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Assessing the Challenges of Economic Evaluation of Critical Care Outreach Services (CCOS): A Typology Approach

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by

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Abstract

There is a paucity of evaluative research into Critical Care Outreach Services (CCOS) with somewhat contradictory findings. A literature review revealed structural and functional heterogeneity between CCOS in England. Yet it remained unknown how the services are configured in Wales. Numerous measures have been used to evaluate effectiveness. However, no economic evaluation has been conducted for CCOS as a whole service. Given the complexity, heterogeneity and multiple aims associated with CCOS, economic evaluation will be challenging. Which standard method of economic evaluation is most appropriate for CCOS remains unexplored.

This thesis addresses the primary and secondary research questions: *What are the challenges of conducting an economic evaluation of CCOS?* and *Is a typology approach to economic evaluation an appropriate methodology for CCOS?* This exploratory mixed methods research was characterised by two distinct phases: a survey captured service delivery configurations, which together with the literature review enabled the development of an empirically grounded typology of models for CCOS; followed by multiple case studies that facilitated more in-depth analyses. The case studies were guided by two additional secondary research questions: *Do local factors influence the effectiveness of CCOS?* and *What outcome measures are most appropriate for the economic evaluation of CCOS?*

This research ultimately revealed how assigning costs to CCOS is complex, and highlighted just how wide-ranging the benefits of the service can be. It uncovered factors that can potentially influence CCOS effectiveness, and how CCOS in Wales continue to evolve - having a tendency to become more educationalist with maturity. Cost-utility analysis alone is therefore likely to be too narrowly focused to capture the full effects of CCOS. Cost-consequence analysis should additionally be conducted to ensure that decisions makers are fully informed when they consider allocating resources to the delivery of CCOS. The tendency of CCOS to evolve as they mature, and the potential influence of contextual factors will also need to be accounted for in the design of future evaluations.

Abbreviations List

ALERT	Acute Life Threatening Events – Recognition and Treatment course
ALS	Advanced Life Support course
BLS	Basic Life Support course
CBA	Cost benefit analysis
CC	Critical Care/Critical Care Unit
CCA	Cost consequence analysis
CCOS	Critical Care Outreach Services/Services
CEA	Cost effectiveness analysis
DNAR	Do not attempt resuscitation
DoH	Department of Health
EWS	Early Warning Score
HDU	High Dependency Unit
HLS	Hospital Life Support course
ICNARC	Intensive Care National Audit and Research Centre
ILS	Intermediate life support
ITU	Intensive Therapy Unit
MEWS	Modified Early Warning Score
NEWS	National Early Warning Score
NICE	National Institute for Health and Care Excellence (*previously* National Institute for Health and Clinical Excellence, and National Institute for Clinical Excellence)
NIV	Non-invasive ventilation
PALS	Paediatric Advanced Life Support
PAR	Patient At Risk
PBMA	Programme budgeting and marginal analysis
RRAILs	Rapid Response to Acute Illness
SBAR	Situation, Background, Action, Response
T&T	Track and Trigger
WAG	Welsh Assembly Government (now Welsh Government)

Glossary of Terms

ALERT	A course designed to train health professionals, including doctors and nurses, to recognise patient deterioration and to respond appropriately.
BAIR Hugger	Forced-air warming blanket.
Educationalist CCOS	CCOS focused on educating general ward staff and staff in other areas to identify and manage the care of deteriorating and/or acutely unwell patients (see Table 6.1).
Hospital at Night	A clinically driven and patient focused change programme, which uses both a multi-professional and multi-specialty approach to delivering care at night and out-of-hours.
Interventionist CCOS	CCOS focused on intervening to manage the care of deteriorating and/or acutely unwell patients in general wards and other areas (see Table 6.1).
Level 0 Care	*"Patients needing care at Level 0 are appropriately cared for in ordinary hospital wards such as are available in all acute hospitals and all general departments of surgery and medicine. Patients' basic psychological and physical needs must be provided for and staff in such areas must safely be able to administer medication, patient controlled analgesia, intravenous maintenance fluids, blood transfusion to correct chronic anaemia and other simple treatments. Observations would usually be required less frequently than every 4 hours."* (Welsh Assembly Government (WAG), 2006 – Designed for Life – pg.2)
Level 1 Care	*"This Level is suitable for patients at risk of their condition deteriorating and those recently relocated from higher levels of care whose needs can be met on an acute ward with additional advice and support from the multidisciplinary critical care team. Staff in this area must be able, safely, to administer intravenous fluids at rates in excess of 3 litres per day, give blood transfusions to resuscitate actively bleeding patients and provide regular but infrequent tracheal suction via a tracheostomy if necessary. Observations would be required at least every 4 hours. Patients without significant co-morbidities could safely be treated with*

continuous epidural analgesia on such a ward." (WAG, 2006 – pg.3)

Level 2 Care

"Patients requiring single organ support such as inotropic support for the cardiovascular system, renal replacement treatment or non-invasive ventilator support may be treated at this level but invasive ventilatory support would not be appropriate. Patients classified as American Society of Anesthesiologists3 3 or 4 following minor or major surgery may be managed at Level 2 provided there is no requirement for invasive ventilatory support. Patients may also be admitted to such units for pre-operative optimisation.

Management of patients requiring frequent tracheal suction via a tracheostomy tube must be within the scope of this general unit. Patients requiring rapid blood transfusion perhaps up to 6 units in 24 hours may be treated in a general Level 2 unit, but Level 2 would not be suitable for a patient requiring massive (>6 units) blood transfusion.

Specialist coronary care, dialysis, neurosurgical and burns Level 2 units will have the same basic staffing requirements as general units but their abilities to provide single organ support will vary. The intra-aortic balloon counter-pulsation device is frequently used in advanced coronary care units while a haemodialysis machine is obviously used in the renal unit; both such units would be operating at Level 2." (WAG, 2006 – pg.3)

Level 3 Care

"Patients at all levels of severity might be appropriately treated at this Level. Organ support and monitoring, as described in Level 2, must be available for most body systems but these facilities might be available for only a small number of patients simultaneously because of staffing or equipment constraints. The duration of treatment for multiple organ failure for a given patient may also be limited, for the same reasons.

All hospitals with an A&E department must be supported by full services and hospitals accepting major trauma or emergency surgical patients must be able to treat Level 3 patients. Hospitals with a vascular surgical department must have Level 3 critical care on site. Units treating patients at Level 3 must have a minimum throughput of 200 Level 3 cases per annum." (WAG, 2006 – pg.4)

Level 3T (Tertiary) Care

"Patients at all levels of severity would be appropriately treated at this Level. Organ support and monitoring for most body systems should be available at Level 3T and these facilities would normally be available to multiple patients simultaneously.

This unit should act as a tertiary referral unit for patients with multiple organ failure and when transfer is appropriate, patients would normally be retrieved by staff from this unit. This unit must have a significant teaching and training role and would normally admit more than 800 patients per annum. To enable such activities, numbers of medical, nursing and other health professional staff in this unit would of necessity be higher than normally available in other units.

A Level 3T unit should be available for every million of population and must have capacity to accommodate all tertiary referrals within this population.

"Critical to Success" also proposes a supplementary classification to identify patients requiring specialist investigation and treatment such as is usually provided in specialist units. These standards are minimum standards that will apply to all adult critical care (general and specialist). However, specialist critical care may have additional requirements." (WAG, 2006 – pg.4)

Night Nurse Practitioners

Advanced Nurse Practitioners who deliver care to patients during out-of-hours.

Open/Closed ITU

ITUs are traditionally described as 'open' or 'closed'. Where open units operate, any doctor in almost any field can admit patients to ITU, with few limitations. They are not required to obtain a CC consultation. They can also review and write orders for a patient whilst they are being cared for in CC. Conversely, where closed ITUs operate, critical care consultations are necessary for admission. In these units the CC doctors have overall responsibility for medical decision making.

PICO

A framework used to guide literature search strategies, focused on:

- P patient/problem/population
- I intervention
- C comparison/control/comparator
- O outcome (Sackett *et al*, 1997)

PIMA — In-house training programme designed to enable non-medical health professionals prescribe x-rays.

RRAILS Sepsis Bundles — A group of interventions related to sepsis that, when implemented together, result in better outcomes than when implemented individually. RRAILS advocate use of the Sepsis Six Bundle (Dellinger *et al*, 2008).

(SPOT)light — A research study conducted by ICNARC, focused on sepsis pathophysiology and organisational timing. Data were collected from 94 NHS Hospitals throughout the UK, between 2010 and 2011. The study was designed to evaluate how sepsis pathophysiology evolves over time, with an in intent to pinpoint optimal timing of treatments. The study included over 20,000 hospital patients who developed a severe illness and required admission to CCU.

STARLITE — This mnemonic outlines the essential elements required in the reporting of literature searches:

- S sampling strategy
- T type of study
- A approaches
- R range of years
- L limits
- I inclusion and exclusions
- T terms used
- E electronic sources (Booth, 2006)

TRANSFER — A course designed to improve the transfer of patients receiving critical care.

1000Lives Plus — A national improvement programme designed to support organisations and individuals in delivering the highest quality and safest healthcare to the Welsh population.

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