
Effectiveness of Critical Care Outreach Services – A Literature Review

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Abstract

Background: Critical Care Outreach Services are considered to be an essential and integral part of a hospital wide approach in improving the early identification and management of deteriorating patients. This is based on the original recommendations made during the modernisation and improvement programme for Critical Care Services within England in 2000 (Department of Health 2000). The widespread implementation of Critical Care Outreach Services as an intervention in practice is not based on robust research evidence.

Objectives: The primary objective of this study is to determine the impact of Critical Care Outreach Services on defined patient and service outcomes (Length of stay, mortality, unplanned Intensive Care Unit (ICU) admissions, readmissions to ICU, in-patient cardiac arrests, adverse patient events, severity of illness scoring).

Design: A systemic literature review of primary research and secondary studies between the dates of 1st January 2003 to 30th October 2011.

Search Strategy: The following electronic databases were searched; General Cochrane Library Search, MEDLINE, AMED, BNI, CINAL, EMBASE, Department of Health, British Association of Critical Care Nurses, Intensive Care Society, National Electronic Library for Health, also reference lists of relevant articles, conference abstracts, hand searches of relevant journals and making contact with relevant clinical experts.

Main Results: A total of eleven studies were selected for review against the inclusion criteria for critical appraisal from a total of 100 studies. The studies included two systematic reviews, two randomised control trials and seven uncontrolled before and after trails. The most frequent outcomes measured for effectiveness of outreach services were; mortality, cardiac arrest, Intensive Care Unit (ICU) readmissions, unplanned ICU admissions, length of stay (ICU and hospital), adverse patient events and severity of illness scoring.

Conclusion: Within this study it has been evidenced that there are positive effects of Critical Care Outreach Services on patient and service related outcomes. However, no clear characteristics of what should form the 'gold standard' for an outreach service could be identified.

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Introduction

In 1999 the Audit Commission compiled a report on Adult Critical Care Services throughout the United Kingdom, entitled 'Critical to Success' (Audit Commission 1999). Critical Care is a global term that covers a diverse set of acute services. Staff in Intensive Care Units provide detailed observation and treatment for very ill patients with potentially recoverable conditions. Within the Audit Commission report, it was identified at the time that critical care costs the National Health Service (NHS) around £700 million each year, and that more money has been going towards these services, yet demand still exceeds supply (Audit Commission 1999). Evidence was also provided within the report

that costs for critical care services were increasing by ten percent each year, and an Intensive Care patient costs six times more than a ward patient. With this ten per cent increase in cost per year, the cost of critical care was estimated at £1400 million in 2009, which would account for on average 2% of a total NHS hospital Trust annual budget (Edbrooke et al 2009).

In order to address the issues identified within the audit commission report the Department of Health (DH) commissioned a review of adult critical care services in England by a select group of experts.

This review group was tasked with the responsibility of developing a framework for the future organisation and delivery

of critical care services in England.

This review resulted in the publication of the white paper 'Comprehensive Critical Care' (DH 2000). This report outlined the commencement plans of the modernisation programme for critical care services over the forthcoming 5 years.

Key recommendations from Comprehensive Critical Care Included:

- Consistent classification of critical care patients
- Defining the characteristics of the service. (Integration, network development, workforce development and data collection to promote a culture of evidenced based practice (DH 2000)

The white paper outlined and defined the current service provision but also established a key ethos of how existing critical care services should be remodelled and the proposal and adoption of new ways of working and the introduction of new innovative services, such as Critical Care Outreach Teams/Services.

Critical Care Outreach Teams were defined within the white paper as providing support to general wards in the care and management of level one patients (DH 2000). Level one patients are defined as: 'Patients at risk of their condition deteriorating, or those recently relocated from higher levels of care whose needs can be met on an acute ward with additional advice and support from the Critical Care Team' (DH 2000,pg 8). An alternative definition of Critical Care Outreach Services is 'a multidisciplinary approach to the identification of patients at risk of developing critical illness, and those patients recovering from a period of critical illness, to enable early intervention or transfer (if appropriate) to an area of suitable care so that patient's individual needs are met (Intensive Care Society 2002,pg 5).

Outreach services are an integral part of Comprehensive Critical Care and they have three essential objectives:

- To avert admissions by identifying patients who are deteriorating and either helping to prevent admission or ensuring that admission to a critical care bed happens in a timely manner to ensure the best outcome
- To enable discharges by supporting the continuing recovery of discharged patients on the wards and post discharge

from hospital, and their relatives and friends

- To share critical care skills with staff working on wards and in the community ensuring enhancement of training opportunities and skills practice and to use information gathered from the ward and community to improve critical care services for patients and relatives (DH 2000)

Prior to the Audit Commission's report in 1999, it had been evident for a number of years that patients in hospital showed signs of deterioration that were observed by medical and nursing staff, but were not acted upon prior to cardiac arrest (Rich 1999, Franklin and Mathew 1994).

There were comparable findings in studies of patients who were admitted to a critical care area of a hospital (Goldhill and Summer 1999, McQuillan et al 1998 and Goldhill 1997).It has also been evidenced that variable standards of care prior to admission to a critical care area can markedly affect patient morbidity and mortality (Audit Commission 1999, McQuillan et al 1998, McGloin et al 1998 and NCEPOD 2005). A number of factors contribute to this inadequate care and this has been identified in the literature and this includes; a skills and knowledge deficit in the nursing workforce in acute care areas (DH 2000), undergraduate as well as postgraduate medical training does not address the specific training and skills involved in patients with critical illness (NCEPOD 2005) and Inadequate nursing provision may lead to failure to focus on groups of patients at risk of developing critical illness and on occasions, nurses may be unsure when to call for assistance (DH 2000).

Other factors that can contribute to suboptimal care of the acutely ill patient in hospital include changes in demographics for example ,hospital ward patient populations have become older and sicker as surgical, anaesthetic and critical care techniques have improved, leading to higher risk patients being offered surgical intervention (McQuillan et al 1998).

Other contributory factors are related to how services are modelled and the demand for acute care, evidence of this can be seen with services becoming increasingly specialised and this is leading to a de-skilling or lack of experience on

general hospital wards. The impact of demand on acute care by patient need and a consequence of bed shortages, patients may be cared for on wards which are not suitable e.g. a patient with a medical condition being nursed on a surgical ward. The result of this is that nurses are unfamiliar with the patient's condition and thus nursing care. Other consequences are that the patients' journey may be affected due to failure to implement other departments' policies and/or which junior medical staff/teams to contact (NCEPOD 2005).

The identification of critically ill or deteriorating patients is key to preventing admission or readmission to the Intensive Care Unit (ICU). It has been known for many years that the highest mortality of all Intensive Care Unit patients is from those patients admitted from wards (Goldhill and Summer 1999). More than a quarter of all ICU deaths occur after ICU discharge and this is identified in the extensive historical work undertaken by Dr Goldhill into this subject (Goldhill and Summer 1999). These key facts identified by Goldhill and Summer (1999) were further substantiated in 2005 in the NCEPOD report 'An Acute Problem'. The development of critical care outreach services was based on the evidence of problems with the care that critically ill patients received on wards.

There was limited evidence that outreach was the solution to these problems according to the National Confidential Enquiry into Patient Outcomes and Death (NCEPOD) published in 2005. However, in 2000 the Government made available as part of the modernisation programme for critical care, funding to take forward the recommendations of 'Comprehensive Critical Care'. At a local level, hospitals devised their own critical care outreach services according to local need, in 2005 there were 191 hospitals in England that had some form of an outreach service (NCEPOD 2005). There is no current and up to date information on how many NHS hospitals have such a service to compare then and now.

A number of different models of critical care outreach services have been introduced but this does however remain a mainly nurse-led service (Ball 2002 and McDonnell et al 2007). The activities undertaken by critical care outreach services also greatly differ.

Some services implement early warning triggers to support healthcare teams identify deteriorating patients earlier and ensure an appropriate response to the patients needs (Ball 2002, Fox and Rivers 2001, Groom 2001, and Nassau 2003), while others provide telephone advice (McDonnell et al 2007). Fewer services provide direct bedside clinical support or follow up of discharged patients (Ball 2002). This diverse and mixed approach from the start of these services in 2000, may account for the poor available evidence and debate with regard to the impact of outreach services (DH 2003 and 2005).

Critical Care Outreach Services are no longer a new idea. The service was founded in Australia in the 1990's, with the concept of Medical Emergency Teams (METs) using the well organised principle that recognition and aggressive intervention improves outcomes from critical illness (Lee et al 1995). Outreach services in the United Kingdom are now losing their youth, which produces an urgent requirement to demonstrate the efficiency and cost effectiveness. This is needed to enable organisations to have the necessary evidence in order to make informed decisions about on-going investment into such services or commissioning intentions of the future.

More recently the focus nationally has been on the incidents of 'failure to rescue' deteriorating patients within hospitals in England. 'Failure to rescue' can be defined as a death after a treatable complication (Griffith et al 2013). This focus has been driven by a key priority in delivering safer care to patients while in hospital and has been led by the National Patient Safety Agency campaign 10 for 2010 which includes a work stream for deteriorating hospital patients (NPSA 2010). This initiative has resulted in systems and processes being developed to prevent failure to rescue and ensuring the correct care is given to every patient every time. This has included the development of track and trigger systems such as the modified early warning scoring system (MEWS) and more recently a draft version of NEWS (NHS Early Warning Score) was issued, which is a nationally based early warning scoring system (Royal College of Physicians 2011). Other relevant focused work has included audit of observations (NICE 2007), standardised communication tools such as SBAR and RSVP (NHS

Institute for Innovation and Improvement 2011) and standardised documentation such a fluid charts.

Within the initiatives to improve the systems and processes there has been no focus on the human resource factor to support these improvements. Assumptions have been made that there is no need for additional specialist services such as critical care outreach teams/services to support this work going forward and improving the key areas of concern identified. This then supports the need for this study to be undertaken to justify the development and existence of outreach services.

Aim of the Study

The aim of this review is to identify what effect Critical Care Outreach Services have on patient outcomes?

To enable the electronic search to start, key words were identified and search terms to support the identification of the most relevant evidence as well as using the Boolean operator (See Table 1). In order to maintain consistency, the same approach was used for all searches undertaken while using electronic databases with regard to key words and terms that were used.

Table 1. Search Terms and Key Words

<u>Search Terms and Key Words</u>
<ul style="list-style-type: none"> • Critical Care Outreach Team(s) OR Medical Emergency Team(s)

AN electronic search was conducted utilising the OVID web interface, selected databases were journal @ OVID, Allied and Complementary Medicine (AMED) Cumulative Index of Nursing and Allied Health Literature (CINAHL),

British Nursing Index (BNI), EMBASE and MEDLINE. This ensured relevant up to date and historical perspective on the subject matter. Material was selected according to pre defined inclusion criteria (Table 2)

Table 2. Inclusion Criteria

Inclusion Criteria	Rationale
1. Language – English	To save time and cost of project
2. Relevant to question - evidence that relates to the effectiveness of Critical Care Outreach Teams	Identify evidence which is not relevant to the study and remove it and identify evidence that is relevant and relates to the following criteria; length of stay, mortality, cardiac arrest rates, readmissions to Intensive Care Units (ICU), timely ICU admissions, averting ICU admissions
3. Date of material 2003 until present	Most recent evidence to focus the evidence & dissertation work due to time limits on the work
4. Adult population (>16 years)	
5. Setting of a paper will be in an acute hospital environment.	This is where critical care outreach services are delivered.
6. Quantitative – Randomised Control Trials, Systematic Reviews, Before and After Trails	The evidence based question is focused on the effectiveness of critical care outreach services based on patient and service outcomes

Table 3. Search results

Database	Results / Findings	General Information About Outreach	Avert ICU Admissions	Timely ICU Admissions	Fol-low-up Post ICU Patients	Edu-cation of the work-force	Other Service Factors (Length of stay/Car-diac Arrests/Mortality/ICU Readmissions)
AMED Database	Using the search terms “Critical Care Outreach Teams” resulted in 1 record not relevant and “Medical Emergency Teams” resulted in 2 records not relevant. Combining the search terms with OR generated the same records.	0	0	0	0	0	0
BNI Database	Using the search terms “Critical Care Outreach Teams” resulted in 6 records (2 relevant and 4 not relevant) and “Medical Emergency Teams” resulted in 11 records (7 relevant and 4 not relevant). Combining the search terms with OR generated the same records.	6	0	0	0	0	3
CINAL Database	Using the search terms “Critical Care Outreach Teams” resulted in 2 records (1 relevant) and “Medical Emergency Teams” resulted in 186 records (8 relevant and 178 not relevant). Combining the search terms with OR generated the same records.	6	0	0	0	2	3
EMBASE Data base	Using the search terms “Critical Care Outreach Teams” resulted in 2 records (1 relevant) and “Medical Emergency Teams” resulted in 856 records (3 relevant and 853 not relevant). Combining the search terms with OR generated the 40 records and 1 relevant record.	2	0	0	0	1	1
General Cochrane Library Search	Using the search terms “Critical Care Outreach Teams” resulted in 1 cochrane review and 2 trails and the term “Medical Emergency Teams” resulted in 4 Cochrane reviews (1 relevant), 88 trials (9 relevant) and 3 economic evaluations (not relevant)	2	0	1	0	0	12

The core objectives of Critical Care Outreach Services were used to identify the number of pieces of evidence found relating to each objective. (See Table 3).

In order to identify whether Outreach Services are effective or not, the focus

was based on specific patient and service related outcomes, but this was not an exhaustive list and included:

- Unplanned admissions to Intensive Care Units
- Readmissions to Intensive Care Units
- Cardiac arrest rate in hospital patients

- Mortality of Intensive Care and Hospital patients
- Length of stay in Intensive Care unit and overall hospital stay
- Severity of illness on admission to Intensive Care

Table 4. Selected Papers from the literature Search

Paper	Title	Publication / Date	Methods	Authors
1	A Prospective Before and After Trial of a Medical Emergency Team	Medical Journal Australia 15 th September 2003 pp 283 - 287	Uncontrolled before and after trial	Bellomo et al
2	Introducing Critical Care Outreach : A Ward-Randomised Trial of Phased Introduction in a General Hospital	Intensive Care Medicine 27 th April 2004 pp 1398 - 1404	Randomised control	Priestley et al
3	Impact of a Critical Care Outreach Team on Critical Care Re-Admissions and Mortality	Acta Anaesthesiologica Scandinavica 21st June 2004 pp 1096 – 1100	Uncontrolled before and after trial	Garcea et al
4	Introduction of the Medical emergency Team: A Cluster-Randomised Control Trial	Lancet 2005 pp 2091 -2097	Cluster randomised control trial	Hillman et al
5	Effect of Critical Care Outreach Team on Patient Survival to Discharge From Hospital and Re-Admission to Critical Care : Non-Randomised Population Based Study	British Medical Journal 1 st November 2003 pp 1 - 4	Uncontrolled before and after trial	Ball et al
6	The Role and Effectiveness of a Nurse Practitioner Led Critical Care Outreach Service	Intensive and Critical Care Nursing 16 th April 2008 pp 375 - 382	Uncontrolled before and after trial	Pirret, A.M.
7	The Impact of the Introduction of Critical Care Outreach Services in England : A Multicentre Interrupted Time – Series Analysis	Critical Care 13 th June 2007 pp 1 - 9	Observational study - Multicentre Interrupted Time Series Analysis of data	Gao et al
8	Impact of an Outreach Team on Re-Admissions to a Critical Care Unit	Anaesthesia 15 th December 2003 pp 328 - 332	Uncontrolled before and after trial	Leary & Ridley
9	Investigating the Effectiveness of Critical Care Outreach Services : A Systematic Review	Intensive Care Medicine 13 th February 2006 pp 1713 - 1721	Uncontrolled Systemic review	Esmonde et al
10	The Effect of Critical Care Outreach on Post-Operative Serious Adverse Events	Anaesthesia 12 th May 2004 pp762 - 766	Before and after trial	Story et al
11	The Effect of Outreach and Early Warning Systems for the prevention of ICU admission and death of critically ill Ward Patients: A Systematic Review	Cochrane Library - Systematic Reviews 8 th October 2008	Systemic review	McGaughey et al

Main Results

A total of eleven studies were met the inclusion criteria (See Table 4). The studies included two systematic reviews, two randomised control trials and seven uncontrolled before and after trails. The critical appraisal of the selected evidence sought to address the effectiveness of Critical Care Outreach Services. Seven

studies were conducted in England, two studies conducted in Australia and two studies conducted in New Zealand.

Table 5 gives a summary of the main results

Priestley et al (2004) study found a reduction in overall hospital mortality (two level odds ratio: 0.52 (95% CI 0.32 – 0.85) and for length of hospital stay the find-

ings were equivocal and outreach increased length of stay (hazard ratio: 0.90; 95% CI: 0.84 – 0.97).

Hillman et al (2005) before (medical emergency team (MET) introduction) and after (post MET introduction) study found; cardiac arrests per 1000 admissions: Control 1.64 Intervention 1.31, unplanned ICU admissions per 1000 admis-

Table 5. Summary of Results

Summarised Study Results							
Results Based on Patient and Service Outcomes of Critical Care Outreach Services							
Study	Length of Stay	Patient Mortality	Intensive Care Unit Readmissions	Unplanned ICU admissions	In-Patient Cardiac Arrests	Adverse patient events	Severity of Illness Scoring
Esmonde et al (2006)	4 studies showing positive impact & 7 showing no impact	8 studies showing positive impact & 14 showing no impact	2 studies showing positive impact & 4 showing no impact	3 studies showing positive impact & 5 showing no impact	4 studies showing positive impact & 8 showing no impact	Not Measured	Not Measured
McGaughey et al (2008)	Not Measured	The UK based trial found that outreach reduced in-hospital mortality	Australian study showed no impact	Australian study showed no impact	Not Measured	Not Measured	Not Measured
Priestley et al (2004)	Length of hospital stay - Findings equivocal - Outreach increased length of stay.95% CI	Reduction in overall hospital mortality. two level odds ratio: 0.52 (95% CI 0.32 – 0.85	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured
Hillman et al (2005)	Not Measured	Unexpected deaths per 1000 admissions: Control 1.18 and Intervention 1.06	Not Measured	Unplanned ICU admissions per 1000 admissions: Control 4.68 and Intervention 4.19	Cardiac Arrests per 1000 admissions: Control 1.64 and Intervention 1.31	Not Measured	Not Measured
Bellomo et al (2003)	A 1353 hospital bed days versus 159 in the intervention period. RRR: 88% P <0.001	There were 303 deaths in the before period and 222 in the intervention period.– RRR:26% P = 0.004	Not Measured	Not Measured	There were 63 cardiac arrest in the before period and 22 in the intervention period. relative risk reduction (RRR): 65% P < 0.001	37 deaths were attributed to cardiac arrests in the before period and 16 in the intervention period. RRR: 56% P=0.005	Not Measured
Gao et al (2007)	Not Measured	Unit mortality = odds ratio 0.97, 0.87 to 1.08	Not Measured	Admissions to ICU out of hours = odds ratio 0.91, 0.84 to 0.97	Admissions receiving CPR before admission to ICU = odds ratio 0.84,95% confidence interval 0.73 to 0.96	Admissions to ICU out of hours = odds ratio 0.91, 0.84 to 0.97	Mean physiology scoring = decrease in 1.22, 0.33 to 2.12
Ball et al (2003)	Not Measured	Survival to discharge = Control 162 and Intervention 235	Readmission = Control 25 and Intervention 16	Not Measured	Not Measured	Not Measured	Not Measured
Story et al (2004)	Not Measured	Not Measured	Not Measured	Not Measured	Not Measured	Patients having serious adverse postoperative incidents = C=14% and I=14%	Not Measured
Leary & Ridley (2003)	Not Measured	Not Measured	Readmissions = Control 49/1291 and Intervention 51/1355	Not Measured	Not Measured	Not Measured	Not Measured
Pirret, A.M. (2008)	Length of stay of readmissions = Control 5 days and Intervention 3 days	Death of readmissions = numbers were too small for analysis	ICU readmissions within 72 hrs = Control 28 and Intervention 9	Not Measured	Reduced ward cardiac arrests as a result of the reduction in ICU readmissions = No data presented	Not Measured	Severity of illness score = Control 18 and Intervention 19
Garcea et al (2004)	Not Measured	Total Hospital Mortality and critical care mortality = Reduced 14.3% to 9.8% and 9.3% to 4.8%	Mortality of readmissions to critical care = Reduced from 36.7% to 22.8% and 49.6% to 32.6%	Not Measured	Not Measured	30 day mortality = Reduced 53.1% to 32.6%	Not Measured

sions: Control 4.68 Intervention 4.19 and unexpected deaths per 1000 admissions: Control 1.18 Intervention 1.06. The MET system increased emergency team calling but does not substantially affect the incidence of cardiac arrest, unplanned ICU admission or unexpected deaths.

Gao et al (2007) study included 108 Intensive Care Units in the analysis of which 79 had formal outreach services. No significant change in proportion of unplanned admissions from Wards. Outreach was associated with a significant decrease in CPR during 24 hours before admission (odds ratio 0.84, 95% confidence interval 0.73 to 0.96) decrease in admissions out of hours (odds ratio 0.91, 0.84 to 0.97) and a decrease in the mean severity physiology score (decrease in 1.22, 0.33 to 2.12). Outreach services using track and trigger tools were associated with lower rates of CPR before admission. Larger teams were associated with a higher proportion of admissions from Wards and higher hospital mortality for patients discharged back to the ward. No effect was found on Unit mortality rates (odds ratio 0.97, 0.87 to 1.08).

Ball, C et al (2003) No significant differences between populations of critical care survivors were seen before or after outreach implementation for age, sex, diagnosis, length of stay, and severity of illness or co-morbidities. After introduction of outreach there was significant increase in survival to hospital discharge (risk ratio (95% CI) 1.08 (1.00 to 1.18) and decrease in ICU readmissions (risk ratio (95% CI) 0.48 (0.26 to 0.87)).

Story et al (2004) study demonstrated no differences in the before and after implementation of Critical Care Outreach on post operative serious adverse events. Patients having serious adverse postoperative incidents control group 14% and intervention group 14%. Patients having serious adverse postoperative incidents 95% CI: 5% absolute decrease to 5% absolute increase during the intervention phase.

Leary & Ridley (2003) study found that Critical Care Outreach had no affect on the readmission rate to an Intensive Care Unit. Readmissions in the control group was 49/1291 and the intervention group 51/1355 (readmissions rate of 4%, 95% CI 4.76 – 3.24 %).

Bellomo et al (2003) prospective before and after trial of a Medical Emergency Team (MET) found the intervention to decrease in-hospital cardiac arrest, death following cardiac arrest, bed occupancy related to cardiac arrest and overall in-hospital mortality. There were 63 cardiac arrests in the before period and 22 in the intervention period (relative risk reduction (RRR): 65% P < 0.001). 37 deaths were attributed to cardiac arrests in the before period and 16 in the intervention period (RRR: 56% P=0.005). Survivors of cardiac arrest in the before period required 163 ICU bed days versus 33 in the interventional period (RRR: 80% P <0.001) and 1353 hospital bed days versus 159 in the intervention period (RRR: 88% P <0.001). There were 303 deaths in the before period and 222 in the intervention period (RRR: 26% P = 0.004).

Garcea et al (2004) Study on the impact of the intervention Critical Care Outreach on ICU readmissions and Mortality found a decrease in ICU mortality, in-hospital mortality and 30 day mortality. Mortality of readmissions to critical care reduced from 36.7% to 22.8% and 49.6% to 32.6% (CI -2.4-30.3% and -1.4% to 33.5%). Total hospital mortality and critical care mortality reduced 14.3% to 9.8% and 9.3% to 4.8% (confidence interval not indicated in the paper) and 30 day mortality reduced 53.1% to 32.6% (CI+ 2.8-37.6%).

Pirret (2008) study found the following impact of Critical Care Outreach on specific measures before and after the service was implemented. ICU readmissions within 72 hrs the control group was 28 and the Intervention group 9, severity of illness score control group was 18 and the intervention group 19, length of stay of readmissions in the control group was 5 days and the intervention group 3 days. Reduced ward cardiac arrests as a result of the reduction in ICU readmissions data was in graphs and not clear on its impact and not described in the text. Death of readmission numbers were too small for analysis within the study.

Esmonde et al (2006) identified Seventeen studies and six brief reports were selected for inclusion from a list of 1760 titles. (2 were randomised controlled trials, 16 uncontrolled before and after studies, 3 quasi-experimental studies, 1 controlled before and after study and one post-only controlled study). The results of each study were separated and identified

as being significant or not significant in relation to impact upon specific patient outcomes (mortality, length of stay, cardiac arrest rates, and unplanned admission rates to Intensive Care and Intensive Care readmissions). Improvements in patients outcomes were found, the evidence in this review is insufficient to demonstrate this conclusively. The many differences in outreach service delivery do not permit identification of a service typology.

McGaughey et al (2008) identified 2 cluster randomised controlled trials were included: 1 randomised at hospital level (23 Australian hospitals) and 1 at ward level (16 wards un the UK) The primary outcome in the Australian trial showed no statistical significant difference between the control and the intervention group for patient mortality (hospitals with medical emergency team (adjusted P value 0.640; adjusted odds ratio 0.98; 95% CI 0.83-1.16). The UK based trial found that outreach reduced in-hospital mortality (adjusted odds ratio 0.52; 95% CI 0.32 TO 0.85) compared with the control group.

Discussion

From undertaking this systematic literature review to address the question of effectiveness of Critical Care Outreach Services, eleven studies were identified that met the inclusion criteria.

These studies consisted of two randomised control trials, seven uncontrolled before and after trials and two systematic reviews. McGaughey et al (2008), Hillman et al (2005), Story et al (2004) and Leary & Ridley (2003) showed no statistical significance of the effectiveness of outreach as an intervention. Esmonde et al (2006), Bellomo et al (2003) Gao et al (2007), Ball et al (2003), Pirret, A.M. (2008) and Garcea et al (2004) all showed the intervention of outreach to have a statistically significant impact upon specific outcomes

The overall limitations and strengths of this systematic review must be noted. The evidence presented by the primary studies in this review is weak. Only two randomised control trial studies were identified (level one evidence) which investigated the effectiveness of outreach as an intervention.

The other studies were two systematic reviews and seven before and after (un-

controlled) trials. The benefit of having wider inclusion criteria for the level evidence resulted in a wide spread of evidence but also demonstrated the lack of robust, high level research evidence on the impact and effectiveness of outreach services. The systematic reviews included within this study also contained some of the studies which were identified from my search. McGaughey et al (2008) focused their inclusion criteria on level one evidence only and the time span was from 1990 to 2006. Within that study they could only identify 2 primary studies using a randomised control approach. These two studies were Hillman et al (2005) and Priestley et al (2004), which were identified within my search as the only level one pieces of evidence. The limited number of studies identified could also have been a result of my search strategy and this may have resulted in lost evidence. This argument is not supported by the systematic reviews included within this study, which support my finding that there is limited high quality evidence available on this specific service development. However Esmonde et al (2006) widened their inclusion criteria to include wider levels of evidence and they identified 1,760 studies and included 23 of these in the systematic review. Six of the studies included by Esmonde et al (2006) are included in this systematic review.

No clear typology for Critical Care Outreach Services emerged from this review. There was a wide variation in terms of service membership, type of outreach activity and availability of service. The variations in the delivery of a complex interventions, in addition to variability in organisational characteristics of hospitals such as policies and access to other services/professionals and variations in case mix at patient level all contribute to the heterogeneity of the included studies. Given the wide variation in outreach services and study settings, generalisability is difficult to assess, and no assumptions should be made about the transferability of the findings. The timing of evaluation between studies varies (1 month to 12 months post implementation of outreach). Having a longer 'run in' period may deliver a more realistic picture of the impact of a new service such as outreach. When studies use a before and after study design, a time lapse between before and after measurement may result in bias. Within this study the economic im-

plications of outreach services were not considered because of the diversity of service models, hours of service and the variability in who staffed such services. Economic consideration is an important factor when evaluating new services such as outreach because it will inform policy makers about financial sustainability and viability, which should be considered alongside other factors such as effectiveness. This point should be considered for any future research studies.

The concept of healthcare services developing bespoke outreach services from a central service is not new within the National Health Service (NHS). This is common place in mental health, community services and social services (Russell et al 2010, McKenzie and Paterson 2010).

The development of these services have been embedded in national objectives but they have been allowed to evolve at a local level to meet patient need. They depend upon the population but are measured against well defined metrics for example reduction of alcohol intake for a given population (UKATT Group 2005). Interestingly the literature suggests that these services can be well defined with clear objectives, but demonstrating impact and effectiveness is just as problematic and challenging (Robinson and Bawden 2007, Tischler et al 2002). This supports the findings and results from this study in proving effectiveness of an outreach service such as Critical Care Outreach.

Critical Care Outreach Services pose a challenging area to research. Some of these challenges can be overcome for example choosing a suitable research method/design and others are not so easy to overcome, for example outreach services that are established and functioning within their own unique service model. In order to develop a measuring system with regard to impact on patient outcomes, a set of indicators are required that can; quantify trends and characteristics, describe performance in achieving health service goals (in this case, elements to which an outreach service strongly contributes) and provide information to improve outreach services in the NHS (Pencheon 2008 and Griffiths et al 2008).

Conclusions

Critical Care Outreach Services exist within a wide spectrum of different ser-

vice models across the National Health Service and are therefore a complex intervention making assessment and evaluation of their effectiveness difficult. Critical Care Outreach Services provide a provision of expert care that fills gaps according to local need and "one size" may not fit all. This also supports the findings that services are based on "best fit" and this is the predominate approach nationally for implementing outreach services.

Other benefits of having a Critical Care Outreach Service were identified from the wider literature that supported this study and they included; how they create and facilitate connectivity of patient care, reduce communication failure and enhance the delivery of care across organisational, professional and speciality boundaries. (Goldhill 1997, Fox and Rivers 2001, Groom 2001). The services then support and create an important culture change leading to improved quality of care that has improved recognition and response of acute deterioration in patients, their initial management and escalation of treatment. These factors suggest that the impact and effectiveness of outreach services may be both direct and indirect, and raises specific challenges for evaluation.

These challenges include choosing the most sensitive research design to capture impact, timing of evaluation and identification of relevant measures/indicators. Although there is insufficient evidence to support effectiveness of Critical Care Outreach Services on patient and service outcomes, conversely the review has not demonstrated that Critical Care Outreach Services are ineffective. On this basis there is no reason for suggesting that outreach services should be discontinued or developments halted. This does mean however, that there is a need to commission a comprehensive evaluation of this service within the United Kingdom using the most effective research study design.

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