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A clinical librarian in a hospital critical care unit may generate a positive return on investment

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Abstract

Background: Timely information provided by clinical librarians can contribute to outcomes such as improved patient care and time savings for hospital staff. What is unknown is the return on investment (ROI) of a clinical librarian on a critical care unit.

Objective: The aim of this study was to assess the ROI, from the employer perspective, of placing a clinical librarian in a critical care unit in a large UK acute hospital.

Methods: Using a mixed methods approach, ROI was estimated by comparing the total costs with the total monetised benefits of implementing the clinical librarian intervention. Total costs included salary and equipment costs. Total monetised benefits included time saving for hospital staff, support for professional development and improved patient care.

Results: When total monetised benefits were compared with total costs, the 15-month clinical librarian intervention generated a positive ROI of £1.18–£3.03 for every £1 invested.

Discussion: Using outcome measures derived from previous research, this novel study generated promising results indicative for commissioners seeking to improve patient care and deliver value for money. To improve generalisability, multisite studies using standardised ROI tools are recommended.

Conclusion: Employing a clinical librarian in a critical care unit can generate a positive ROI.

Keywords: consultants; costs and cost analysis; evidence-based practice; information services; knowledge transfer; knowledge translation; librarians, clinical; library and information professionals; National Health Service(NHS); nurses

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Key Messages

- A range of clinical librarian services contribute effectively and efficiently to professional development requirements for critical care staff.
- Benefits of clinical librarian services are often associated with time saved in searching for information by clinical staff, with some incidences of cost avoidance.
- It is possible to demonstrate a return on investment for clinical librarian services aimed at professional development of healthcare staff.

Background

Although clinical librarians have attended ward rounds since the 1970s, the number of clinical librarians increased substantially with the development of evidence-based practice (EBP) in the 1990s (Harrison & Beraquet, 2010). By 2015, 58% of library services in the NHS in England provided a clinical librarian to support clinical staff and improve patient care (Health Education England, 2015). Research indicates that timely information provided by clinical librarians have

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contributed to positive outcomes such as improved quality of life for patients, increased patient involvement in decision making, and a reduction in unnecessary tests, referrals and readmissions (Brettle, Maden, & Payne, 2016).

Clinical librarians frequently work in hospital wards to support healthcare staff by uncovering knowledge needs, facilitating knowledge mobilisation and constructively sharing ideas and evidence with staff and patients (Brettle et al., 2016). Possessing a range of technical skills, including evidence searching and summarising, clinical librarians mobilise knowledge from producers (researchers) to consumers (healthcare professionals, patients, families). With the improvement of mobile technology and the internet, clinical librarians can now search for evidence immediately on ward rounds and at the patient's bedside (McLaren & Lindfield, 2018).

The role of the clinical librarian is especially important in critical care where patients are often admitted with life-threatening conditions and health professionals are required to make clinical decisions at speed (Hansen & Severinsson, 2009; Johnson et al., 2010; Lane et al., 2013; Rose, 2011). Being admitted to critical care, or having a family member admitted, is often an emotionally distressing experience, which can sometimes be made worse by insufficient information about the condition or treatment. Patients and families have identified the importance of appropriate and accurate evidence-based information as a key factor in improving their experience in critical care (Auerbach et al., 2005; Khalaila, 2013; Sherlock et al., 2009; Stricker et al., 2009).

Although return on investment (ROI) is the most frequently used method for evaluating the financial return of clinical librarian services, there appears to be no evidence of a standardised or validated tool for assessing ROI (Madden et al., 2016). ROI is a type of cost-benefit analysis in which the costs of an intervention are compared with the monetised benefits. The National Institute for Health and Care Excellence (NICE) recommends a broad approach to economic evaluation which includes cost-benefit analysis (NICE, 2012). No study has yet, to our knowledge, examined whether a clinical librarian in a critical care unit is cost-effective from the employer perspective.

The aim of this study is to assess the ROI of placing a part-time clinical librarian in a hospital critical care unit over a 15-month intervention period. A positive ROI indicates that a clinical librarian can deliver cost savings and value for money, which is especially important during times of financial constraint and calls for efficiency savings. Estimating the ROI of clinical librarian activities is aligned with the current NHS Long Term Plan (NHS, 2019) which focuses on maximising health outcomes generated from NHS services, while minimising costs.

Methods

This paper reports on the ROI findings, which were part of a larger study evaluating the effectiveness of a clinical librarian intervention tailored to a critical care unit (Sadera et al., 2019). Ethics approval was granted by the NHS Health Research Authority (IRAS project ID 180509) and the Wirral University Teaching Hospital (WUTH) Research Department.

Recruitment and procedure

The setting for this study was a critical care unit in a large acute UK hospital. Staffing levels fluctuated throughout the intervention period, but when ROI recruitment began the critical care team was composed of 12 consultants, 20 doctors and 100 nurses (132 in total). A purposive sample was recruited by emailing staff members who had engaged with the clinical librarian intervention during the study period.

Staff members who responded to the email received a participant information sheet (Appendix 1), signed a consent form (Appendix 2), completed an ROI questionnaire (Appendix 3) and participated in a short interview or focus group of up to 30 minutes (Appendix 4). Interviews and focus groups were audio-recorded, transcribed and analysed using thematic analysis (Braun & Clarke, 2006).

Intervention

The clinical librarian intervention was implemented in the critical care unit from

September 2016 to December 2017. During the 15-month intervention, a clinical librarian was employed 15 hours per week to support consultants, registrars and nurses who worked in the unit. The clinical librarian's time was divided into 4 × 3.75 hour sessions across different days and times to enable contact with as many staff members as possible. To enhance visibility on the unit, the clinical librarian wore a bright yellow polo t-shirt with the words 'Clinical Librarian' printed on the back.

On the unit, the clinical librarian worked at the nurse's station and participated in ward-based activities, including ward rounds, when required. The clinical librarian used a laptop and iPad to access online resources for staff and patients. In addition, the clinical librarian actively contributed to departmental team meetings, case-based discussions, educational activities such as the monthly Journal Club, and assisted with the inductions and training of new nurses and registrars.

The clinical librarian intervention consisted of the following activities:

- *Pop-up library:* Specific times each week when the clinical librarian was present on the critical care unit to talk with staff, answer questions and offer knowledge-related support.
- *Academic study support:* Training and guidance on academic writing, information searching and critical appraisal skills, referencing and proofreading for nurses in postgraduate training.
- *Evidence searching support:* Systematic and thorough summaries of evidence on topics requested by critical care staff.
- *Noticeboard:* A dedicated noticeboard in the critical care unit corridor to display, share and promote information relevant to the knowledge requirements of staff.
- *Journal club:* Monthly consultant-led face-to-face sessions for critical care staff. The clinical librarian assisted staff members to identify, appraise and present suitable research studies.
- *Facebook group:* A private, online forum moderated by the clinical librarian to share knowledge and learning between staff members.
- *Online journal club:* Critical appraisal of research studies selected by the clinical librarian and critical care staff for those unable to attend the monthly face-to-face journal club.
- *Book box:* Located in a departmental office, a small collection of relevant book titles selected by the clinical librarian for staff to borrow.

ROI analysis

Return on investment was estimated from quantitative and qualitative data collected from a purposive sample of critical care staff who utilised the clinical librarian services during the 15-month intervention. ROI was determined by comparing the total costs of employing a part-time clinical librarian with the total monetised benefits of implementing the intervention. Three ROI metrics were calculated: net benefits, benefit cost ratio and ROI.

- Net benefits = total benefits – total costs
- Benefit cost ratio = total benefits/total costs
- ROI = [(total benefits – total costs)/total costs] × 100

The total costs of implementing the clinical librarian intervention were calculated from the employer perspective. Only direct costs to the employer, such as salary and equipment costs, were considered. Overhead costs for printing and telephone were minimal and not considered as additional.

The total benefits were estimated from the ROI questionnaires and interviews with participants and from financial information provided by administrative staff on the unit. Based on previous research (Weightman & Williamson, 2005) and on the findings from the ROI questionnaires and interviews, the following outcome categories were monetised:

1. Time savings for critical care staff
2. Professional development for nurses
3. Improved patient care

Results

The purposive sample of critical care staff ($n = 24$) consisted of 18 nurses, two junior doctors and four

consultants. The 3:1 ratio of nurses to doctors in the sample reflected the overall 3:1 ratio of nurses to doctors in the critical care unit. The logic model (Figure 1) below illustrates the underlying relationships between the inputs (i.e., funding), outputs (i.e., activities), outcomes (i.e., benefits) and impact of the clinical librarian intervention.

Total costs: salary and equipment costs

The salary cost for hiring a Band 6 clinical librarian at 0.4 FTE (15 hours per week) for the 15-month study was £15 382 (Royal College of Nursing, 2017).

Equipment costs were £2007, which included:
- laptop and accessories (£1389)
- iPad and case (£535)
- audio recorder (£54)
- bright yellow polo T-shirt (£29)

Total costs for salary and equipment were £17 389.

Total benefits

Findings from the questionnaires and interviews identified three themes, which were used to monetise the principal benefits of employing a clinical librarian:

1. Time savings for critical care nurses, registrars and consultants
2. Professional development for nurses enrolled in postgraduate training
3. Improved care for patients and family members

Time saving to critical care staff. The ROI questionnaire asked critical care staff to indicate the number of hours saved per month by utilising clinical librarian services during the 15-month intervention. Results showed that the clinical librarian saved 1563 hours of critical care staff time. Most of the time saving (85%) was reported by nursing staff (Table 1). Using median hourly rate pay scales for consultants, registrars and nurses in 2016–2017, the value of the total time saving was estimated at £26 312 (Royal College of Nursing, 2017; NHS Employers, 2017). Time saving was also evident from interviews with nurses, registrars and consultants:

- 'The clinical librarian saved me hours and a lot of stress, because I work full-time and have small children. I wouldn't have had time to sit in the library'. (Nurse, Band 5)
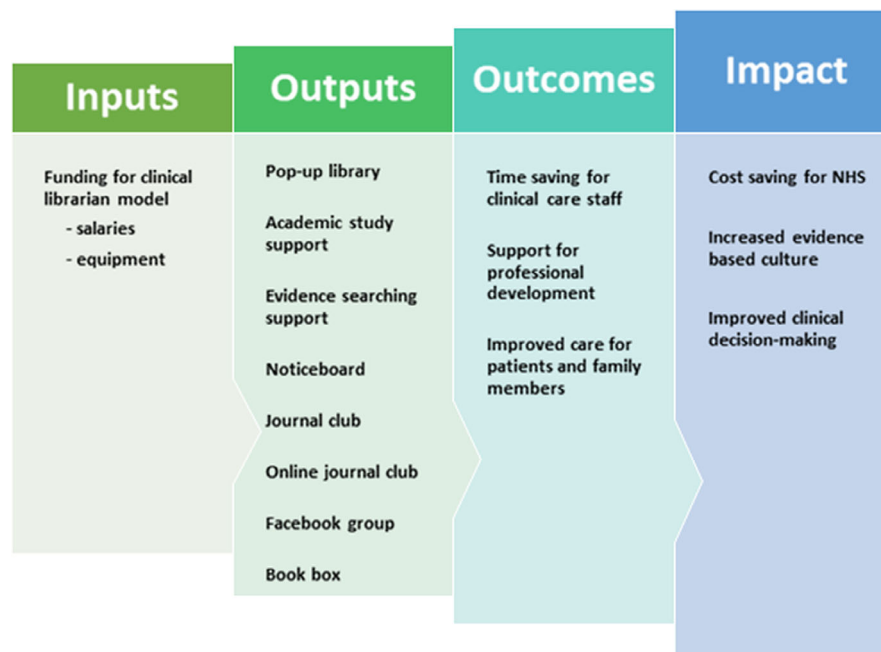

Figure 1 Logic model of the clinical librarian intervention

Table 1 Time saving to critical care staff

Band level	Total hours saved over 15 months	Salary per hour/per person (£)	Total value of time savings (£)
Band 5 nurses (*n* = 8)	750	12.11†	9082
Band 6 nurses (*n* = 3)	225	14.79†	3328
Band 7 nurses (*n* = 7)	360	17.49†	6296
Junior doctors (*n* = 2)	90	18.73‡	1686
Consultants (*n* = 4)	138	42.90‡	5920
Totals (*n* = 24 staff)	1560		26 312

†Royal College of Nursing (2017).
‡NHS Employers (2017).

- 'Without the clinical librarian, we haven't got time to go and research, and there isn't someone there to ask'. (Nurse, Band 5)
- 'When I was doing my master's, the clinical librarian saved me time and stress. I was trying to hold down a fulltime job and do the course. It's pretty tough'. (Nurse, Grade 6)
- 'The clinical librarian saved me a lot of time because I needed someone who could get me the latest guidelines, the latest evidence, and access it very quickly'. (Nurse, Band 7)
- 'I remember writing a guideline about high-dose insulin, and the clinical librarian provided me with a big list of abstracts from literature searches, which was actually very useful. That alone saved me a lot of time'. (Registrar)
- 'With respect to time savings, the clinical librarian helped me with the clinical governance newsletter. I wrote the report, and she helped with the layout. She did a very good job of making it look very presentable. It did save me time'. (Consultant)

Support for professional development of critical care nurses. Return on investment questionnaires from critical care nurses indicated that they used clinical librarian services primarily in support of academic study and professional development.

Professional development support for junior nurses—During the study, at least 50% of critical care nurses were required to hold a Postgraduate Certificate in Critical Care Nursing (Deacon et al., 2017). This requirement was necessary because advances in critical care nursing require specialised skills, in-depth knowledge and an ability to apply evidence-based knowledge to clinical practice.

Findings from quantitative and qualitative data revealed that Band 5 nurses experienced a considerable amount of support from the clinical librarian in completing their Postgraduate Certificate Course in Critical Care. The Course was offered at a nearby university and consisted of three modules: Concepts of Critical Care Nursing, Advancing Knowledge and Skills in Critical Care Nursing and Managing Complex Clients in Critical Care.

The Postgraduate Certificate Course was required of all critical care nurses who worked for a minimum of 18 hours per week on the unit, who cared for Level 3 patients (i.e., those requiring advanced respiratory support), and who had a minimum of 12 months' post-registration experience in critical care.

In the two years preceding the clinical librarian intervention (2015–2016), two junior nurses dropped out each year from the Postgraduate Certificate Course, costing the NHS more than £3000 in prepaid tuition (University of Chester, 2019). When the clinical librarian intervention was implemented in 2017, the percentage of enrolled nurses completing the course increased to 100% (Table 2). It is likely that the clinical librarian intervention was instrumental in preventing nurses (*n* = 2, based on the previous two years) from dropping out, representing a cost saving of £3136 (2016 prices).

Clinical librarian support for junior nurses enrolled on the Postgraduate Certificate Course was evident from the interviews:

- 'Without the clinical librarian, I don't think I would have even started my course, to be honest. The clinical librarian was invaluable to me'. (Nurse, Band 5)
- 'Oh God, I don't think I could have done the ITU Course [Postgraduate Certificate Course] without her'. (Nurse, Band 5)
- 'The University says "you need these books for reading," and the clinical librarian already has them, and you think "great, I've already got everything I need"...' (Nurse, Band 5)
- 'I needed help with the most basic things, my logins, how to access Athens, how to do evidence searches.' (Nurse, Band 5)

Professional development for senior nurses – case study—Professional development is an important part of career advancement in nursing. Nurses frequently pursue academic studies alongside their clinical work. During the time when the clinical librarian intervention was implemented, an experienced Band 6 nurse was working on the critical care unit.

With support from the clinical librarian, the Band 6 nurse decided to pursue a master's degree in Advanced Practice. The academic support offered by the clinical librarian enabled the Band 6 nurse to complete a master's in Advanced Practice, proceed from Band 6 to Band 8a, and obtain a minimum pay increase of £4803 (Royal College of Nursing, 2017) (Table 3). Although this pay increase did not result directly in cost savings to the NHS, it offers a proxy value for professional development and career advancement facilitated by the clinical librarian.

An interview with the Band 6 nurse indicated the support received from the clinical librarian:

The clinical librarian helped me quite a bit with evidence searching, especially accessing journal articles and different databases. She reviewed my work, gave me pointers and helped support my work with better evidence. It was really good. If it wasn't for her support, I wouldn't have gone on to complete my master's. As part of my course, I did a dementia module, and delirium was a big issue. Both dementia and delirium are common causes of cognitive impairment. The clinical librarian helped me particularly with that module, because it was quite difficult to find evidence. I also did a module on evidence-based research, and that was all about proning in intensive care for acute respiratory distress syndrome. The clinical librarian really helped me with that module as well. I'm a Band 6 currently, and once I've completed my master's, I go to 8a. The clinical librarian definitely helped me get started and keep going with my career progression. (Nurse, Band 6).

Support for career development was also evident from other interviews with Band 7 nurses:

- 'I wish the clinical librarian was still here now, because I'm doing a master's module and I would have used her'. (Nurse, Band 7)
- 'We're a very junior ITU (intensive therapy unit/ critical care unit) team, and we've had a massive surge of older staff, who were very skilled and knowledgeable, either retired or moved on. We've become very bottom heavy, and that knowledge is gone. In order to support the junior staff, the model of knowledge mobilisation would be a massive benefit'. (Nurse, Band 7)

Improved care for patients and family members. To monetise improved patient care, critical incident technique (CIT) was applied to measure how specific incidents involving the

Table 2 Completion rates for Postgraduate Certificate Course in Critical Care

Postgraduate Certificate Course	Number of nurses enrolled	Number of nurses completed (%)	Number of nurses dropped out (%)	Approx cost per course (£)	Total cost of course attrition (£)
2015	6	4 (67)	2 (37)	1542†	3084
2016	7	5 (71)	2 (29)	1568†	3136
2017	12	12 (100)	0 (0)	1625†	0

†University of Chester (2019).

Table 3 Value of career advancement

Highest level of pay at Band 6	Lowest level of pay at Band 8a	NHS monetary value of career advancement from Band 6 to Band 8a
£35 225†	£40 028†	£4803

†Royal College of Nursing (2017).

clinical librarian contributed to improved patient outcomes. Used as a valid evaluation method by organisations in healthcare and education, CIT is recommended as a 'robust' and 'tried and trusted method for demonstrating impact' in research involving clinical librarians (Brettle et al., 2016).

Critical incident: Improved patient care—During the first month of the clinical librarian intervention, a patient arrived in the critical care unit extremely ill with an acute severe asthma attack. Upon arrival, the patient's condition deteriorated quickly and she was given breathing assistance via a breathing tube and ventilator.

Over the next several days, the patient's condition was closely observed by critical care staff. A bedside monitor was used to assess breathing, heart rate and oxygen saturation. The clinical librarian supported the patient and her partner by supplying appropriate written information on the patient's condition and the process of recovering from a traumatic episode.

After a few days when the ventilator was removed and medication reduced, the patient suddenly experienced an episode of delirium and hallucinations, which caused great distress to both the patient and her partner. Fortunately, the clinical librarian was on duty, and quickly provided the partner with relevant information on delirium. This information enabled the partner to understand what was happening, and to feel more calm and at ease. This also enabled the partner to explain what was happening to the patient who was extremely agitated and confused.

During the next few days, the patient's condition stabilised and the couple prepared to return home. Once again, the clinical librarian provided helpful information to the patient and her partner. The aim of this information was to ensure that the couple were well prepared to cope with any possible recurrent anxiety, flashbacks, nightmares, hallucinations or negative thought patterns arising from the trauma of the asthma attack and delirium.

In a follow up interview, six weeks after discharge, the couple reported how traumatised they were from the patient's acute illness and delirium, and how grateful they were for the written information and verbal support provided by the clinical librarian. Both the patient and her partner made a successful recovery without requiring any treatment for post-traumatic stress disorder (PTSD).

Cost-avoidance from preventing PTSD—Post-traumatic stress disorder occurs in approximately 22% of survivors of critical illness (Parker et al., 2015). Additionally, 33% of family members of critical illness survivors have a high risk of developing PTSD, especially if they have been provided with incomplete or inadequate information (Azoulay et al., 2005). As a result, PTSD in critical illness survivors and their family members results in a high economic cost to the NHS.

To treat PTSD, the NICE suggests 8–12 sessions of trauma-focused psychological treatment lasting between 60 and 90 minutes at a cost of approximately £190 per session (Curtis & Burns, 2016). If the couple described in the critical incident above had required specialist treatment for PTSD, the cost would have been approximately £1904 for 8–12 sessions. Given the probability of requiring PTSD sessions is 22% for survivors of critical illness and 33% for family members, the cost of PTSD sessions for the patient and her partner was estimated at £1047, which represents the estimated cost savings to the NHS in PTSD sessions avoided (Table 4).

Although the critical incident above describes one example of improved patient care due to the clinical librarian intervention, interviews with staff suggested an even greater impact:

- 'I remember one particular incident, where she actually researched for me. I had a HF (heart failure) machine going, so that's something you need to be constantly there for. You can't really go away and be looking these things up. So the clinical librarian

enabled me to carry on with my job, while she got the information and brought it to me. I could read through that information while I was still caring for the patient, doing the things that I needed to do'. (Nurse, Band 5)

- 'I think impact on patient care, maybe not at that point (when the intervention was implemented), but I think ultimately it would have had a big impact. It had only just started to be seen as a valuable resource'. (Nurse, Band 6)

- 'Sometimes a patient would have an illness that we didn't know much about, and the clinical librarian would get us an article or a piece of research that we would give to the patient and say, 'Have a read of this, and you'll learn more about what's going on.' And that was of great help'. (Nurse, Band 7)

Sensitivity analysis

The monetised benefits of the clinical librarian intervention were based on assumptions made from available quantitative and qualitative evidence. Sensitivity analysis investigated the robustness of the results by comparing the assumptions in the base case with a more conservative case to present a reasonable range of ROI metrics (Table 5).

ROI metrics: net benefits, benefit cost ratio and ROI

To estimate the ROI from the employer perspective over the 15-month study, the monetised benefits of clinical librarian intervention were compared with the total costs using both base case and conservative case scenarios (Table 6). For both base case and conservative case scenarios, the clinical librarian intervention generated a positive ROI from time saving, support for professional development and improved patient care. The ROI analysis indicated that for every £1 invested, a value of £1.18 to £3.03 was generated in monetised outcomes.

Additional non-monetised outcomes

Interviews with staff members indicated further outcomes, which were difficult to monetise, such as improved staff culture. The following statements were indicative:

- 'The clinical librarian's presence keeps people thinking, 'why are we doing it this way, and are there other ways of doing this?' (Nurse, Band 6)

- 'When the clinical librarian first came on the ward, we thought 'A librarian? What would we want a librarian here for? But do you know what, the culture then changed because the clinical librarian would say, 'I'll look that up for you.' All of sudden, everyone thought that having a clinical librarian on the ward was quite a good idea. Now we miss the clinical librarian. We miss the role. I don't know who can signpost the nurses anymore, because now they have to go down to the library and find someone, whereas with the model, the clinical librarian would be here on

Table 4 Financial value of avoiding PTSD sessions

	Probability of acquiring PTSD in critical care	Mean cost saving per person from avoiding PTSD sessions (8–12 sessions)	Mean cost saving per person from avoiding PTSD sessions (% probability from total critical care admissions)
Patient with life-threatening illness	22%†	£1904‡	£419 (22% probability)
Family member of patient with life-threatening illness	33%§	£1904†	£628 (33% probability)
Total cost saving of PTSD sessions avoided		£3808	£1047

†Parker et al. (2015).
‡Curtis and Burns (2016).
§Azoulay et al. (2005).

Table 5 Base case and conservative case assumptions

Item of analysis	Base case assumption	Conservative case assumption	Reason for conservative case
Time saving	100% of time saving to clinical care staff valued at NHS pay rate per hour	50% of time saving to clinical care staff valued at NHS pay rate per hour	Nurses on postgraduate courses do not often complete written assignments within NHS working hours. Unpaid home study is frequently required.
Reduced drop out rate from postgraduate courses	100% of reduced drop out rate attributed to clinical librarian	50% of reduced drop out rate attributed to clinical librarian	The reduced drop out rate from postgraduate study could have been due to other reasons such as family or work commitments, and/or health issues.
Value of career advancement	NHS monetary value of career advancement from Band 6 to Band 8a £4803	Same as base case	Base case and conservative case are the same based on interview with staff member: 'If it wasn't for her (clinical librarian) support, I wouldn't have gone on to complete my master's'.
Improved patient care: Cost-saving from avoiding PTSD sessions	22% probability of survivors of critical illness and 33% probability of family members acquiring PTSD	Same as base case	Base case and conservative case are the same based on literature review stating probabilities of acquiring PTSD for patients and their family members.

the ward several days a week, and much more accessible'. (Nurse, Band 8a).

- 'I think the model certainly informed the care a lot better. I think there are differences of opinion between consultants, and I think the model helped inform what to do'. (Registrar)
- 'At the end of a ward round, a question would come up, and the clinical librarian would do a very quick literature search, and speak to us afterwards to let us know the current situation and the current evidence'. (Consultant)

Discussion

The results showed that a part-time clinical librarian in a critical care unit could generate a positive ROI when outcomes such as time saving, support for professional development and improved patient care were monetised.

Time saving

Research indicates that time saving is the most common measure of financial impact in clinical librarian studies (Madden et al., 2016). Booth, Sutton, and Falzon (2002) and McGowan, Hogg, Zhong, and Zhao (2012) reported significant time saving to medical consultants when clinical librarians were employed to conduct literature searches. When the hourly pay of a clinical librarian was compared with a medical consultant, the time saving resulted in considerable cost saving.

O'Connor (2002) and Booth et al. (2002) reported that literature searching by clinical librarians was more relevant, efficient and thorough than those conducted by consultants and clinical staff. McGowan et al. (2010) stated that the quality of literature searching and knowledge mobilisation by clinical librarians could further reduce costs by improving clinician decision making and decreasing the need for referrals, further tests and other courses of action.

In our study, the ROI questionnaire asked consultants, registrars and nurses to estimate the number of hours that they saved per month by using the clinical librarian service. Because this question was asked after the 15-month intervention, the response could be subject to recall bias which introduces a degree of uncertainty.

Table 6 Monetised outcomes compared with total costs

Outcomes	Base case scenario	Conservative case scenario
Time saving	£26 312	£13 156
Support for professional development		
(1) Improved completion rate in postgrad training	£3136	£1568
(2) Value of career advancement	£4803	£4803
Critical incident of improved patient care	£1047	£1047
Total monetised benefits	£35 298	£20 574
Total costs	£17 389	£17 389
Net benefits	£17 909	£3185
Benefit cost ratio	3.03	1.18
ROI = [(benefits − costs)/costs] × 100	103%	18%

Professional development

Professional development is an area where clinical librarians have a high impact (Brettle et al., 2016). However, there is no consistent method reported in the literature to describe the financial and clinical impact of professional development activities (Opperman et al., 2016).

In our study, support for academic study and professional development were the two most common benefits mentioned by staff who engaged with the clinical librarian intervention. Although there is no standard tool for measuring 'support for professional development', revealed preference valuation was applied which used information from a related market (e.g., tuition costs for academic study and professional development) to impute a value for a non-market good (i.e., professional development). A related market is one that indirectly reveals the value of a non-market good (Fujiwara & Campbell, 2011).

Interviews with nursing staff enrolled on the postgraduate training revealed that support from the clinical librarian was highly valued and enabled several of the nurses to complete their professional development requirements. During the clinical librarian intervention, the junior nurse completion rate in postgraduate training was 100% (*n* = 12) in 2017, whereas the completion rates in 2015 (*n* = 6) and in 2016 (*n* = 7) were 67% and 71% respectively. In 2015 and 2016, four nurses withdrew from the postgrad course, two each year. Therefore, the proxy value used to measure 'support for professional development' was £3136 which represented the prepaid tuition cost for a

hypothetical two nurses who did not drop out in 2017 when the clinical librarian offered professional development support to the nurses.

Interviews with senior nursing staff also showed how 'support for professional development' enabled a Band 6 nurse to progress to Band 8a, resulting in a minimum salary increase of £4803 (2017 prices). In this case, the salary increase of £4803 represented the related market value for the non-market good of 'support for professional development', which enabled one nurse to advance their career.

Patient care

Clinical librarians can also have a high impact in improving the quality of life for patients and their carers (Brettle et al., 2016). Since measuring the direct impact of a clinical librarian on patient care is difficult due to the significant number of intervening variables, research seeks to determine if clinical librarians make a *contribution* to patient care rather than a direct impact (Brettle et al., 2016). To measure the contribution, CIT is recommended in clinical librarian studies. Validated and cited frequently in research studies, CIT measures specific instances of impact (Brettle, et al., 2016; Weightman & Williamson, 2005).

The critical incident described in this study described how the clinical librarian provided timely information to a patient with acute severe asthma and delirium. An interview with the patient and family member six weeks later indicated the degree to which the information from the clinical

librarian helped the patient and family member to cope with the trauma of severe illness in hospital and at home, thus avoiding a possible occurrence of PTSD. This is an example of *cost-avoidance*, where input from the clinical librarian helped to avoid additional specialist referrals.

Examples of cost-avoidance were also cited in a large multisite study investigating the impact of clinical librarian services on patient care. The results of this study revealed that information provided by clinical librarians contributed to the avoidance of events that would have incurred costs such as additional tests and procedures, hospital readmissions, hospital-acquired infections and surgeries (Marshall et al., 2013). It is possible, that in our study, information provided by the clinical librarian contributed to additional incidents of cost-avoidance, which could mean an even higher ROI.

Strengths and limitations

Measuring the ROI of clinical librarians has long been recognised as a challenge, and there is ongoing debate as to whether cost savings can be reliably measured (Weightman & Williamson, 2005). Despite the difficulties of measurement, there is an expanding body of evidence suggesting that information provided by clinical librarians can save clinician's time, support professional development and improve patient care.

This study had several strengths. First, despite the lack of standardised ROI tools or templates, this study was the first to evaluate the ROI of a clinical librarian on a critical care unit. Second, the validity of results was strengthened by comparing quantitative information from self-report questionnaires with qualitative information from interviews and focus groups. Third, outcome measures – time saving, support for professional development and contribution to patient care – were derived from previous research (Weightman & Williamson, 2005).

The study also had some limitations. First, this is a small study involving a purposive sample of 24 health professionals from a fluctuating population of 132 health professionals on a critical care unit. Second, the outcome measure generating the greatest benefit (i.e., time saving) was assessed using a self-report questionnaire at the conclusion of the 15-month intervention. Recall bias increases uncertainty in the results. Third, the generalisability of the results is hampered due to evaluating a single critical care unit at one UK hospital.

Conclusion

This study showed that a clinical librarian intervention on a critical care unit could generate value for money. Quantitative and qualitative data indicated that time saving, support for professional development and improved patient care were important outcomes. The development of a core set of validated outcomes would enable a direct comparison of results in future studies. Multisite studies using standardised ROI tools are recommended to investigate the financial return of employing a clinical librarian in critical care.

Conflict of interest

The authors declare no conflict of interest.

Authors' contributions

G.S, V.T., R.T.E. and N.H. developed the study concept, acquired funding and contributed to the study design. N.H. led the data collection and analysed the data. N.H. and C.L. drafted the manuscript. All authors contributed to interpretation of the findings, reading and approving the final draft. All authors have read and agreed to the published version of the manuscript.

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Appendix 1

Participant Information Sheet

You are being invited to take part in a research study. Before you decide if you wish to take part we would like to give you some information about the study and its purpose.

The purpose of the research is: To explore the return on investment of the clinical librarian as knowledge mobiliser in critical care.

Who is organising and funding the research?

The research is being organised by a team of academics from Bangor University and staff from the Critical Care Unit and Library and Knowledge Service at Wirral University Teaching Hospital. The research is funded by Health Education North West.

Why have I been chosen to take part?

The research involves staff who used the clinical librarian services in the critical care unit between September 2016 and December 2017.

Do I have to take part?

No. Whether you agree or not to take part in the research is completely up to you. You can refuse to take part in the research. You can also decide at any point to no longer be involved in the study, without explaining why you want to withdraw.

What will happen if I take part?

You are being invited to participate by completing a questionnaire and/or interview. The questionnaire will take approximately 5–10 minutes to complete. The interview will take approximately 15–30 minutes to complete. You will be invited to share your experience of using services provided by the clinical librarian from September 2016 to December 2017. This will be audio recorded and transcribed.

Can I be identified?

All material from this research will be treated confidentially and anonymously and will be handled by suitably trained and experienced researchers at Bangor University in accordance with the Data Protection Act. If you receive the questionnaire electronically, you can return the questionnaire to ned.hartfiel@bangor.ac.uk. This study has been granted the appropriate ethical approval through IRAS (Integrated Research Ethics System).

Will I be paid?

Staff members who used the services offered by the clinical librarian from September 2016 to December 2017 and who complete questionnaires will be given a $10 gift voucher for Nando's. Staff members who complete interviews will be given a £20 gift voucher for Nando's.

Who can I contact for further information?

Contact Chief Investigator, Dr Girendra Sadera on 0151 6047056, 6785111 - ext 2205, 2039 or email girendra.sadera@nhs.net. For enquiries regarding the return on investment questionnaires or interviews, contact Dr Ned Hartfiel at Bangor University on 01248 388 691 or ned.hartfiel@bangor.ac.uk.

Appendix 2

Participant Consent Form

Project title: The librarian as knowledge mobiliser in critical care	Please tick the boxes below
1. I confirm that I have read and have understood the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered to my satisfaction.	▢
2. I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason, without legal rights being affected.	▢
3. I understand that, under the *Data Protection Act*, I can ask at any time for access to the information I provide and can also request the destruction of that information if I wish.	▢
4. I understand that the research team may wish to use my direct quotations anonymously in the research reports produced, without them being linked to me personally.	▢
5. I agree to take part in the study.	▢

Participant:
Participant:
Print name _____

Signature _____

Date _____

Researcher:
Print name _____

Signature   _____   Date

_____

Appendix 3

The librarian as knowledge mobiliser in critical care
Staff questionnaire stage 4 (return on investment)

All answers are treated with confidentiality and anonymity by the researcher.

We are interested to know ***how much you benefitted*** from utilising the services offered by the clinical librarian from September 2016 to December 2017.

1) Please indicate your NHS band level in the Critical Care Department:

Grade 5	○	Consultant	○
Grade 6	○	Other_____	○
Grade 7	○		

2) Please indicate which clinical librarian services you used from Sept 2016 to Dec 2017:

	Yes	No	If yes, how many times did you use this service?
Enquiries and general support	○	○	
Academic Study Support	○	○	
Evidence Searching Support	○	○	
Journal Club	○	○	
Facebook Group	○	○	
Other _____	○	○	

3) Please indicate how much the clinical librarian services you used from Sept 2016 to Dec 2017 supported you in the following areas:

	Not at all	Small amount	Moderate amount	High amount	Very high amount
Patient care	○	○	○	○	○
Clinical decision-making	○	○	○	○	○
Evidence searching	○	○	○	○	○
Academic study	○	○	○	○	○
Professional development	○	○	○	○	○
Career advancement	○	○	○	○	○
General wellbeing	○	○	○	○	○
Time savings	○	○	○	○	○

4) Please circle the approximate number of hours that you have saved per month by using the clinical librarian services from Sept 2016 to Dec 2017.

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|___|___|___|___|___|___|___|___|___|___|___|___|___|___|
0   1   2   3   4   5   6   7   8   9   10   Other_____
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5) Please describe any examples of how the services offered by the clinical librarian supported you in your patient care, clinical decision-making, evidence searching, academic study, professional development, career advancement, general wellbeing or time savings from Sept 2016 to Dec 2017.

Appendix 4

The librarian as knowledge mobiliser in critical care

Staff interview questions – return on investment

1. What is your band level and job role on the Intensive Care Unit?
2. How often did you use the services offered by the clinical librarian from September 2016 to December 2017?
3. Which clinical librarian services did you use during this time period?
4. How did these services contribute to your clinical decision making and patient care?
5. How did these services contribute to your professional development and career advancement?
6. How did these services contribute to your overall job performance?
7. How did these services enable you to save time?
8. How much time (approximately) did these services save you from September 2016 to December 2017?
9. How did these services affect your levels of stress and wellbeing?
10. How would you have managed without these services?
11. Without evidence searching support, would you have embarked on evidence searching on your own? If not, what would have been the consequences?
12. Are there any other observations or comments you have regarding the services offered by the clinical librarian?