococcus and staphylococcus. Fungi were rare in this cohort with candida isolated from a minority of patients. The causative organisms for sepsis have evolved over many years. The original studies of sepsis bore out that Gram-negative bacteria were among the most common causes of sepsis. It is now recognised that sepsis may occur from any bacteria, as well as from fungal and viral organisms. More recent epidemiology studies reveal that Gram-positive bacteria have become the most common cause of sepsis in the past 25 years. According to the most recent estimates in sepsis, there are approximately 200,000 cases of Gram-positive sepsis each year, compared with approximately 150,000 cases of Gram-negative sepsis.[47] While bacterial causes of sepsis have increased with the general increases in incidence, fungal causes of sepsis have grown at an even more rapid pace. This may represent a general increase in hospital-acquired cases of sepsis.

Where specimens were successfully isolated, it was most commonly from blood (47%) urine (27%) or sputum (11%) (Table 7.14). This is in line with the presumed sources of infection listed in Table 7.12.

Table 7.14 Most common samples used to isolate a specimen

Sample	Number of patients	%
Blood cultures	87	47.3
Urine	49	26.6
Sputum	21	11.4
Wound swab	10	5.4

Answers may be multiple n=184; 8 not answered

Despite 95% (323/339) of hospitals including the administration of IV antimicrobials in their sepsis protocols and 95% (305/321) of those protocols specifying that antimicrobials should be given within one hour, only 226/361 (63%) patients received antimicrobials within one hour (Table 7.15).

Kumar et al. brought the importance of early antimicrobial therapy in patients with septic shock to the forefront in 2006. Kumar and his colleagues completed a retrospective cohort study of 2,731 adult patients with septic shock, examining mortality in patients who received antimicrobials after the onset of recurrent or persistent hypotension. They found that administration of an appropriate antimicrobial within one hour of identified hypotension resulted in a survival rate of 79.9%. Each hours' delay in administration of an antimicrobial resulted in a 7.6% decrease in survival.[48]

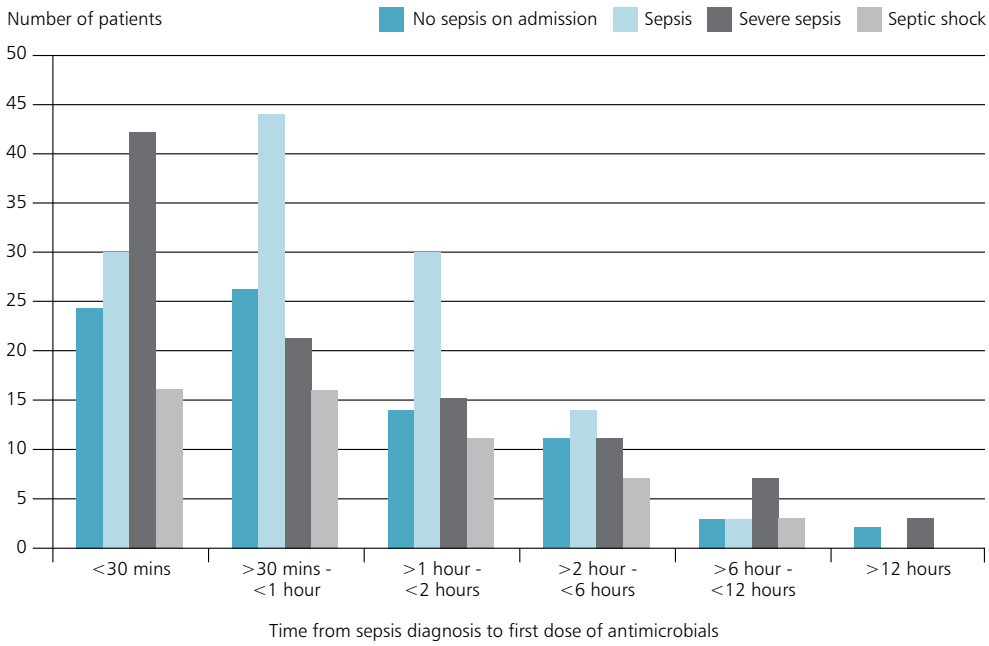

Figure 7.2 Time delay in administration of antimicrobial and sepsis status on admission to hospital (Reviewer's opinion)

Table 7.15 Time delay for administration of antimicrobials

Time first dose of antimicrobials given from first diagnosis of sepsis	Number of patients	%
<30 minutes	118	32.7
>30 mins - < 1 hour	108	29.9
>1 hour - < 2 hours	70	19.4
>2 hours - < 6 hours	43	11.9
>6 hours - < 12 hours	17	4.7
> 12 hours	5	1.4
Subtotal	**361**	
Time antimicrobials administered not documented	100	
Time sepsis diagnosed not documented	32	
Neither time documented	7	
Not applicable - already on antimicrobials	33	
Not applicable - antimicrobials not given	1	
Insufficient data	17	
Total	**551**	

Similarly, in 2010, the International Surviving Sepsis Campaign (SSC) published results in over 15,000 episodes showing that delivery of early antimicrobials (at that stage within 3 hours) was independently associated with survival in a risk-adjusted model (odds ratio 0.86), but was achieved in only 67% of cases.[11] Figure 7.2 shows the time delay in administering antimicrobials to patients, grouped by severity of sepsis. It can be seen that whilst the majority of patients in all groups received antimicrobials within 6 hours of diagnosis, there were 21 patients with septic shock on admission who received antimicrobials more than 1 hour after diagnosis and 13 patients with severe sepsis or septic shock on admission who had a delay of more than 6 hours in the delivery of antimicrobials.

Table 7.16 Length of time from first recorded arrival (triage) in the emergency department to the first dose of antimicrobial in patients considered by the Reviewers to have sepsis on arrival in the emergency department.

Time from first recorded arrival in the emergency department to first dose of antimicrobial	Number of patients	%
Already received first dose of antimicrobial on arrival	7	2.8
0-30 minutes	35	13.8
>30minutes- 1 hour	29	11.5
>1 hour- 3 hours	89	35.2
>3 hours to 6 hours	42	16.6
>6 hours- 12 hours	32	12.6
>12- 24 hours	7	2.8
>24 hours	12	4.7
Subtotal	**253**	
Data missing/no sepsis in ED	25	
Total	**278**	

Table 7.16 shows the time delay from first arrival in the emergency department to the first dose of antimicrobial being administered in patients who the Reviewers felt had evidence of sepsis on arrival to the emergency department. One fifth of this group (51/253; 20%) had a delay of more than 6 hours in the administering of antimicrobials. This is a combination of the delay in identification of sepsis and the delay in administering antimicrobials once the diagnosis has been made.

The Reviewers considered that there was an avoidable delay in the administration of antimicrobials in 114/391 (29%) patients. The principle identifiable cause of delay was in prescribing (Table 7.17) and Table 7.18 details the reason given for the delay.

There may be benefit from the extension of prescribing responsibilities to non-medically qualified healthcare professionals. Triage nurses and nurse practitioners in AMUs would be ideally placed to ensure patients with sepsis received prompt antibiotic therapy.

Table 7.17 Avoidable delay in administering antimicrobial – Reviewers' opinion

Avoidable delay	Number of patients	%
Yes	114	29.2
No	277	70.8
Subtotal	**391**	
Insufficient data	160	
Total	**551**	

Table 7.18 Reason for delay in administering antimicrobials

Reason	Number of patients	%
Delay in prescribing	40	39.2
Lack of escalation	17	16.7
Unclear from the notes	14	13.7
Awaiting source confirmation	10	9.8
Communication between teams e.g. handover	9	8.8
Delay in sepsis recognition	9	8.8
Delay review by senior staff	8	7.8
Delay in administration after prescribing	6	5.9
Not prescribed a stat dose	6	5.9
Awaiting microbiology review	3	2.9
IV access problems	2	2.0
Other clinical reason	2	2.0
Pharmacy delay	0	0.0

Answers may be multiple n=102; not answered in 12

The Reviewers were of the opinion that a delay in the administration of antimicrobials affected the outcome in nearly half (43/97; 44%) of those patients who did not receive antimicrobials in a timely manner (Table 7.19).

In those in whom the Reviewers considered that a delay may have affected outcome the Reviewers' reasons fell into the broad themes of wrong route of administration and wrong antimicrobial given later than considered appropriate.

Table 7.19 Outcome affected by a delay in antimicrobials – Reviewers' opinion

Outcome affected	Number of patients	%
Yes	43	44.3
No	54	55.7
Subtotal	**97**	
Insufficient data	17	
Total	**114**	

Table 7.20: Patient started on a sepsis care bundle following diagnosis – Reviewers' opinion

Sepsis care bundle	Number of patients	%
Yes	135	31.1
No	299	68.9
Subtotal	**434**	
Insufficient data	117	
Total	**551**	

Only one in three patients (135/434; 31%) were started on a sepsis care bundle (Table 7.20), despite 358/544 (66%) hospitals claiming to have specific sepsis care bundles (Chapter 2).

Table 7.21 Patient started on a sepsis care bundle following diagnosis – Clinician questionnaire

Sepsis care bundle	Number of patients	%
Yes	207	39.4
No	318	60.6
Subtotal	**525**	
Not answered	185	
Total	**710**	

The clinicians completing the questionnaire similarly reported that 207/525 (39%) patients were managed on a care bundle following diagnosis (Table 7.21).

Figure 7.3 demonstrates the positive effect of care bundles on timely treatment, antimicrobial administration, timely escalation, prompt fluid administration, prompt oxygen administration, documentation, blood cultures and gases being taken, and the identification of a source of sepsis.

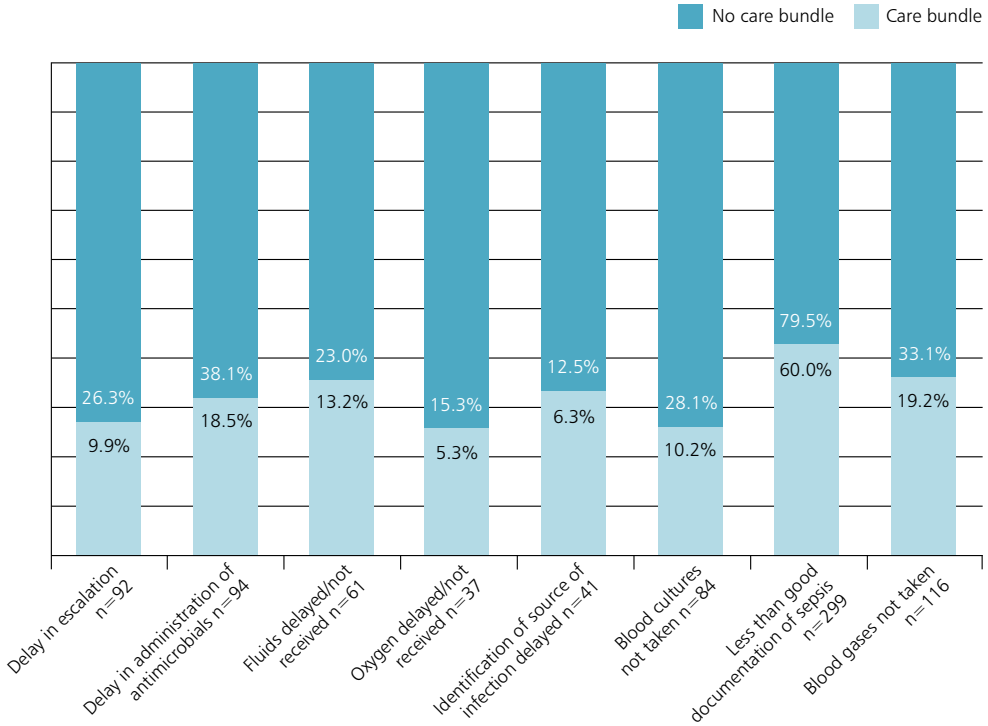

Figure 7.3 Use of care bundles

With significant advancement in the care of patients with sepsis and implementation of guidelines for bundled care, investigators involved in the Surviving Sepsis Campaign demonstrated a decline in 28 day mortality from 37% to 30.8% over two years. Compliance with the initial six hour bundle, termed the resuscitation bundle, increased from 10.9% to 31.3% of subjects over the two years after initiation of the SSC guidelines. It is difficult to know if the improved outcomes that were observed should be attributed to the SSC guidelines, or to a heightened appreciation by medical teams that the treatment of sepsis is time sensitive.[1] More recently, the National Emergency Laparotomy Study[49] demonstrated the relationship between time from onset of hypotension, time to administration of antimicrobials and survival fraction.

Antimicrobial stewardship

The term 'antimicrobial stewardship' is defined as 'an organisational and by implication, healthcare-system-wide approach, to promoting and monitoring the correct use of antimicrobials to preserve their future effectiveness' and the recently published NICE guideline recommends specific approaches to the prescription of antimicrobials which should be adhered to.[12]

The rationale behind the choice of antimicrobial in this study is outlined in Table 7.22. In 1 in 3 patients (181/531; 34%) no rationale for prescription was documented. However, the Reviewers considered that only 1 in 10 (49/521; 9%) patients had been started on an inappropriate antimicrobial (Table 7.23). The correct dose was prescribed in 98% (405/414) of patients (Table 7.24).

Much research from the last decade has highlighted the strong relationship between the choice of empiric antimicrobial therapy and the risk of death among patients hospitalised with serious infections. Most studies suggest that the risk of hospital death in association with inappropriate initial antibiotic therapy goes up twofold to fourfold when compared with patients who receive appropriate coverage.[50-55]

Table 7.22 How the antimicrobial was chosen

Antimicrobial choice	Number of patients	%
According to local hospital policy	191	36.0
Previous culture results	25	4.7
Based on site of infection	121	22.8
Administered broad spectrum antibiotics	128	24.1
Rationale not documented	181	34.1
Other	33	6.2

Answers may be multiple n=531, not answered in 20

Table 7.23: Appropriateness of the choice of antimicrobial therapy – Reviewers' opinion

Appropriate antimicrobial	Number of patients	%
Yes	472	90.6
No	49	9.4
Subtotal	**521**	
Insufficient data	30	
Total	**551**	

Table 7.24 Correct dose of antimicrobial therapy – Reviewers' opinion

Correct dose of antimicrobial	Number of patients	%
Yes	405	97.8
No	9	2.2
Subtotal	**414**	
Insufficient data	58	
Total	**472**	

In this study, a consultant microbiologist was consulted on the suitability of therapy only in half the patients (244/471; 52%; Table 7.25). However, 317/404 (78.5%) patients had a regular review of their antimicrobial therapy (Table 7.26), which was most commonly undertaken by a microbiologist (153/276; 55%) (Table 7.27).

Table 7.25 Consultation with a microbiologist

Consultation with a microbiologist	Number of patients	%
Yes	244	51.8
No	227	48.2
Subtotal	**471**	
Insufficient data	80	
Total	**551**	

Table 7.26 Regular review of antimicrobial therapy

Regular review	Number of patients	%
Yes	317	78.5
No	87	21.5
Subtotal	**404**	
Insufficient data	147	
Total	**551**	

Table 7.27 Clinical specialty that conducted the review of antimicrobial therapy

Specialty	Number of patients	%
Microbiologist	153	55.4
Critical care	34	12.3
Medical team	83	30.1
Surgical team	10	3.6
Pharmacy	4	1.4
Other	4	1.4
Subtotal	**276**	
Insufficient data	16	
Total	**317**	

Answers may be multiple

Escalation of antimicrobials was considered in 85% (358/420) of patients. De-escalation was considered in 74% (289/389) and the duration of therapy considered in 80% (329/413) of patients (Table 7.28 and Figure 7.4).

Table 7.28 Details of the antimicrobial therapy considered

Consideration given to	Yes	%Yes	No	%No	Subtotal	Insufficient data	Total
1) Escalation of antimicrobial therapy	358	85.2	62	14.8	**420**	131	**551**
2) De-escalation of antimicrobial therapy	289	74.3	100	25.7	**389**	162	**551**
3) Duration of antimicrobial therapy	329	79.7	84	20.3	**413**	138	**551**

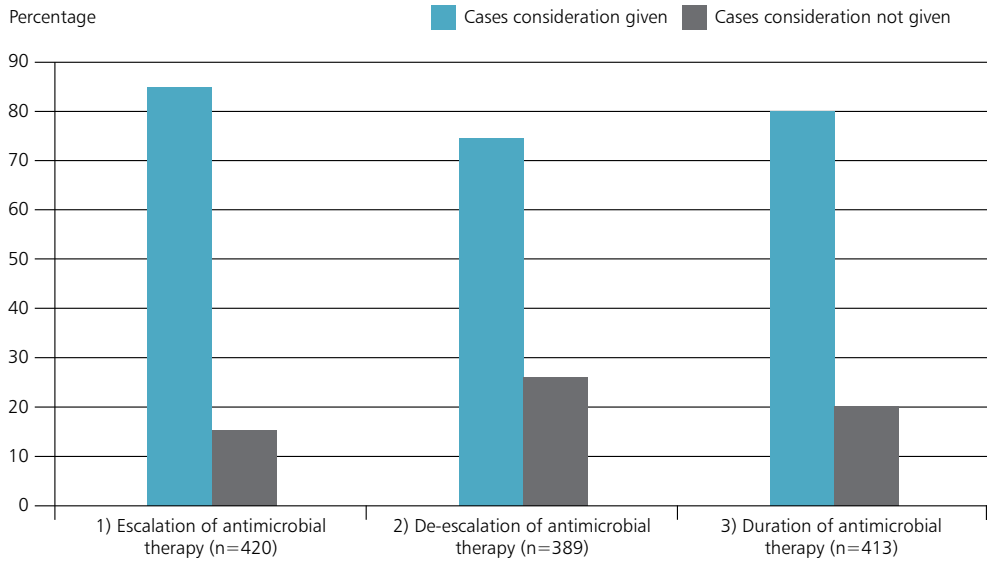

Figure 7.4 Details of antimicrobial therapy considered

Following microbiology review, changes were made in 360/482 (74%) of this group (Table 7.29).

Table 7.29 Antimicrobial therapy modified following microbiology review

Therapy modified	Number of patients	%
Yes	360	73.6
No	129	26.4
Subtotal	**489**	
Insufficient data	62	
Total	**551**	

Establishing an optimal antibiotic dosage regimen is important, but so is the presence of an effective de-escalation strategy to shorten unnecessary antibiotic exposure by streamlining therapy and narrowing antibiotic choices based on a patient's culture result. After the initiation of broad-spectrum antibiotics, de-escalation can be typically conducted in several ways: the antibiotics can be streamlined to more narrow-spectrum agents once culture and susceptibilities are available, the dosage if initially high can be de-escalated to a standard dosage for a susceptible organism, or antibiotics can be discontinued altogether if subsequent data reveal it is unlikely that the patient had an infection in the first place.[56] This study demonstrates that clinicians have heeded the need for antimicrobial stewardship but there is ongoing room for improvement.

Source of infection and its control

Infection source control dates back to the origins of medicine.[57] The need to drain abscesses and remove foreign bodies has been recognised since the fourth century BC, and the modern management of sepsis still depends on such surgical therapy. Identifying a source of infection and removing it, if possible, remains a core principle. The Surviving Sepsis Campaign guidelines recommend that the source of infection be confirmed within 6 hours of presentation.[8] This requires blood cultures to be taken prior to the administration of antimicrobials and often requires ultrasound or CT imaging; other cultures (e.g. urine, cerebrospinal fluid, synovial fluid) may also be required.

Once identified, the focus of infection should be drained or removed with the least physiologic insult. The recent National Emergency Laparotomy Audit demonstrated that both early source control and early antimicrobial administration dramatically improves survival.[49]

In this study a source of infection was identified in 434/493 (88 %) cases (Table 7.30). In 16 of 49 cases the Reviewers considered more could have been done to identify the source (Table 7.31). Only in 29% of cases was the source amenable to an immediate procedure for control (Table 7.32).

Table 7.30 Source of infection was identified

Source identified	Number of patients	%
Yes	434	88.0
No	59	12.0
Subtotal	**493**	
Insufficient data	58	
Total	**551**	

Table 7.31 If 'No' could more have been done to identify the source

More could have been done	Number of patients
Yes	16
No	30
Subtotal	**46**
Insufficient data	13
Total	**59**

Table 7.32 Infection source was amenable to immediate control

Amenable to control	Number of patients	%
Yes	137	28.7
No	341	71.3
Subtotal	**478**	
Not applicable	17	
Insufficient data	56	
Total	**551**	

The procedures performed to control the source of infection are shown in Table 7.33. In those patients in whom a source was amenable to control the Reviewers were of the opinion that control was delayed in 43% (Table 7.34), the reasons for delay are listed in Table 7.35. 'Other' reasons for delay included the patient initially being treated conservatively, missed diagnosis, delayed senior review, patient refusal and equipment failure (Table 7.36).

Table 7.33 Procedure performed to control the source of infection

Procedure performed	Number of patients	%
Laparotomy +/- wash out	35	25.5
Abscess drainage under interventional radiology	8	5.8
Chest drain	7	5.1
Nephrostomy	7	5.1
Catheter irrigation/replacement	6	4.4
Laparosopy and wash out	5	3.6
Endoscopic retrograde cholangiopancreatography (ERCP)	4	2.9
Line/peg replacement	4	2.9
Amputation	3	2.2
Joint debridement/washout	3	2.2
Gallbladder drainage	3	2.2
Ventricular drain	2	1.5
Other	8	5.8

Answers may be multiple n=137

Table 7.34 Delay in source control – Reviewers' opinion

Delay	Number of patients	%
Yes	55	42.6
No	74	57.4
Subtotal	**129**	
Insufficient data	8	
Total	**137**	

Table 7.35 Reasons for delay in controlling the source of infection – Reviewers' opinion

Reason for delay	Number of patients
Patient too unwell to tolerate surgery	7
Lack of beds	2
Out of hours/weekend	4
Delay in investigations	15
Lack of available staff	7
Delay in identifying source	16
Lack of specialist	5
Patient reasons - refusal, consent	3
Next scheduled list	2
Reason not documented	4

Answers may be multiple n=137

The Reviewers were of the opinion that delay in source control affected the outcome in 33/47patients (Table 7.36).

Table 7.36 Delay in source control affected the outcome – Reviewers' opinion

Outcome affected	Number of patients
Yes	33
No	14
Subtotal	**47**
Insufficient data	8
Total	**55**

CASE STUDY 8

An elderly patient with prostate cancer was admitted with a urinary tract infection and signs of sepsis. The diagnosis of sepsis due to perinephric abcess was made and within one hour the patient had undergone appropriate imaging and 90 minutes after the imaging the patient underwent a percutaneous nephrostomy. The patient was discharged from hospital 9 days later.

The Reviewers considered that this demonstrated the value of early source control in sepsis.

Patient information

The patient notes contained evidence that discussions had taken place between healthcare providers and the patient and/or their relatives in two thirds (299/452; 66%) of cases (Table 7.37). However 3 in 10 patients appeared not to have had any discussion about the condition. Where discussions took place it appears that the discussions were more often with patients' relatives than with the patients (Table 7.38).

Table 7.37 Evidence of discussion between healthcare professionals and relatives/carer/patient

Evidence	Number of patients	%
Yes	299	66.2
No	153	33.8
Subtotal	**452**	
Insufficient data	92	
Not applicable	7	
Total	**551**	

Table 7.38 Detail of discussions with relatives/carer/patient

Evidence in the notes	Patient				Relative			
	Yes	Yes%	No	Subtotal	Yes	Yes%	No	Subtotal
1) Diagnosis of sepsis:	94	49.7	95	**189**	165	67.9	78	**243**
2) Cause of sepsis	108	56.8	82	**190**	180	72.9	67	**247**
3) Regularly updated treatment plan	100	59.2	69	**169**	159	75.0	53	**212**
4) Possible outcome for the patient	89	53.3	78	**167**	187	82.4	40	**227**
5) Rehabilitation plan	55	40.4	81	**136**	53	36.6	92	**145**

Management on general wards

Just under half of the patients in this study were managed on a general ward throughout their episode of sepsis (Table 7.39). This group was managed with input from Critical Care Outreach Teams, critical care and microbiology (data not shown).

Table 7.39 Entire episode managed on a general ward

Episode managed on general ward	Number of patients	%
Yes	257	47.2
No	288	52.8
Subtotal	**545**	
Insufficient data	6	
Total	**551**	

Thirteen patients received inotropes in the general ward environment of which evidence of adequate monitoring could be found in only five. The Reviewers considered the administration of inotropes on a general ward was a holding manoeuvre prior to transfer to a high care area in five of the 13 patients. The Reviewers considered that all 13 patients had received inotropes in a timely manner. However, they considered that the administration of inotropes on a general ward was only appropriate in 5/13 patients (the same five who were given inotropes as holding measure).

Table 7.40 Managing the entire patient's episode on the ward was appropriate – Reviewers' opinion

Appropriate management	Number of patients	%
Yes	209	93.3
No	15	6.7
Subtotal	**224**	
Insufficient data	33	
Total	**257**	

The Reviewers were of the opinion that 93% (209/224) of patients who were managed on the general ward were in the correct location (Table 7.40). The reasons as to why 6.7% were not in the correct location can be broadly grouped into: delay in investigations, inadequate monitoring and delays in delivering care (data not shown).

Table 7.41 summarises the areas where the Reviewers considered improvements could have been made in the initial management of patients and whether they thought the patient's outcome had been affected. When ranked in order of influence on outcome, failure to deal with the source of infection ranked highest (87%) with inadequacies in review and delay in diagnosis the next two most influential areas for improvement.

Table 7.41 Reasons for room for improvement in the initial management of patients – Reviewers' opinion

	Listed reason for room for improvement					If YES - outcome affected					
	Yes	Yes %	No	Subtotal	ID	Outcome affected	Outcome affected %	No	Subtotal	ID	Total
Failure to adhere to sepsis 6 pathway	201	76.4	62	**263**	29	116	67.1	57	**173**	28	**292**
Documentation	183	69.6	80	**263**	29	58	39.7	88	**146**	37	**292**
Delay in diagnosis of sepsis	173	65.8	90	**263**	29	107	66.9	53	**160**	13	**292**
Communication with patient/ relatives	137	53.9	117	**254**	38	25	21.0	94	**119**	18	**292**
Inadequacies in review	129	51.4	122	**251**	41	84	73.7	30	**114**	15	**292**
Inadequacies in monitoring	99	39.6	151	**250**	42	99	39.6	151	**250**	15	**292**
Delay in diagnosis of infection	92	35.9	164	**256**	36	59	71.1	24	**83**	9	**292**
Failure to deal with source of infection within acceptable timeframe	78	31.7	168	**246**	46	55	87.3	8	**63**	15	**292**
Other	51	64.6	28	**79**	213	19	70.4	8	**27**	24	**292**

ID = insufficient data

Escalation and critical care management

Critical Care Outreach Teams, Rapid Response Teams or Medical Emergency Teams, depending on the geographical location, have become increasingly involved in sharing their expertise of critical care by reviewing and treating patients early on in their acute illness, on the ward as well as in the critical care unit, in order to prevent further deterioration and death.[58] The benefit of Critical Care Outreach Teams has been demonstrated to reduce hospital morbidity and mortality.[59] In this cohort of patients 79% (406/513) of patients were referred to Critical Care Outreach Teams. In the group that was not referred 48/107 patients were admitted directly to Level 3 care (Table 7.42).

Table 7.42 Patient referred to the Critical Care Outreach Team

Referred to CCOT	Number of patients	%
Yes	406	79.1
No	107	20.9
Subtotal	**513**	
Not applicable	9	
Insufficient data	29	
Total	**551**	

Table 7.43 Trigger for the referral to the Critical Care Outreach Team

Trigger for referral	Number of patients	%
Automatic call to the Critical Care Outreach Team – early warning score trigger	62	18.6
Direct referral by clinicians on ward	128	38.3
Direct referral by nursing staff	33	9.9
Peri/cardiac arrest	12	3.6
Manual early warning score calculation	69	20.7
Other	30	9.0
Subtotal	**334**	
Insufficient data	72	
Total	**406**	

Table 7.44 Timely referral to the Critical Care Outreach Team

Timely referral to CCOT	Number of patients	%
Yes	287	83.9
No	55	16.1
Subtotal	**342**	
Not applicable	10	
Insufficient data	54	
Total	**406**	

Table 7.45 Reasons why the referral to the Critical Care Outreach Team was not timely – Reviewers' opinion

Reason why referral was not timely	Number of patients
Inaccurate calculation of early warning score	1
Did not respond to high early warning score/did not appreciate severity of illness	12
Insufficient seniority of review	12
Insufficient frequency of clinical review	5
Insufficient monitoring of observations	3
Critical Care Outreach Team not available out of hours	1
Other	4
Insufficient data	19

Answers may be multiple n=55

Table 7.46 Critical Care Outreach Team arrived promptly following contact with them – Reviewers' opinion

Prompt arrival	Number of patients	%
Yes	237	88.8
No	30	11.2
Subtotal	**267**	
Not applicable	13	
Insufficient data	126	
Total	**406**	

The commonest trigger for a referral to the Critical Care Outreach Team was direct clinician referral (Table 7.43). The referrals were considered to be timely in 84% (287/342) of cases (Table 7.44) and if not timely this was due most commonly to lack of senior review (Table 7.45). The Critical Care Outreach Team arrived promptly on 89% of occasions (Table 7.46).

One in four patients had input from the Critical Care Outreach Team before formal referral to critical care (Table 7.47).

Table 7.47 Input from the Critical Care Outreach Team prior to referral to critical care

CCOT input	Number of patients	%
Yes	64	22.5
No	220	77.5
Subtotal	**284**	
Not applicable	13	
Insufficient data	109	
Total	**406**	

Sixty percent of the patients in this cohort were referred to critical care (Table 7.48). Critical care services responded in an appropriate time frame in 93% of referrals (Table 7.49). Three quarters of the critical care referrals of patients with sepsis were then transferred to critical care (Table 7.50).

Table 7.48 Patient was referred to critical care

Referred to critical care	Number of patients	%
Yes	278	58.8
No	195	41.2
Subtotal	**473**	
Not applicable	10	
Insufficient data	68	
Total	**551**	

Table 7.49 Timely response from critical care

Timely response	Number of patients	%
Yes	222	93.3
No	16	6.7
Subtotal	**238**	
Insufficient data	40	
Total	**278**	

Table 7.50 Outcome of critical care referral

Outcome of referral	Number of patients	%
Continued management on general ward - no change	28	10.1
Transferred to Level 3 care	103	37.1
Transferred to Level 2 care	102	36.7
Continued management on general ward - advice from critical care	34	12.2
Other	11	4.0
Total	**278**	

Table 7.51 Correct decision to admit the patient to Level 3 care – Reviewers' opinion

Correct decision not to admit to critical care	Number of patients
Yes	47
No	10
Subtotal	**57**
Not answered	16
Total	**73**

The Reviewers considered that in 10 of 57 patients in whom information was available, that the decision not to admit to Level 3 was incorrect (Table 7.51).

The reasons given included lack of available critical care beds dictating management decisions and missed opportunities for intervention. Of those patients admitted to critical care 70% required support of their cardiovascular system, 78% of their respiratory system and 26% support of their renal system (Table 7.52).

Table 7.52 Systems requiring treatment in critical care

System	Number of patients	%
Cardiovascular system	119	70.0
Respiratory system	132	77.6
Renal System	44	25.9

Answers may be multiple, n=170, not answered in 35

Table 7.53 System, treatment given, timeliness

System requiring treatment	Cardiovascular system n=119	Respiratory system n=132	Renal system n=44
Treatment given	**Inotropes**	**Ventilation**	**Filtration**
Yes	**93**	**89**	**29**
% yes	94.9	90.8	76.3
No	**5**	**9**	**9**
Subtotal	**98**	**98**	**38**
Not applicable	0	3	2
Insufficient data	21	31	4
Timely	**80**	**83**	**26**
% timely	96.4	98.8	96.3
Not timely	3	1	1
Subtotal	**83**	**84**	**17**
Insufficient data	10	5	2

The Reviewers considered that in more than 90% of cases the treatment was delivered in a timely fashion (Table 7.53).

Table 7.54 Monitoring employed on the critical care unit

Monitoring employed	Number of patients	%
Arterial line	172	94.5
Central venous catheter	123	67.6
Central venous pressure measurement	79	43.4
Cardiac output monitoring	21	11.5
Other	12	6.6

Answers may be multiple n=182; not answered in 23

Table 7.55 Adequate monitoring in critical care – Reviewers' opinion

Adequacy monitoring	Number of patients	%
Yes	176	96.2
No	7	3.8
Subtotal	**183**	
Insufficient data	22	
Total	**205**	

The Reviewers were of the opinion that monitoring was not adequate in seven patients in whom the Reviewers felt that direct arterial blood pressure and cardiac output monitoring might have been beneficial (Tables 7.54 and 7.55).

CASE STUDY 9

An elderly patient with a history of ischaemic heart disease, hypertension and 40 years of smoking was admitted with pneumonia and acute kidney injury. A diagnosis of pneumonia and sepsis was made in the emergency department. The patient was put on a sepsis pathway and transferred to critical care. Within 30 minutes of arriving in hospital the 'sepsis six' had been completed. Relatives were informed of the patient's condition and escalation of care discussed. The patient required ventilatory support for three days in critical care. The patient made a full recovery and was discharged from hospital 10 days later.

The Reviewers considered that this patient had received prompt care that was at a standard that should be expected for all patients. The relatives were kept informed throughout the admission and the severity of the sepsis was identified early and documented clearly in the case notes.

There was no evidence of a regular review by a microbiologist in 1 in 3 patients whilst in critical care (Table 7.56), which is comparable with the finding from the organisational questionnaire that there was incomplete coverage of microbiology input in critical care units.

Table 7.56 Regular review by microbiologist

Regular review	Number of patients	%
Yes	102	70.3
No	43	29.7
Subtotal	**145**	
Insufficient data	60	
Total	**205**	

The Reviewers believed that there was room for improvement in 21% (39/190) of the patients treated in critical care (Table 7.57), the principal area for improvement being documentation (19/36) (Table 7.58).

Table 7.57 Room for improvement in critical care – Reviewers' opinion

Room for improvement	Number of patients	%
Yes	39	20.5
No	151	79.5
Subtotal	**190**	
Insufficient data	15	
Total	**205**	

Table 7.58 Areas in need of improvement in critical care – Reviewers' opinion

Areas for improvement	Number of patients
Documentation	19
Communication with patient/ relatives	10
Treatment	9
Other	9
Communication between healthcare professionals	7
Monitoring	6
Review	1
Management of complications	1

Answers may be multiple n=36, not answered in 3

Key Findings

- Half of the patients with sepsis were managed by acute medical teams (270/539; 50%)
- The Reviewers considered that escalation/commencement of treatment was not timely in 98/504 (19.4%) patients
- One in three patients (207/525; 39.4%) were started on a sepsis care bundle
- Management on a care bundle was associated with fewer delays in the treatment of patients with sepsis
- 71/412 (17.2%) patients were not given or had delayed fluid administration
- There was room for improvement in the patient's fluid management in 203/447 (45.4%) cases
- In 62.6% (226/361) of patients antimicrobials were administered within one hour of diagnosis
- According to Reviewers, there was an avoidable delay in the administration of antimicrobials in 114/391 (29.2%) patients
- The Reviewers felt that the delay in the administration of antimicrobials affected the outcome in 44.3% (43/97) of those patients who did not receive antibiotics in a timely manner
- The correct dose of antimicrobial was prescribed in 405/414 (97.8%) of patients
- A microbiologist was consulted on the suitability of therapy in half (244/471; 51.8%) of the patients
- Escalation was considered in 358/420 (85.2%) patients. De-escalation was considered in 289/389; 74.3%) and the duration of therapy considered in 329/413 (79.7%) patients
- Following review antimicrobial therapy was modified in 360/489 (73.6%) of patients in this group
- A pathogen was identified in 198/481 (41.2%) patients. The commonest pathogens were E coli, other coliforms and streptococcus
- Clinicians responsible for the patient considered that the choice of antimicrobial was not made in line with local hospital policy in 193/593 (32.5%) cases
- A source of infection was identified in 434/493 (88%) of cases and in 137/478 (28.7%) of these cases was the source amenable to a procedure for control
- In 16/46 patients more could have been done to identify the source
- In patients in whom a source was amenable to control, that control was delayed in 55/129 (42.6%)
- Delay in source control affected the outcome in 33/47 patients
- The Critical Care Outreach Team arrived promptly on 237/267 (88.8%) occasions
- Critical care services responded in an appropriate time frame in 222/238 (93.3%) referrals

8

Complications of sepsis and discharge planning

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Survivors of sepsis are frequently left with a legacy of long-term physical, neurological, psychological, and quality of life impairments. Furthermore, beneficial interventions are increasingly being identified to help patient management and reduce the prevalence and impact of these long-term complications. One in five patients in this cohort had evidence of complications following their episode of sepsis. The Reviewers considered that the majority of patients had complications identified in a timely fashion and adequately documented but there could have been improvement in the manner in which they were appropriately treated. It was also considered that rehabilitation was adequately planned. The commonest specialty referred to post-discharge was physiotherapy followed by occupational therapy and speech and language therapy.

On step down from critical care (or for patients who were not admitted to critical care, during the admission) there was evidence of complications of sepsis found in one third of the study sample (141/433; 33%) (Table 8.1).

Post Sepsis Syndrome (PSS) is the term used to describe the group of long-term problems that some patients who have experienced severe sepsis can suffer during their rehabilitation period. Any critical illness and time being treated in a critical care unit is already recognised as causing certain long-term problems. However, sepsis can cause additional physical and psychological problems which may not become apparent for several weeks and these patients are more prone to recurring infections during the recovery period. The details of the complications in this group of patients and the timeliness in identifying them, the documentation and the appropriateness of treatment are shown in Table 8.2.

Table 8.1 Evidence of complications of sepsis at step down from Level 3 care (or if patient did not go to Level 3 care then at any time during the inpatient episode)

Evidence	Number of patients	%
Yes	141	32.6
No	292	67.4
Subtotal	**433**	
Insufficient data	118	
Total	**551**	

Table 8.2 Complications related to sepsis

	Number of patients	Timely identification	No timely identification	Insufficient data	Adequate documentation	No adequate documentation	Insufficient data	Appropriate treatment	No appropriate treatment	Insufficient data
Worsened physical function	**62**	**51**	4	7	**48**	3	11	**42**	2	18
Worsening cognitive state	**31**	**27**	2	2	**25**	1	5	**22**	1	8
Post sepsis syndrome	**13**	**4**	4	5	**4**	2	7	**3**	1	9
Chronic pain	**9**	**5**	1	3	**5**	0	4	**3**	0	6
Post traumatic stress disorder	**7**	**1**	4	2	**1**	1	5	**0**	0	7
Amputation	**6**	**2**	0	4	**2**	0	4	**2**	0	4
Other	**69**	**28**	3	38	**26**	0	43	**26**	0	43

Answers may be multiple n=141

Worsened physical function and cognitive state were the most common complications. Complications listed under the 'other' category include acute kidney injury, cardiac arrest and hospital-acquired pneumonia (Table 8.3).

Table 8.3 Other complications of sepsis

Other complications	Number of patients
Acute kidney injury/ impaired renal function	11
Cardiac arrest	10
Hospital-acquired pneumonia	6
Further surgery	4
Delirium	3
Wound problems	3
Fatigue	3
Further drainage required	3
Tracheostomy	3
Atrial fibrillation	2
Depression	2
Fluid overload	2
Muscle weakness	2
Weight loss	2
Another infection	2
Ischaemic bowel	2
Gastrointestinal bleed	2

There were 391 patients in this study who were alive at discharge, although Reviewers found evidence that 11 of these patients died after discharge. It was felt that the rehabilitation planning for the patients who were alive at discharge was appropriate in 284/294 (97%) cases (Table 8.4).

Referrals were most commonly made to physiotherapy (138/158; 54%) but only made to psychology in 9/258 (4%) cases (Table 8.5).

Follow-up appointments were not common with only 95/333 (29%) admitting physicians seeing these patients following discharge from hospital (Table 8.6). More systematic follow-up might have identified complications sooner and resulted in better post-discharge management of these patients.

Table 8.4 Rehabilitation planning adequate for patients discharged

Adequate rehabilitation plan	Number of patients	%
Yes	284	96.6
No	10	3.4
Subtotal	**294**	
Insufficient data	97	
Total	**391**	

Table 8.5 Specialty referrals post discharge

Referrals made	Number of patients	%
Physiotherapy	138	53.5
Occupational therapy	93	36.0
Psychology	9	3.5
Specialist rehabilitation	28	10.9
Speech & language therapy	59	22.9
Other therapy	20	7.8
No referral	3	1.2
Other	37	14.3

Answers may be multiple n=258; insufficient data in 133

Table 8.6 Follow-up appointment post discharge

Follow-up appointment with	Number of patients	%
Admitting physician	95	28.5
General practitioner	56	16.8
Admitting surgeon	71	21.3
No follow-up appointment	61	18.3
Intensivist who cared for the patient	2	<1
Other	80	24.0
No referral	3	<1
Other	37	11.1

Answers may be multiple n= 333; not answered in 58

The follow-up appointments, where made, were considered by the Reviewers to be appropriate in 257/273 (94%) patients (Table 8.7); where it was considered inappropriate, the reason given was mostly a lack of follow-up with the treating specialist physician or surgeon.

Table 8.7 Appropriate follow-up appointments were made – Reviewers' opinion

Appropriate follow-up	Number of patients	%
Yes	257	94.1
No	16	5.9
Subtotal	**273**	
Insufficient data	118	
Total	**391**	

Table 8.8 Evidence in the case notes that the GP was informed of the admission – Reviewers' opinion

GP was informed of the admission	Number of patients	%
Yes	222	75.5
No	72	24.5
Subtotal	**294**	
Insufficient data	97	
Total	**391**	

In order for patients to be adequately managed following discharge from hospital the patients' general practitioner (GP) must be informed of the hospital admission, diagnosis and post discharge management plan. It appears that for 1 in 4 patients GPs were not informed of their admission (Table 8.8). However there was better compliance with the patient's GP receiving a discharge summary (222/227; 97%). There was however, insufficient data to answer in 164 cases (Table 8.9).

Table 8.9 GP was given a copy of the discharge summary – Reviewers' opinion

GP given copy of the discharge summary	Number of patients	%
Yes	222	97.8
No	5	2.2
Subtotal	**227**	
Insufficient data	164	
Total	**391**	

In the clinician questionnaire, the treating clinician was asked if sepsis was mentioned on the discharge summary (Table 8.10), and it was in just over half (264/490; 53%) of cases. Increasing this proportion could be an opportunity to improve feed-back to primary care using standard terminology and raise awareness of sepsis throughout the pathway and the risk of repeat episodes of sepsis.

Table 8.10 Sepsis was mentioned on the discharge summary – Clinician questionnaire

Sepsis mentioned	Number of patients	%
Yes	264	53.9
No	226	46.1
Subtotal	**490**	
Not applicable - still an inpatient	10	
Not answered	210	
Total	**710**	

The Reviewers were asked if, in their opinion, sufficient information was given to the patient, their relatives and carers on discharge from hospital (Table 8.11). It was not possible to ascertain whether this had occurred in many patients. In several cases there was no evidence that patients, their relatives or carers had received either verbal or written information about the disease and its consequences.

Table 8.11 Sufficient information given to the patient/relatives/care giver – Reviewers' opinion

Sufficient information provided	Patient	%	Relatives	%	Care giver	%
Yes	109	82.0	86	76.1	27	62.8
No	24	18.0	27	23.9	16	37.2
Subtotal	**133**		**113**		**43**	
Insufficient data /not answered	245		267		295	
Not applicable	13		11		53	
Total	**391**		**391**		**391**	

One in five patients had evidence of complications at discharge (Table 8.12). The commonest being worsened physical function, which was identified in over half of patients (38/71) (Table 8.13).

Table 8.12 Complications present at discharge

Complications	Number of patients	%
Yes	71	21.5
No	260	78.5
Subtotal	**331**	
Insufficient data	60	
Total	**391**	

Table 8.13 List of complications present at discharge

Complications at discharge	Number of patients	%
Worsened physical function	38	53.5
Worsened cognitive state	14	19.7
Kidney injury/ impaired kidney function	10	14.1
Post-sepsis syndrome	4	5.6
Wound problems	4	5.6
Chronic pain	9	12.7
Wound problems	3	4.2
Amputation	6	8.5
Tracheostomy	3	4.2
Post traumatic stress disorder	7	9.9
Atrial fibrillation	3	4.2
Recurrence of sepsis	2	2.8
Weight loss	2	2.8
Depression	2	2.8
Muscle weakness	2	2.8

Answers may be multiple n=71

In 19% of those patients with complications at discharge the Reviewers considered that the complication had delayed the patients discharge from hospital (Table 8.14). The length of the delay is shown in Table 8.15.

Table 8.14 Patient's discharge from hospital was delayed – Reviewers' opinion

Delay in discharge	Number of patients	%
Yes	68	19.3
No	284	80.7
Subtotal	**352**	
Insufficient data	39	
Total	**391**	

Table 8.15 Length of delay to discharge

Days	Number of patients
0-2 days	4
3-6 days	24
7-14 days	11
15-30 days	13
> 30 days	4
Subtotal	**56**
Insufficient data	12
Total	**68**

Table 8.16: Patient was readmitted

Readmitted	Number of patients	%
Yes	31	10.1
No	275	89.9
Subtotal	**306**	
Insufficient data	85	
Total	**391**	

The treating clinician provided information regarding the functional status of patients on admission and at discharge. These data are shown in Figure 8.1. It can be seen that in general, the worse a patient's condition on admission, the worse their outcome at discharge. However, of the group who had no disability on admission, just over 20% had moderate disability or worse at discharge (Figure 8.1).

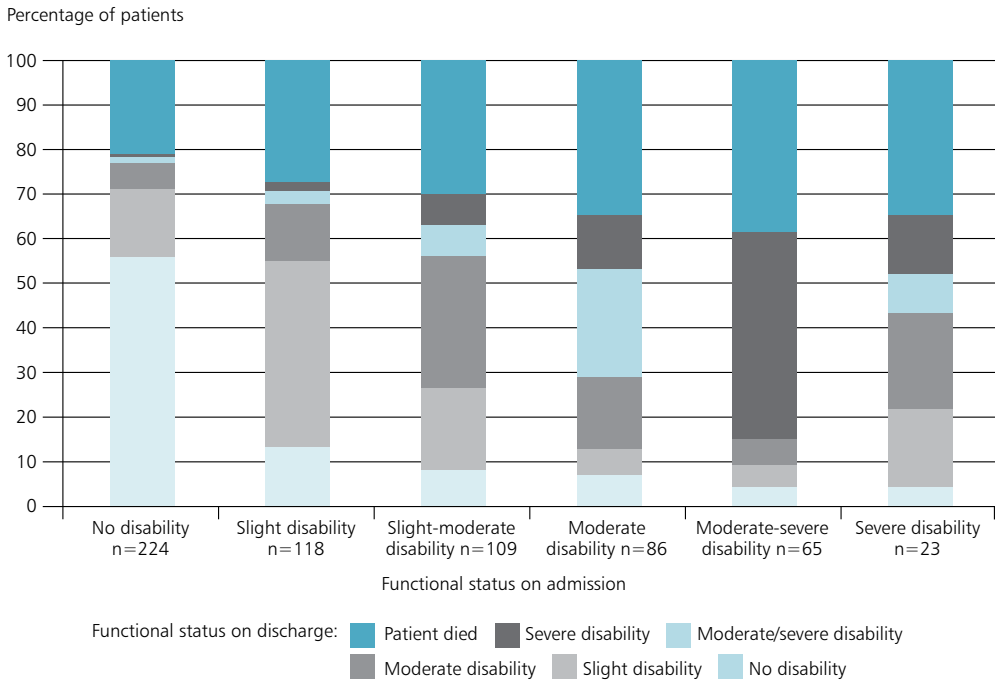

Figure 8.1 Functional status of patients at admission and at discharge – Clinician questionnaire

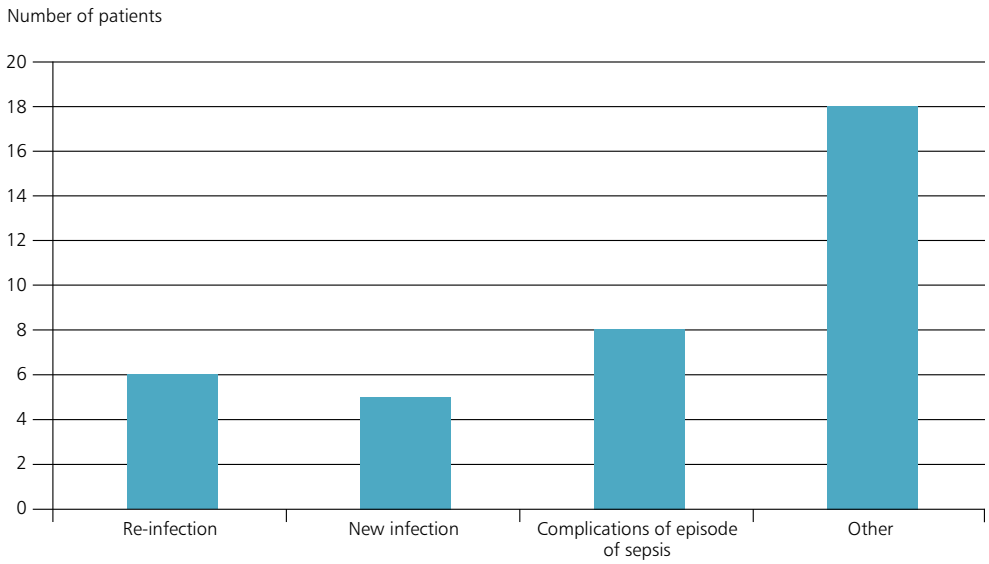

Figure 8.2 Reason for readmission

Reviewers found evidence that one in ten patients (31/306; 10%) were readmitted to hospital (Table 8.16). Of these patients one fifth had a new infection and another fifth had re-infection (Figure 8.2). The Reviewers were of the opinion that 5/23 of the patients who were readmitted could have had this readmission prevented (data not shown).

End of life care

Medical treatment should only be withdrawn on clinical grounds because the treatment will not benefit the patient or the expected benefits are outweighed by the burdens of treatment. There is a need to know, where possible, the wishes of the patient. If the patient is not competent to communicate their wishes, their family and friends should be consulted. Attempts must be made to discover the patient's wishes in this situation. Advance directives, if available and relevant, may be helpful.[60] Many units consider it good practice to involve two senior clinicians in the decision making process when considering withdrawal of treatment.

Treatment was withdrawn from 66% (94/142) of patients who died during the admission (Table 8.17). The Reviewers considered this appropriate in all but three.

Table 8.17 Treatment withdrawal in patients who died

Treatment withdrawn	Number of patients	%
Yes	94	66.2
No	48	33.8
Subtotal	**142**	
Insufficient data	6	
Total	**148**	

The decision to withdraw treatment was made by a clinician of suitable seniority in 87/90 cases, by more than one clinician in 73/82 cases. The decision was discussed with the patients' relatives in 86/89 cases, the patient in 14/42 cases and a patient advocate in 16/27 cases (Table 8.18). The reason for the "discussion with patient category" being so low is believed to be because a number of very unwell patients in Level 3 care would have been sedated when these decisions were made.

Table 8.18 Decisions about withdrawal of treatment

Treatment withdrawal discussions:	Yes	No	Subtotal	Insufficient data/ Not applicable	Total
Made by clinician of appropriate seniority	87	3	**90**	4	**94**
Made by more than one clinician	73	9	**82**	12	**94**
Discussed with the patient	14	28	**42**	52	**94**
Discussed with relatives	86	3	**89**	5	**94**
Discussed with patient advocate	16	11	**27**	67	**94**

Table 8.19 Patient was on an end of life care pathway

Patient was on an end of life care pathway	Number of patients	%
Yes	32	23.7
No	103	76.3
Subtotal	**135**	
Insufficient data	13	
Total	**148**	

Thirty-two patients were placed on end of life care pathways (Table 8.19). The Reviewers considered this to be appropriate in all cases (Table 8.20).

Table 8.20 Decisions about end of life care for patients on an end of life care pathway

End of life care	Yes	No	Subtotal	Insufficient data/ Not applicable	Total
Made by clinician of appropriate seniority	30	0	**30**	2	**32**
Made by more than one clinician	23	4	**27**	5	**32**
Discussed with the patient	7	8	**15**	17	**32**
Discussed with relatives	26	2	**28**	4	**32**
Discussed with patient advocate	4	9	**13**	19	**32**

Table 8.21 Involvement of a palliative care team

Palliative care team involved	Number of patients	%
Yes	20	27.8
No	52	72.2
Subtotal	**72**	
Not applicable	469	
Insufficient data	10	
Total	**551**	

In only 20 patients were palliative care teams involved (Table 8.21). The Reviewers considered that palliative care should have been involved in six further patients (Table 8.22).

There were 148 patients in the study case review cohort who died during their admission. A further 11 patients were identified who died following discharge from hospital, making a total of 159 patients who did not survive (159/551; 29%). There were 11 patients who were still an inpatient at the time of data collection and one patient in the case review cohort for whom there was insufficient information available to establish if they survived (Table 8.23).

Table 8.22 Palliative care team should have been involved – Reviewers' opinion

Palliative care team should have been involved	Number of patients
Yes	6
No	29
Subtotal	**35**
Insufficient data	17
Total	**52**

Table 8.23 Outcome of patients in the study at 30 days post diagnosis of sepsis

Outcome at 30 days	Number of patients	%
Discharged alive	380	69.1
Inpatient at 30 days	11	2.0
Died during admission	148	26.9
Died after discharge	11	2.0
Subtotal	**550**	
Unknown mortality status	1	
Total	**551**	

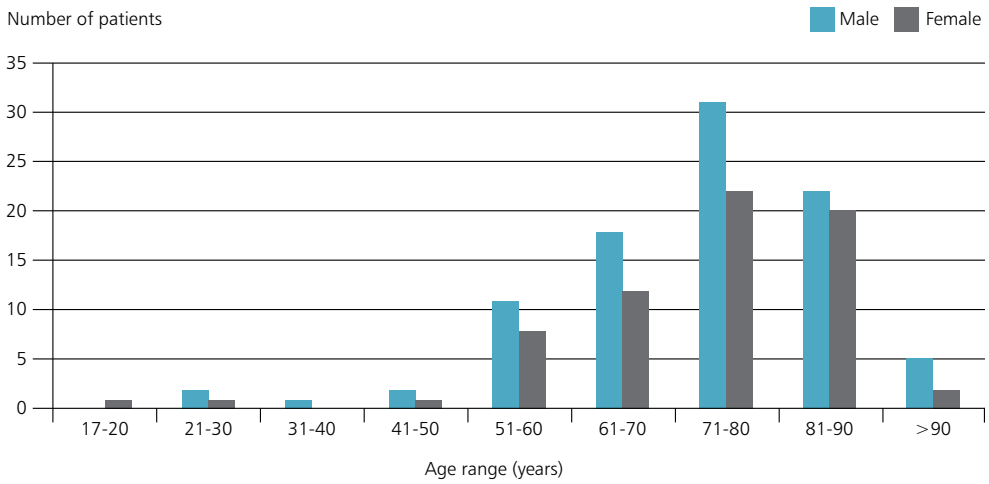

Figure 8.3 Age and gender of the patients in this study who died

Figure 8.3 shows the age profile of the patients in the cohort who died. The age distribution of this group is similar to the whole cohort but with a greater proportion of patients in the ninth decade of life.

An autopsy was only performed in 12% (15/124) of those patients who died (Table 8.24) and sepsis was only mentioned in the causes of death on 40% (42/103) of death certificates (Table 8.25).

Table 8.24 Autopsy performed

Autopsy performed	Number of patients	%
Yes	15	12.1
No	109	87.9
Subtotal	**124**	
Insufficient data	36	
Total	**159**	

Table 8.25 Sepsis recorded on the death certificate

Sepsis recorded	Number of patients	%
Yes	42	40.8
No	61	59.2
Subtotal	**103**	
Insufficient data	46	
Total	**149**	

The Reviewers were of the opinion that of those cases for which sepsis was not mentioned on the death certificate as a cause of death, that it should have been in 48/59 cases (Table 8.26). Information from death certificates is used to measure the relative contributions of different diseases to mortality. Statistical information from death certificates is important for monitoring the health of the population, evaluating public health interventions, recognising priorities for medical research and health services, planning health services, and assessing the effectiveness of healthcare. The treating clinician completing the questionnaire felt that the death was preventable in 10/192 (5%) of cases (Table 8.27). In 6/10 of these cases, the reasons given related to delay in diagnosis of sepsis and/or antimicrobial therapy.

Table 8.26 Sepsis should have been recorded on the death certificate – Reviewers' opinion

Sepsis should have been recorded	Number of patients	%
Yes	48	81.4
No	11	18.6
Subtotal	**59**	
Insufficient data	2	
Total	**61**	

Nearly two-thirds of patients who died with sepsis (where it could be identified by the treating clinician) were discussed at a morbidity and mortality (M&M) meeting (Table 8.28).

Table 8.27 Preventable death in the view of the clinician caring for the patient – Clinician questionnaire

Death preventable	Number of patients	%
Yes	10	5.2
No	151	78.6
Unknown	31	16.1
Total	**192**	

Table 8.28 Case discussed at a morbidity and mortality meeting – Clinician questionnaire

Case discussed	Number of patients	%
Yes	69	63.9
No	39	36.1
Subtotal	**108**	
Unknown	74	
Not answered	10	
Total	**192**	

Of the 48 cases where sepsis was not mentioned on the death certificate but should have been, according to the Reviewers, 18 cases were discussed at an M&M meeting according to the treating clinician. M&M meetings have the potential to provide accountability and the necessary improvement measures required for patient safety as well as professional learning. Studies have shown that for M&M meetings to facilitate improvement and be more than a forum for peer review, they need to be structured and systematic in reviewing and discussing deaths, directing discussions towards improving system and process variations.[65]

Key Findings

- 71/331 (21.5%) patients had evidence of complications at discharge
- The most common complication was worsened physical function (38/71; 53.5%)
- 31/306 (10.1%) patients were readmitted to hospital following an episode of sepsis
- No follow-up appointment was made for 61/333 (18.3%) patients
- According to Reviewers there was no evidence that the GP was informed of the admission in 72/294 (24.5%) cases
- Sepsis was not mentioned on the discharge summary in 226/490 (46.1%) of cases
- There was evidence of insufficient information being given to patients on discharge in 24/133 cases
- The discharge was delayed in 68/352 (19.3%) cases
- The decision to withdraw treatment was made by a clinician of suitable seniority in 87/90 cases
- For those placed on end of life care pathways (32/135; 23.7%), 100% were found to be appropriate
- An autopsy was performed in 15/124 (12.1%) patients who died
- Sepsis was included on the death certificate in 42/103 (40.8%) patients who died. Of those where it was not included Reviewers considered that it should have been in 48/59 (2 not answered)
- Cases were documented as being discussed at M&M meetings in 69/108 (63.9%) patients who died

9

Overall quality of care

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The Reviewers were asked to comment on the overall quality of care received by patients in the study. Just over one third of the study population were considered to have received good care during their admission. Most commonly in the group of patients who were judged to have received less than good care, it was considered that there was room for improvement in clinical aspects of their care rather than organisational factors. This suggests that the deficiencies are more in the management, awareness and decision making of the doctors and nurses caring for these patients rather than systematic deficiencies in process or the organisation of services or equipment (Table 9.1, Figure 9.1).

Table 9.1 Overall quality of care as rated by the Reviewers

Overall quality of care	Number of patients	%
Good practice	198	36.5
Room for improvement (clinical)	149	27.4
Room for improvement (organisational)	39	7.2
Room for improvement (both)	123	22.7
Less than satisfactory	34	6.3
Subtotal	**543**	
Insufficient data	8	
Total	**551**	

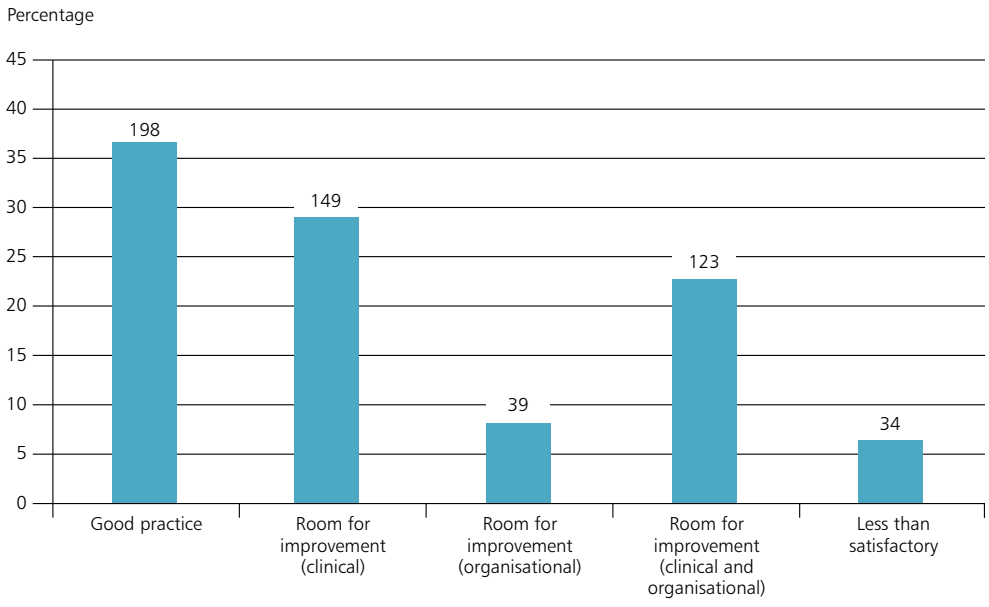

Figure 9.1 Overall quality of care

Recommendations

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1. All hospitals should have a formal protocol for the early identification and immediate management of patients with sepsis. The protocol should be easily available to all clinical staff, who should receive training in its use. Compliance with the protocol should be regularly audited. This protocol should be updated in line with changes to national and international guidelines and local antimicrobial policies. *(Medical Directors)*

2. Training in the recognition and management of sepsis in primary and secondary care should be included in educational materials for healthcare professionals undertaking new posts. Where appropriate this training should include the use of a standardised hospital protocol *(Medical Directors, Nursing Directors, Postgraduate Deaneries, Health Education England, Royal Colleges)*

3. A Clinical Lead in sepsis should be appointed in every Trust/Health Board to champion best practice and take responsibility for the clinical governance of patients with sepsis. This Lead should also work closely with those responsible for antimicrobial stewardship in their hospital(s). *(Medical Directors, Nursing Directors, Trust Chief Executives)*

4. Trusts/Health Boards should use a standardised sepsis proforma to aid the identification, coding, treatment and ongoing management of patients with sepsis (some examples are available at sepsistrust.org and survivingsepsis.org). To ensure continuity of care, this proforma should be compatible, where possible with any similar proforma or system used in primary care and should permit the data to be shared electronically. *(Medical Directors, Primary Care Practitioners, Commissioners)*

5. An early warning score, such as the National Early Warning Score (NEWS) should be used in both primary care and secondary care for patients where sepsis is suspected. This will aid the recognition of the severity of sepsis and can be used to prioritise urgency of care. *(General Practitioners, Ambulance Trusts, Health Boards, NHSE, Clinical Directors, Royal Colleges)*

6. Primary care providers should ensure that robust safety netting arrangements are in place for those patients who are suspected to be at risk of sepsis. *(General Practitioners)*

7. To facilitate the transition from primary to secondary care, a standard method of referral should be introduced in primary care for patients who are in need of a hospital admission for, or thought to be at risk of, sepsis. This should include a full set of observations/ vital signs/risks/relevant history (such as previous sepsis) and any early warning scores used. *(Primary Care Practitioners, Commissioners)*

8. On arrival in the emergency department a full set of vital signs, as stated in the Royal College of Emergency Medicine standards for sepsis and septic shock should be undertaken. *(Emergency Medicine Physicians, Clinical Directors, Nursing Directors)*

9. Where sepsis is suspected, early consideration should be given to the likely source of infection and the ongoing management plan recorded. Once identified, control of the source of infection should be undertaken as soon as possible. Appropriate staffing and hospital facilities (including theatre/interventional radiology) should be available to allow this to occur. *(Medical Directors, Clinical Directors)*

10. The importance of early identification and control of the source of sepsis should be emphasised to all clinicians, and be reinforced in any future guidelines or tools for the management of sepsis. *(International Sepsis Forum, UK Sepsis Trust, NICE, Health Education England, Postgraduate Deaneries, Royal Colleges)*

11. In line with previous NCEPOD and other national reports' recommendations on recognising and caring for the acutely deteriorating patients, hospitals should ensure that their staffing and resources enable:
    a. All acutely ill patients to be reviewed by a consultant within the recommended national timeframes (max of 14 hours after admission)
    b. Formal arrangements for handover
    c. Access to critical care facilities if escalation is required; and
    d. Hospitals with critical care facilities to provide a Critical Care Outreach service (or equivalent) 24/7. *(Medical Directors, Nursing Directors, Commissioners)*

12. All patients diagnosed with sepsis should benefit from management on a care bundle as part of their care pathway. The implementation of this bundle should be audited and reported on regularly. Trusts/Health Boards should aim to reach 100% compliance and this should be encouraged by local and national commissioning arrangements. *(Medical Directors, Clinical Directors, Commissioners)*

13. For any invasive procedure a surgical site bundle should be employed as specified in NICE Clinical Guideline 74. *(Medical Directors, Clinical Directors)*

14. All healthcare providers should ensure that antimicrobial policies are in place including prescription, review and administration of antimicrobials as part of an antimicrobial stewardship process. These policies must be accessible, adhered to and frequently reviewed with training provided in their use. *(Medical Directors, Commissioners, General Practitioners, Postgraduate Deaneries, Health Education England)*

15. There should be senior microbiology input into the management of all patients identified with sepsis. This input should be available 24/7 and sought early in the care pathway. *(Medical Directors, Sepsis Leads, Clinical Directors)*

16. A booklet that provides patients and their relatives with easy to understand information on the recognition of sepsis, its long-term complications, recovery and risk of recurrence should be available from all healthcare providers and be provided to patients with sepsis at discharge from hospital. Some examples can be found at the UK Sepsis Trust (sepsistrust.org) and ICU Steps (icusteps.org). *(Medical Directors, Commissioners)*

17. As for all acutely ill patients who are admitted to critical care, a follow-up service for patients with sepsis should be provided by the hospital which includes support and rehabilitation services, as recommended in NICE Clinical Guideline 83 and the Faculty of Intensive Care Medicine and Intensive Care Society Guidelines for the Provision of Intensive Care Services (GPICS). *(Medical Directors, Clinical Directors, Sepsis Leads)*

18. All patients discharged following a diagnosis of sepsis should have sepsis recorded on the discharge summary provided to the general practitioner so that it can be recorded in the patient's GP record. *(All Hospitals Doctors, General Practitioners)*

19. For patients who die with sepsis, the care provided should always be discussed at a hospital multidisciplinary mortality meeting to encourage learning, and, where the source of sepsis has not been identified, an autopsy should be undertaken. *(Medical Directors, Clinical Directors, Clinical Governance Leads, Sepsis Leads, All Clinical Staff)*

20. When diagnosed, sepsis should always be included on the death certificate, in addition to the underlying source of infection. *(All Doctors including Sepsis Leads)*

21. The use of national coding for sepsis must be improved in order to aid clinical audit, national reporting and shared learning. Use of a standardised proforma as described in recommendation 4 should help improve this process, and may help in the development of a national registry. *(Chief Executives, Medical Directors, Clinical Governance Leads, Sepsis Leads)*

Summary

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This study set out to identify and explore avoidable and remediable factors in the process of care for patients with known or suspected sepsis. From the cases identified, the Reviewers were able to assess 551 cases. Of these, 54 sets of general practitioner (GP) notes were received and suitable for review.

This study confirmed that there is huge variability in the clinical presentation of sepsis. Patients seen in the community present diagnostic dilemmas and whilst the difficulty is recognised, it was of note that there was poor recording of clinical observations by primary and secondary care providers that may have assisted with both the immediate management and handover between primary and secondary care. Half of the patients referred to hospital by GPs had no referral letter. The use of pre-alerts was only apparent in 8 patients, although 50% of hospitals reported they were available, and in the Emergency Department (ED) 40% of patients did not have a timely review by a senior clinician.

The importance of source control is often overlooked and it was noted that a possible source of infection was only recorded at triage in 46% of patients admitted via the ED. And in those patients in whom a source was amenable to control, that control was delayed in 43% of cases which could have affected the outcome in 26/41 patients in the view of the case Reviewers.

Following admission to hospital, 20% of the patients in this study were not seen by a consultant within 14 hours. In view of the fact that 61.5% patients had changes made to their care following consultant review, it is paramount that the resources are in place to ensure prompt consultant review.

One quarter of the patients in this study acquired their infection whilst in hospital. In half of these patients the infection was diagnosed following an invasive procedure. A surgical site bundle was only utilised in 43/73 invasive procedures. In 10/88 patients with hospital-acquired infection, the Reviewers felt that the infection was preventable.

The Reviewers considered that there was a delay in identifying sepsis in 182/505 (36%) cases, severe sepsis in 167/324 (51%) and septic shock in 63/193 (32%), and identified that good documentation of sepsis was associated with more timely diagnosis. Despite the presence of protocols, investigations considered essential in the diagnosis of sepsis were missed in 39% of patients and delayed in 39%. Management on a care bundle reduced delays in the treatment of patients with sepsis. However, only 39.4% of patients were started on a sepsis care bundle. This study highlights the absolute requirement for hospitals accepting emergency admission to have a formal protocol for the early identification and immediate management of patients with sepsis. Only 55/215 (25.6%) acute hospitals used standard proformas to identify and monitor patients with sepsis, and less than half (90/204; 44%) audited the timely treatment of severe sepsis against their own protocols. It is recognised that if clinical management is to improve, clinical leadership is important. However, only half of the hospitals in the study (166/322; 52%) had appointed a lead clinician for sepsis.

This is a group of patients who benefit from the use of antimicrobials, but with the current awareness of over use of antimicrobials, antimicrobial stewardship is important; not only in the management of sepsis but also the in broader environment of healthcare. It was of note that a microbiologist was consulted on the suitability of therapy in only 52% of patients. This was also reflected in the organisational data. Senior microbiological input is essential in the management of patients with sepsis to aid the appropriateness of antimicrobial usage.

Morbidity following sepsis is common and 22% patients had evidence of complications at discharge. There was little evidence of information being given to sepsis patients on the disease and its consequences.

For those patients who died, an autopsy was only performed in 12.1% of cases, sepsis was only included on the death certificate in 40.8% and only 63.8% of cases were discussed at mortality and morbidity reviews, missing opportunities to learn from the care provided.

Throughout the patient pathway areas for improvement were identified and the Reviewers were of the opinion that good care was delivered in only 36% of cases. Early recognition, better documentation and prompt treatment of sepsis would all lead to improved care for this group of patients. Using the word 'sepsis' as soon as it is considered would also raise awareness amongst healthcare professionals and patients.

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Appendices

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Appendix 1 – Glossary

Acute Medical Unit (AMU)	This is the first point of entry for patients referred to hospital as emergencies by their GP and those requiring admission from the Emergency Department.
Antimicrobial	An antimicrobial kills microorganisms or inhibits their growth. Antimicrobial medicines can be grouped according to the microorganisms they act primarily against. For example, antibacterials are used against bacteria and antifungals are used against fungi.
Antimicrobial stewardship	This refers to co-ordinated interventions designed to improve and measure the appropriate use of antimicrobials by promoting the selection of the optimal antimicrobial drug regimen, dose, duration of therapy, and route of administration.
AVPU	The AVPU scale (an acronym from "alert, voice, pain, unresponsive") is a system by which a first aider, ambulance crew or healthcare professional can measure and record a patient's responsiveness, indicating their level of consciousness.
Candida	Candida is a type of yeast and is the most common cause of fungal infections.
Care bundle	A set of interventions that, when used together, improve patient outcomes.
Critical Care Outreach / Rapid Response /Medical Emergency Teams/Service	Multidisciplinary teams, consisting of staff trained in intensive care who review acutely ill patients.
CDU/MAU	The Clinical Decisions Unit (CDU) deals with all acute medical problems.
Coliform bacteria	A broad class of bacteria found in our environment, including the faeces of humans and animals.
Critical care /ICU - Level 3/ HDU - Level2	Intensive Care (Level 3) or High Dependency Care (Level 2). Specialist hospital wards providing detailed care for very sick patients.
Cultures	The growth of bacteria in a laboratory environment.
Early warning score/EWS/ NEWS	This is a guide used by medical services to quickly determine the degree of illness of a patient. It is based on data derived from four physiological readings (systolic blood pressure, heart rate, respiratory rate, body temperature) and one observation (level of consciousness, AVPU). The 'N' stands for National.
Functional status ranking	Slight disability: generally able to carry out activities unaided but may require assistance with certain tasks; moderate disability: Requiring some help but able to walk without assistance; moderate to severe disability: Unable to walk without assistance and unable to attend to own bodily needs without assistance; severe disability: Bedridden, incontinent and requiring constant nursing care and attention.
Glasgow Coma Scale (GCS)	This is a neurological scale to record the conscious state of a person – from 3 (indicating deep unconsciousness) to 15.

Gram-negative	Bacteria that do not retain the crystal violet stain used in the Gram staining method of bacterial differentiation, making positive identification possible. E.g. Staphylocuccus aureus
Gram-positive	Bacteria that take up the crystal violet stain used in the test, and then appear to be purple-coloured when seen through a microscope. E.g. Streptoccus pneumoniae
ICNARC	Intensive Care National Audit & Research Centre
Inotropes	An agent that alters the force or energy of muscular contractions.
MBRRACE-UK	Mothers and Babies: Reducing Risk through Audits and Confidential Enquiries in the UK.
Post Sepsis Syndrome (PSS)	Physical and/or long term effect such as insomnia, fatigue or joint pain
Procalcatoinin	This is a marker of inflammatory response.
Sepsis	A common and potentially life threatening condition triggered by infection. Sepsis is defined as infection plus systemic manifestations of infection. For the purposes of this study, the definition from the surviving sepsis campaign has been used: the presence of infection plus systemic manifestations of infection (see page 13)
Sepsis six	The Sepsis Six is the name given to a bundle of medical therapies designed to reduce the mortality of patients with sepsis - three diagnostic and three therapeutic steps – all to be delivered within one hour of the initial diagnosis of sepsis. 1 Deliver high-flow oxygen. 2 Take blood cultures. 3 Administer empiric intravenous antibiotics. 4 Measure serum lactate and send full blood count. 5 Start intravenous fluid resuscitation. 6 Commence accurate urine output measurement.
Septic shock	A life-threatening condition that happens when blood pressure drops to a dangerously low level after an infection.
Serious incident	Adverse events, where the consequences to patients, families and carers, staff or organisations are so significant or the potential for learning is so great, that a heightened level of response is justified.
Severe sepsis	Sepsis which is complicated by acute organ dysfunction.
Systemic inflammatory response syndrome (SIRS)	An inflammatory state affecting the whole body, frequently a response of the immune system to infection.
Staphylococcus	A type of Gram-positive bacteria.
Streptococcus	A group of bacteria.
Track and trigger	A system which uses periodic observations of basic vital signs (heart rate, blood pressure, etc.) together with pre-determined criteria to ensure timely recognition of deteriorating patients and to trigger a request for more experienced staff, usually the critical care outreach service.
Vasopressors	A powerful class of drugs that induce vasoconstriction and thereby elevate mean arterial pressure (MAP). Vasopressors differ from inotropes, which increase cardiac contractility; however, many drugs have both vasopressor and inotropic effects. E.g. Noradrenaline

Appendix 2 – Existing sepsis information, templates and tools

THE UK SEPSIS TRUST

http://sepsistrust.org/professional/professional-resources/
http://sepsistrust.org/clinical-toolkit/
http://sepsistrust.org/professional/educational-tools/

The Royal College of Emergency Medicine

http://www.rcem.ac.uk/Shop-Floor/Clinical%20Standards/Sepsis

STANDARDS 1) Temperature, pulse rate, respiratory rate, blood pressure, mental status (AVPU or GCS) and capillary blood glucose on arrival. **2)** Senior EM a ssessment of patient within 60mins of arrival. **3)** High flow O2 via non-re-breathe mask was initiated (unless there is a documented reason to the contrary) before leaving the ED. **4)** Serum lactate measured before leaving the ED. **5)** Blood cultures obtained before leaving the ED. **6)** Fluids - first intravenous crystalloid fluid bolus (up to 20mls/kg given: 75% within 1 hour of arrival; 100% before leaving the ED. **7)** Antibiotics administered: 50% within 1 hour of arrival; 100% before leaving the ED. **8)** Urine output measurements instituted before leaving the ED.

The Scottish Trauma Audit Group

http://www.stag.scot.nhs.uk/SEPSIS/Forms.html

NICE National Institute for Health and Care Excellence

https://www.nice.org.uk/guidance/gid-cgwave0686/documents/sepsis-the-recognition-diagnosis-and-management-of-severe-sepsis-scope-consultation

Royal College of Physicians

https://www.rcplondon.ac.uk/resources/national-early-warning-score-news

Appendix 3 – The role and structure of NCEPOD

The National Confidential Enquiry into Patient Outcome and Death (NCEPOD) is an independent body to which a corporate commitment has been made by the Medical and Surgical Colleges, Associations and Faculties related to its area of activity. Each of these bodies nominates members on to NCEPOD's Steering Group.

Steering Group as at 24th November 2015

Dr A Hartle	Association of Anaesthetists of Great Britain and Ireland
Mr F Smith	Association of Surgeons of Great Britain and Ireland
Mr K Altman	Faculty of Dental Surgery, Royal College of Surgeons of England
Vacancy	Faculty of Public Health Medicine
Mr S Barasi	Lay Representative
Ms S Payne	Lay Representative
Dr J Fazackerley	Royal College of Anaesthetists
Dr A Batchelor	Royal College of Anaesthetists
Dr C Mann	Royal College of Emergency Medicine
Dr D Cox	Royal College of General Practitioners
Mrs J Greaves	Royal College of Nursing
Dr E Morris	Royal College of Obstetricians and Gynaecologists
Mr W Karwatowski	Royal College of Ophthalmologists
Dr I Doughty	Royal College of Paediatrics and Child Health
Dr M Osborn	Royal College of Pathologists
Mr M McKirdy	Royal College of Physicians and Surgeons of Glasgow
Dr M Jones	Royal College of Physicians of Edinburgh
Dr A McCune	Royal College of Physicians of London
Dr M Ostermann	Royal College of Physicians of London
Dr M Cusack	Royal College of Physicians of London
Dr T Sabharwal	Royal College of Radiologists
Mr W Tennant	Royal College of Surgeons of Edinburgh
Mr J Abercrombie	Royal College of Surgeons of England
Mr M Bircher	Royal College of Surgeons of England

Observers

Dr R Hunter	Coroners' Society of England and Wales
Mrs J Mooney	Healthcare Quality Improvement Partnership
Ms T Strack	Healthcare Quality Improvement Partnership

Trustees

Mr B Leigh - Chair
Dr D Mason - Honorary Treasurer
Professor L Regan
Professor R Endacott
Mr I Martin
Professor T Hendra
Ms J Barber

Company Secretary - Dr M Mason

NCEPOD is a company, limited by guarantee (Company number: 3019382) and a registered charity (Charity number: 1075588)

Clinical Co-ordinators

The Steering Group appoint a Lead Clinical Co-ordinator for a defined tenure. In addition there are 13 Clinical/Nursing Co-ordinators who work on each study. All Co-ordinators are engaged in active academic/clinical practice (in the NHS) during their term of office.

Lead Clinical Co-ordinator	Dr M Juniper (Medicine)
Clinical Co-ordinators	Dr K Wilkinson (Anaesthesia)
	Dr A P L Goodwin (Anaesthesia)
	Mr M Sinclair (Surgery)
	Mr D O'Reilly (Surgery)
	Dr V Srivastava (Medicine)
	Dr S McPherson (Radiology)
	Dr K Horridge (Paediatrics)
	Dr S Cross (Liaison Psychiatry)
	Dr M Allsopp (Adolescent Psychiatry)
	Gemma Ellis (Nursing)
	Dr A Michalski (Paediatric Oncology)

Supporting organisations

The Clinical Outcome Review Programme into Medical and Surgical Care is commissioned by the Healthcare Quality Improvement Partnership (HQIP) on behalf of NHS England, NHS Wales, the Northern Ireland Department of Health, Social Services and Public Safety (DHSSPS), the States of Jersey, Guernsey, and the Isle of Man.

Members of the Clinical Outcome Review Programme into Medical and Surgical Care Independent Advisory Group:

Dr K Stewart
Ms R Binks
Professor M Dent
Dr K Gully
Mrs M Hughes
Mr P Lamont
Professor D O'Donoghue
Ms J Russell
Professor R Taylor
Dr W Taylor
Mr P Willan
Professor K Willett
Dr I Woods
Dr P Woods
Dr M Ferreira
Mr T O'Kelly

The organisations that provided additional funding to cover the cost of this study:

Aspen Healthcare
Beneden Hospital
BMI Healthcare
BUPA Cromwell
East Kent Medical Services Ltd
Fairfield Independent Hospital
HCA International
Hospital of St John and St Elizabeth
King Edward VII's Hospital Sister Agnes
New Victoria Hospital
Nuffield Health
Ramsay Health Care UK
Spire Health Care
St Joseph's Hospital
The Horder Centre
The London Clinic
Ulster Independent Clinic

Appendix 4 – Participation

Trust/Health Board name	Number of participating hospitals	Number of organisational questionnaires returned	Number of included cases/ clinician questionnaires sent	Number of clinician questionnaires returned	Number of sets of case notes returned
Abertawe Bro Morgannwg University Health Board	5	5	9	7	8
Aintree Hospitals NHS Foundation Trust	2	1	5	4	4
Airedale NHS Foundation Trust	1	1	3	3	3
Aneurin Bevan University Health Board	2	0	6	5	5
Anglian Community Enterprise (ACE) CIC	0	0	0	0	0
Ashford & St Peter's Hospital NHS Trust	2	2	5	5	5
Aspen Healthcare	4	4	0	0	0
Barking, Havering & Redbridge University Hospitals NHS Trust	2	2	7	7	7
Barnsley Hospital NHS Foundation Trust	1	1	3	3	3
Barts Health NHS Trust	6	6	13	2	1
Basildon & Thurrock University Hospitals NHS Foundation Trust	2	2	4	3	3
Bedford Hospital NHS Trust	1	0	5	4	3
Belfast Health and Social Care Trust	3	2	11	3	7
Benenden Hospital	1	1	0	0	0
Berkshire Healthcare NHS Foundation Trust	5	0	0	0	0
Betsi Cadwaladr University Local Health Board	19	19	14	5	3
Birmingham Community Healthcare NHS Trust	2	2	0	0	0
Blackpool Teaching Hospitals NHS Foundation Trust	2	2	5	5	5
BMI Healthcare	45	41	0	0	0
Bradford Teaching Hospitals NHS Foundation Trust	4	4	4	2	1
Braintree Clinical Services Limited (Serco Health Ltd)	0	0	0	0	0
Bridgewater Community Healthcare NHS Trust	1	1	0	0	0
Brighton and Sussex University Hospitals NHS Trust	3	3	9	9	9
Buckinghamshire Healthcare NHS Trust	6	6	5	3	3
BUPA Cromwell Hospital	0	0	0	0	0
Burton Hospitals NHS Foundation Trust	3	3	4	4	4
Calderdale & Huddersfield NHS Foundation Trust	2	2	10	8	10
Caldew Hospital	0	0	0	0	0
Cambridge University Hospitals NHS Foundation Trust	1	1	4	3	1

Trust/Health Board name	Number of participating hospitals	Number of organisational questionnaires returned	Number of included cases/ clinician questionnaires sent	Number of clinician questionnaires returned	Number of sets of case notes returned
Cambridgeshire Community Services NHS Trust	1	0	0	0	0
Cardiff and Vale University Health Board	6	6	5	3	5
Central and North West London NHS Foundation Trust	0	0	0	0	0
Central London Community Healthcare NHS Trust	0	0	0	0	0
Central Manchester University Hospitals NHS Foundation Trust	3	3	5	2	1
Chelsea & Westminster Healthcare NHS Trust	1	0	5	4	2
Chesterfield Royal Hospital NHS Foundation Trust	1	1	3	3	3
City Hospitals Sunderland NHS Foundation Trust	2	2	5	5	5
Colchester Hospital University NHS Foundation Trust	1	1	5	5	3
Countess of Chester Hospital NHS Foundation Trust	2	2	4	3	3
County Durham and Darlington NHS Foundation Trust	8	8	8	8	8
Croydon Health Services NHS Trust	1	1	3	3	3
Cumbria Partnership NHS Foundation Trust	9	9	0	0	0
Cwm Taf Local Health Board	2	2	9	9	9
Dartford & Gravesham NHS Trust	1	1	5	3	3
Derby Teaching Hospitals NHS Foundation Trust	1	1	4	4	4
Derbyshire Community Health Services NHS Foundation Trust	11	11	0	0	0
Doncaster and Bassetlaw Hospitals NHS Foundation Trust	2	2	8	5	4
Dorset County Hospital NHS Foundation Trust	1	1	5	5	5
Dorset Healthcare University NHS Foundation Trust	9	9	0	0	0
East & North Hertfordshire NHS Trust	3	3	6	6	6
East Cheshire NHS Trust	2	2	4	4	4
East Coast Community Healthcare CIC	4	4	0	0	0
East Kent Hospitals University NHS Foundation Trust	3	3	12	11	12
East Kent Medical Services	1	1	0	0	0
East Lancashire Hospitals NHS Trust	5	5	5	4	4

Appendix 4 – Participation (continued)

Trust/Health Board name	Number of participating hospitals	Number of organisational questionnaires returned	Number of included cases/ clinician questionnaires sent	Number of clinician questionnaires returned	Number of sets of case notes returned
East Sussex Healthcare NHS Trust	7	7	7	7	7
Epsom and St Helier University Hospitals NHS Trust	3	3	8	7	6
Fairfield Independent Hospital	1	1	0	0	0
Frimley Health NHS Foundation Trust	3	3	9	8	8
Gateshead Health NHS Foundation Trust	1	1	5	3	2
George Eliot Hospital NHS Trust	1	1	4	4	4
Gloucestershire Care Services NHS Trust	8	8	0	0	0
Gloucestershire Hospitals NHS Foundation Trust	2	2	9	5	5
Great Western Hospitals NHS Foundation Trust	4	4	4	3	3
Guy's & St Thomas' NHS Foundation Trust	2	2	7	7	7
Hampshire Hospitals NHS Foundation Trust	2	0	9	5	2
Harrogate and District NHS Foundation Trust	3	3	5	5	5
HCA International	4	4	1	1	1
Health and Social Services Department, States of Guernsey	1	1	2	1	1
Heart of England NHS Foundation Trust	3	2	15	14	10
Hertfordshire Community NHS Trust	3	3	0	0	0
Hillingdon Hospitals NHS Foundation Trust (The)	1	1	4	2	2
Hinchingbrooke Health Care NHS Trust	1	1	5	5	5
Homerton University Hospital NHS Foundation Trust	1	1	3	2	2
Hospital of St John and St Elizabeth	1	1	1	1	1
Hounslow and Richmond Community Healthcare NHS Trust	0	0	0	0	0
Hull and East Yorkshire Hospitals NHS Trust	2	2	9	9	9
Humber NHS Foundation Trust	0	0	0	0	0
Hywel Dda Local Health Board	9	9	13	11	12
Imperial College Healthcare NHS Trust	4	4	12	9	9
Ipswich Hospital NHS Trust	1	1	4	4	4
Isle of Wight NHS Trust	1	1	3	2	1
Isle of Man Department of Health & Social Security	1	1	5	5	5
James Paget University Hospitals NHS Foundation Trust	1	1	2	2	2
Kent & Medway NHS & Social Care Partnership Trust	0	0	0	0	0

Trust/Health Board name	Number of participating hospitals	Number of organisational questionnaires returned	Number of included cases/ clinician questionnaires sent	Number of clinician questionnaires returned	Number of sets of case notes returned
Kent Community Health NHS Trust	10	10	0	0	0
Kettering General Hospital NHS Foundation Trust	1	1	4	4	4
King Edward VII's Hospital Sister Agnes	1	0	0	0	0
King's College Hospital NHS Foundation Trust	3	3	10	10	9
Kingston Hospital NHS Trust	1	1	4	4	4
Lancashire Care NHS Foundation Trust	0	0	0	0	0
Lancashire Teaching Hospitals NHS Foundation Trust	2	0	5	4	1
Lewisham and Greenwich NHS Trust	2	2	9	7	9
Lincolnshire Community Health Services NHS Trust	0	0	0	0	0
Liverpool Heart and Chest Hospital NHS Trust	1	1	4	4	4
Liverpool Women's NHS Foundation Trust	1	1	0	0	0
Locala Community Partnerships CIC	0	0	0	0	0
London North West Healthcare NHS Trust	4	4	10	8	10
Luton and Dunstable Hospital NHS Foundation Trust	1	1	5	2	2
Maidstone and Tunbridge Wells NHS Trust	2	2	6	6	6
McIndoe Surgical Centre	0	0	0	0	0
Medway NHS Foundation Trust	1	1	4	4	4
Mid Cheshire Hospitals NHS Foundation Trust	1	1	5	5	5
Mid Essex Hospitals NHS Trust	1	1	4	3	3
Mid Yorkshire Hospitals NHS Trust	3	3	9	8	9
Milton Keynes Hospital NHS Foundation Trust	1	1	5	4	5
Moorfields Eye Hospital NHS Foundation Trust	1	1	0	0	0
New Victoria Hospital	1	1	0	0	0
Newcastle upon Tyne Hospitals NHS Foundation Trust	5	5	7	6	7
NHS Liverpool Community Health	0	0	0	0	0
Norfolk & Norwich University Hospital NHS Trust	1	1	5	4	5
Norfolk Community Health & Care NHS Trust	7	7	0	0	0
North Bristol NHS Trust	1	1	5	4	5

Appendix 4 – Participation (continued)

Trust/Health Board name	Number of participating hospitals	Number of organisational questionnaires returned	Number of included cases/ clinician questionnaires sent	Number of clinician questionnaires returned	Number of sets of case notes returned
North Cumbria University Hospitals NHS Trust	2	2	10	9	9
North Middlesex University Hospital NHS Trust	1	1	5	5	5
North Somerset Community Partnership CIC	0	0	0	0	0
North Tees and Hartlepool NHS Foundation Trust	2	2	5	4	1
Northampton General Hospital NHS Trust	1	1	4	4	4
Northamptonshire Healthcare NHS Foundation Trust	0	0	0	0	0
Northern Devon Healthcare NHS Trust	15	15	5	4	4
Northern Health & Social Care Trust	3	1	5	3	2
Northern Lincolnshire & Goole NHS Foundation Trust	2	2	9	9	9
Northumbria Healthcare NHS Foundation Trust	8	8	9	7	6
Nottingham University Hospitals NHS Trust	2	2	8	8	8
Nuffield Health	2	2	0	0	0
Outer North East London Community Services	0	0	0	0	0
Oxford Health NHS Foundation Trust	0	0	0	0	0
Oxford University Hospitals NHS Trust	3	0	9	2	2
Oxleas NHS Foundation Trust	0	0	0	0	0
Papworth Hospital NHS Foundation Trust	1	1	2	2	2
Peninsula Community Health CIC	7	7	0	0	0
Pennine Acute Hospitals NHS Trust (The)	4	4	13	13	13
Peterborough & Stamford Hospitals NHS Foundation Trust	2	2	5	5	5
Phoenix Hospital Group	1	1	0	0	0
Plymouth Hospitals NHS Trust	1	1	5	5	5
Poole Hospital NHS Foundation Trust	1	1	0	0	0
Portsmouth Hospitals NHS Trust	1	1	5	4	1
Powys Teaching Local Health Board	9	9	0	0	0
Provide UK	0	0	0	0	0
Queen Victoria Hospital NHS Foundation Trust	1	1	0	0	0
Ramsay Health Care UK	18	12	0	0	0
Robert Jones and Agnes Hunt Orthopaedic Hospital NHS Foundation Trust	1	1	0	0	0

Trust/Health Board name	Number of participating hospitals	Number of organisational questionnaires returned	Number of included cases/ clinician questionnaires sent	Number of clinician questionnaires returned	Number of sets of case notes returned
Rotherham Doncaster and South Humber NHS Foundation Trust	0	0	0	0	0
Royal Berkshire NHS Foundation Trust	1	1	4	4	4
Royal Bolton Hospital NHS Foundation Trust	1	1	5	5	5
Royal Bournemouth and Christchurch Hospitals NHS Trust	1	1	4	4	4
Royal Brompton and Harefield NHS Foundation Trust	2	2	1	1	1
Royal Cornwall Hospitals NHS Trust	3	3	5	5	5
Royal Devon and Exeter NHS Foundation Trust	1	1	4	4	4
Royal Free London NHS Foundation Trust	3	3	7	7	7
Royal Liverpool & Broadgreen University Hospitals NHS Trust	1	1	5	5	5
Royal Marsden NHS Foundation Trust (The)	2	2	4	1	1
Royal National Orthopaedic Hospital NHS Trust	1	1	0	0	0
Royal Orthopaedic Hospital NHS Foundation Trust	1	1	0	0	0
Royal Surrey County Hospital NHS Trust	1	1	4	4	4
Royal United Hospitals Bath NHS Foundation Trust	2	2	5	5	5
Salford Royal Hospitals NHS Foundation Trust	1	1	5	3	5
Salisbury NHS Foundation Trust	1	1	5	5	5
Sandwell and West Birmingham Hospitals NHS Trust	2	2	7	6	6
SEQOL(Care and Support Partnership Community Interest Company	1	1	0	0	0
Sheffield Teaching Hospitals NHS Foundation Trust	3	3	9	9	8
Sherwood Forest Hospitals NHS Foundation Trust	2	2	5	5	5
Shrewsbury and Telford Hospitals NHS Trust	2	1	10	9	10
Shropshire Community Health NHS Trust	0	0	0	0	0
Sirona Care & Health CIC	0	0	0	0	0
Solent NHS Trust	2	2	0	0	0
South Devon Healthcare NHS Foundation Trust	1	1	5	5	5
South Eastern Health & Social Care Trust	3	3	4	3	2
South Essex Partnership University NHS Foundation Trust	0	0	0	0	0

Appendix 4 – Participation (continued)

Trust/Health Board name	Number of participating hospitals	Number of organisational questionnaires returned	Number of included cases/ clinician questionnaires sent	Number of clinician questionnaires returned	Number of sets of case notes returned
South Tees Hospitals NHS Foundation Trust	8	8	4	3	2
South Tyneside NHS Foundation Trust	2	2	5	3	2
South Warwickshire NHS Foundation Trust	1	1	4	4	4
South West London and St Georges Mental Health NHS Trust	1	1	0	0	0
South West Yorkshire Partnership NHS Foundation Trust	0	0	0	0	0
Southend University Hospital NHS Foundation Trust	1	1	5	4	1
Southern Health & Social Care Trust	2	2	10	10	10
Southern Health NHS Foundation Trust	6	6	0	0	0
Southport and Ormskirk Hospitals NHS Trust	1	1	3	1	3
Spire Healthcare	29	14	1	1	1
St George's University Hospitals NHS Foundation Trust	1	1	5	5	4
St Helens and Knowsley Teaching Hospitals NHS Trust	2	2	4	4	4
St Joseph's Hospital	0	0	0	0	0
Staffordshire & Stoke on Trent Partnership NHS Trust	5	5	0	0	0
States of Jersey Health & Social Services	1	1	0	0	0
Stockport NHS Foundation Trust	1	1	3	3	1
Suffolk Community Healthcare	0	0	0	0	0
Surrey & Sussex Healthcare NHS Trust	1	0	5	2	1
Surrey Community Health	0	0	0	0	0
Sussex Community NHS Trust	7	7	0	0	0
Tameside Hospital NHS Foundation Trust	1	1	5	5	5
Taunton & Somerset NHS Foundation Trust	1	1	5	5	5
The Christie NHS Foundation Trust	1	1	0	0	0
The Dudley Group NHS Foundation Trust	1	1	5	5	3
The Foscote Private Hospital	0	0	0	0	0
The Horder Centre	0	0	0	0	0
The Hospital Management Trust	1	1	0	0	0
The Leeds Teaching Hospitals NHS Trust	3	3	9	7	5
The London Clinic	1	1	3	3	0
The Princess Alexandra Hospital NHS Trust	1	1	5	5	5
The Queen Elizabeth Hospital King's Lynn NHS Foundation Trust	1	1	5	4	3

Trust/Health Board name	Number of participating hospitals	Number of organisational questionnaires returned	Number of included cases/ clinician questionnaires sent	Number of clinician questionnaires returned	Number of sets of case notes returned
The Rotherham NHS Foundation Trust	1	1	5	5	5
The Royal Wolverhampton Hospitals NHS Trust	2	2	5	5	4
The University Hospitals of the North Midlands NHS Trust	2	2	10	6	10
The Walton Centre NHS Foundation Trust	1	1	2	2	2
Torbay and Southern Devon Health & Care NHS Trust	5	5	0	0	0
Ulster Independent Clinic	1	1	0	0	0
United Lincolnshire Hospitals NHS Trust	3	2	15	9	8
Univ. Hospital of South Manchester NHS Foundation Trust	2	2	5	5	5
University College London Hospitals NHS Foundation Trust	4	4	8	5	3
University Hospital Southampton NHS Foundation Trust	1	0	4	4	4
University Hospitals Birmingham NHS Foundation Trust	1	1	5	5	5
University Hospitals Coventry and Warwickshire NHS Trust	2	2	4	4	4
University Hospitals of Bristol NHS Foundation Trust	4	4	5	2	1
University Hospitals of Leicester NHS Trust	3	3	10	7	10
University Hospitals of Morecambe Bay NHS Trust	3	3	6	6	6
Velindre NHS Trust	1	1	0	0	0
Walsall Healthcare NHS Trust	1	0	4	4	4
Warrington & Halton Hospitals NHS Foundation Trust	2	2	0	0	0
West Hertfordshire Hospitals NHS Trust	2	2	5	5	5
West Middlesex University Hospital NHS Trust	1	0	5	4	5
West Suffolk NHS Foundation Trust	1	1	3	3	3
Western Health & Social Care Trust	2	2	7	2	2
Western Sussex Hospitals NHS Foundation Trust	2	2	6	6	6
Weston Area Health Trust	1	1	5	1	1
Whittington Health	1	1	3	3	3
Wirral University Teaching Hospital NHS Foundation Trust	2	2	4	3	3
Worcestershire Acute Hospitals NHS Trust	3	3	6	3	6

Appendix 4 – Participation (continued)

Trust/Health Board name	Number of participating hospitals	Number of organisational questionnaires returned	Number of included cases/ clinician questionnaires sent	Number of clinician questionnaires returned	Number of sets of case notes returned
Worcestershire Health and Care NHS Trust	0	0	0	0	0
Wrightington, Wigan & Leigh NHS Foundation Trust	2	2	4	3	3
Wye Valley NHS Trust	2	1	5	5	5
Yeovil District Hospital NHS Foundation Trust	1	1	5	4	4
York Teaching Hospitals NHS Foundation Trust	5	5	9	9	9

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