The clinical librarian as a knowledge mobiliser:
A mixed-methods intervention study developing and evaluating the effectiveness and return on investment of a knowledge mobilisation model tailored to critical care

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The clinical librarian as a knowledge mobiliser: A mixed-methods intervention study developing and evaluating the effectiveness and return on investment of a knowledge mobilisation model tailored to critical care

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"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." (Nurse)

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

"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)

"[The librarian] was able to get me all the latest research, without me having to go trawling out, she was just there, immediately, on-site. So if found that actually very, very useful. (Nurse)

"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." (Junior doctor)

"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)

"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)

"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)

1. Summary

1.1 Background

Mobilising knowledge involves making information accessible and useable. In the healthcare setting, effective knowledge mobilisation ensures that staff can easily access, understand and apply information to practice. In critical care, knowledge about complex conditions and treatments can be difficult for staff, patients and families to navigate. A clinical librarian is a specialist role that combines technical skills (such as evidence searching and summarising) with the necessary personal attributes to mobilise knowledge effectively.

In this mixed-methods study, a model of knowledge mobilisation tailored to critical care was designed and implemented by a clinical librarian in an acute teaching hospital in the UK. The model was evaluated and the potential return on financial investment examined. This is the first study to our knowledge that has measured the contribution and return on investment (ROI) of the clinical librarian role specifically in a critical care setting.

1.2 Approach

This mixed-methods study was composed of three phases:

- Phase 1 involved identifying knowledge requirements
- Phase 2 involved designing and implementing a knowledge mobilisation model
- Phase 3 involved evaluating the model and measuring ROI

1.2.1 Phase 1: Identifying knowledge requirements

During phase 1 of the study, critical care staff were asked to complete a questionnaire about their knowledge requirements. Interviews and focus groups were also conducted with critical care staff, as well as critical care patients and their family members, to identify what are their knowledge requirements. This methodological triangulation enabled the validity of the questionnaire data and interview data to be established.

Questionnaire and interview data revealed that critical care staff required knowledge that was:
- Available to support all aspects of care
- Visible and accessible to everyone
- Available through multiple channels, both face-to-face and online
- Discussed and shared between colleagues

Critical care staff found seeking and applying knowledge to be challenging for many reasons, including lack of time, pressure on resources, and limited experience of knowledge-seeking.

Questionnaire and interview data revealed that critical care patients and their families wanted knowledge about their condition and treatment that was:

- Primarily delivered via the bedside nurse
- Repeated and reinforced at appropriate milestones of care
- In multiple formats (both verbal and paper)
- Complemented by their own knowledge in the form of photographs or diaries

Findings from phase 1 informed the development of a knowledge mobilisation model (phase 2).

1.2.2 Phase 2: Designing and implementing a model of knowledge mobilisation

During phase 2 of the study, a knowledge mobilisation model was designed and implemented by a clinical librarian. The clinical librarian was embedded within the department and provided support to critical care staff through a number of activities, such as:
- Being available at specific times each week (i.e. providing a 'pop-up library' service)
- Delivering academic study skills training (e.g. how to perform literature searches)
- Supporting a consultant-led departmental journal club where junior doctors could discuss research papers
- Moderating a peer-to-peer learning environment for critical care staff through a Facebook group
- Facilitating a book box where critical care staff could access relevant literature

The model was flexible and refined over a 15-month period in response to observations from the research team and feedback from critical care staff.

1.2.3 Phase 3: Evaluating the model and exploring return on investment (ROI)

During phase 3 of the study, critical care staff were asked to evaluate the knowledge mobilisation model by completing a questionnaire or taking part in an interview or focus group. Findings demonstrated that the knowledge mobilisation model:

- Supported staff learning and education
- Improved the quality of care
- Nurtured an evidence-based culture
- Generated a positive financial value

To evaluate the efficiency/cost-benefit of the investment of the knowledge mobilisation model, ROI analysis was performed using questionnaire and interview data from critical care staff. Total monetised benefits were based on the contribution of the knowledge mobilisation model to time saving for critical care staff, professional development for nurses, and improved patient care. The ROI analysis indicated that for every £1 invested in the knowledge mobilisation model, a financial value in a range from £1.18 to £3.03 was generated.

1.3 Conclusions

In critical care where the evidence base can be complex, staff have a clear need for knowledge support; this need can feasibly be met by a clinical librarian-led model of knowledge mobilisation.

The model of knowledge mobilisation in this study helped critical care staff to learn, develop and improve the quality of their care. It nurtured an evidence-based culture across the department and generated a positive financial value from saving staff time, supporting their professional development and improving patient care.

This study has developed and tested an approach to ROI analysis in clinical librarian services. This approach should be further tested and refined in future studies.

1.4 Recommendations

1. Critical care units should consider employing a clinical librarian within the multidisciplinary team and recognise that this can be done in a way that generates a financial return.
2. NHS Trusts should recognise their responsibility to support the knowledge requirements of staff to enhance patient care, and the contribution of the clinical librarian role to this.
3. Further studies are needed to:
    a. evaluate clinical librarian interventions in other critical care departments and other healthcare settings;
    b. investigate further the financial return of employing a clinical librarian in a multidisciplinary healthcare team.
4. Training and development opportunities should be developed specifically to support knowledge specialists to work in embedded roles.

2. Introduction

Mobilising knowledge means making knowledge easy to access, easy to understand, and easy to apply. Knowledge mobilisation is not simply a one-way flow of information; it involves engaging people in a discussion about how to share, appraise and apply knowledge more effectively. Other terms used to describe this process include knowledge diffusion, knowledge transfer, knowledge exchange and knowledge management. For consistency, the term knowledge mobilisation is used throughout this report.

In a health care setting, knowledge might be newly-published research, practice-based knowledge from real-world experiences, or the attitudes and preferences of the patient. Knowledge mobilisation keeps healthcare professionals connected to research and other sources of information, empowering them to make informed improvements in their practice. Effective knowledge mobilisation is necessary to mitigate the barrage of new research that is published every day and bridge the gap between research and practice (Green, 2014; Smith & Wilkins, 2018).

Clinical librarians are a group of professionals utilised in healthcare to mobilise knowledge. Clinical librarians are specialists with expertise in evidence searching and summarising, delivering information skills training, and mobilising knowledge. They work as part of a multidisciplinary team alongside nurses, doctors, managers and other healthcare professionals, predominantly in an acute hospital setting (Harrison & Beraquet, 2010).

In this mixed-methods study, a model of knowledge mobilisation tailored to critical care was designed and implemented by a clinical librarian. The contribution of this model to patient care and staff development was evaluated. The potential return on financial investment of the clinical librarian was explored. This is the first study to our knowledge that has measured the contribution and ROI of the clinical librarian role specifically in a critical care setting.

The aim of the research was to develop, implement and evaluate a model of knowledge mobilisation for critical care.

The objectives were to:
1. Identify the knowledge requirements of critical care staff, patients and their family members (Phase 1)
2. Design and implement a knowledge mobilisation model and for a critical care environment (Phase 2)
3. Evaluate the knowledge mobilisation model and estimate the ROI of implementing the model (Phase 3)

2.1 Background to knowledge mobilisation

The role of the clinical librarian is to facilitate knowledge mobilisation. This involves bringing people together to build relationships, uncovering knowledge needs, sharing ideas and evidence with the aim of improving practice. Another important function of the clinical librarian role is to act as a knowledge 'broker'. A knowledge broker is someone who aids the mobilisation of knowledge and supports others to do so (Elueze, 2015).

Clinical librarians possess a range of technical skills, including evidence searching and summarising, that support them to effectively mobilise or broker knowledge from its producers (researchers) to its consumers (healthcare professionals, patients, families). The clinical librarian role combines technical skills with the personal attributes of a knowledge broker.

Lomas (2007) describes the attributes of a knowledge broker as:
- Entrepreneurial (networking, problem solving, innovating)
- Trusted and credible
- Clear communicator
- Understands the cultures of both the research and decision making environments
- Able to find and assess relevant research in a variety of formats
- Facilitates, mediates, and negotiates
- Understands the principles of adult learning

In the NHS in England, 58% of library services provide a clinical librarian (or outreach service) to underpin best practice and patient care by providing the best available evidence at the patient's bedside and in the workplace (Health Education England, 2015). There are equivalent roles in health systems worldwide, including in the US, Canada and Australia. Clinical librarians are supported in their role by a network of library and knowledge services which provide access to evidence-based resources (databases, journals) and services (literature searching, document supply) (Health Education England, 2015).

2.2 Mobilising knowledge for health care staff

Evidence-based practice is required in the delivery of healthcare services so that best evidence from research is integrated with clinical policy and practice (Sackett et al., 1996). The NHS in England has a duty to apply evidence obtained from research as decreed in the Health and Social Care Act (Department of Health, 2012). However, there are a range of challenges in applying evidence to clinical practice: practitioners have difficulty finding, assessing, interpreting, and applying current best evidence (Haynes & Haines, 1998). Organisational cultural barriers that inhibit health care improvements include staff resistance, staff skills and knowledge, culture, lack of leadership, lack of funding and organisational culture (Health Foundation, 2015).

In response to the challenge of applying evidence-based practice, clinical librarians employ a range of strategies to broker knowledge in a meaningful way. These include educational activities (Thomas et al., 2006), guideline implementation (Grimshaw et al., 2001), audit, knowledge translation frameworks (Graham et al., 2006), safety checklists (WHO 2008) and quality improvement initiatives (Shojania & Grimshaw, 2004).

A 2016 systematic review showed that information provided by librarians contributes directly to patient outcomes such as diagnosis; choice of intervention; improvements in quality of life; increased patient involvement in decision making, and improved access to patient information (Brettle et al., 2016). Furthermore, direct contributions were also demonstrated for cost savings and risk management by avoiding tests, referrals and readmissions reducing length of stay. Qualitative findings illustrate how librarians contribute to patient care including advice given to the patient, diagnosis and choice of drugs (Marshall et al., 2013).

Studies in general medicine and primary care have concluded that input from a librarian is associated with reduced length of stay (Banks et al., 2007), reduced referrals and return visits (McGowan et al., 2008), and is more likely to be effective in cases which are complex (Esparza, Shi, McLarty, Comegys, & Banks, 2013). However, a quantitative approach may not solely be appropriate to understand the complexities of librarian input to clinical outcomes (Deshmukh & Roper, 2014). As well as potential confounders, finding suitable controls and ethical issues in withholding

information have been problematic in quantitative studies (Banks et al., 2007; Mulvaney, Bickman, Giuse, Lambert, Sathe, & Jerome, 2008; McGowan et al., 2008; Esparza et al., 2013).

In critical care the knowledge challenges experienced by practitioners, patients and families are exacerbated by the need for rapid decision-making and the critical nature of the illnesses being treated. The critical care environment is high pressured, with high rates of patient mortality and staff burnout. Patients are admitted with life-threatening conditions, family members are distressed, and health professionals are required to make clinical decisions at speed (Lane et al., 2013; Rose, 2011; Hansen & Severinsson, 2009; Johnson et al., 2010). Studies have shown that there is a wider than perceived gap between best evidence recommendations (what we know) and clinical practice (what we do) in critical care (Brunkhorst et al., 2008; Quenot et al., 2008; Leone et al., 2012; Heyland, Cahill, & Dhaliwal, 2010).

The critical care environment

Within critical care there is evidence to suggest that a librarian can influence treatment decisions by providing information within seven days of a ward round (Mulvaney et al., 2008). Preliminary evidence from local pilot work suggests that a librarian can play an important role as a member of the critical care team (Sadera & Treadway, 2016).

2.3 Mobilising knowledge for patients and families

Critical care patients and family members represent a unique challenge in knowledge mobilisation. They identify lack of knowledge as a key factor that influences their experience (Auerbach, Kiesler, Wartella, Rausch, Ward, & Ivatury, 2005; Sherlock, Wilson, & Exley, 2009; Khalaila, 2013; Stricker, Kimberger, Schmidlin, Zwahlen, Mohr, & Rothen, 2009). Being admitted to critical care, or having a family member admitted, is an emotionally distressing experience, which can sometimes be worsened by insufficient knowledge about the condition or treatment. It is therefore crucial that patients and family members have access to accurate, evidence-based information.

However, interpreting health information in a meaningful way can present a challenge for patients and families. Up to 61% of the working age population in England finds it difficult to understand health and wellbeing information (Public Health England and The Institute of Health Equity, 2015). Low levels of health literacy impact significantly upon a person's ability to manage long-term conditions, make informed healthy lifestyle choices, and keep to medication regimes.

When high quality health information is provided to patients and their family members, there is a positive impact on service utilisation, patients' experience and health behaviour (Patient Information Forum, 2013). Engaging patients and the public is a key priority for the NHS in England, as a means to support people to stay healthy and make informed choices about their treatment (NHS England, 2014). Equipping people with knowledge about their own condition means they experience better quality care and improved wellbeing and ensures that the healthcare system makes better use of resources (NHS England, 2017).

3. Methodology

3.1 Study design

This study was designed and conducted by a clinician-led team, with academic research support from the School of Medicine, University of Liverpool and the Centre for Health Economics and Medicines Evaluation, Bangor University. Additionally, advice and support were received from the Research Design Service North West. The study was conducted in the critical care unit at Wirral University Teaching Hospital (WUTH) NHS Foundation Trust.

Ethics approval was granted by the NHS Health Research Authority (HRA) and the WUTH Research Department.

The study had a three phase design (Figure 1).
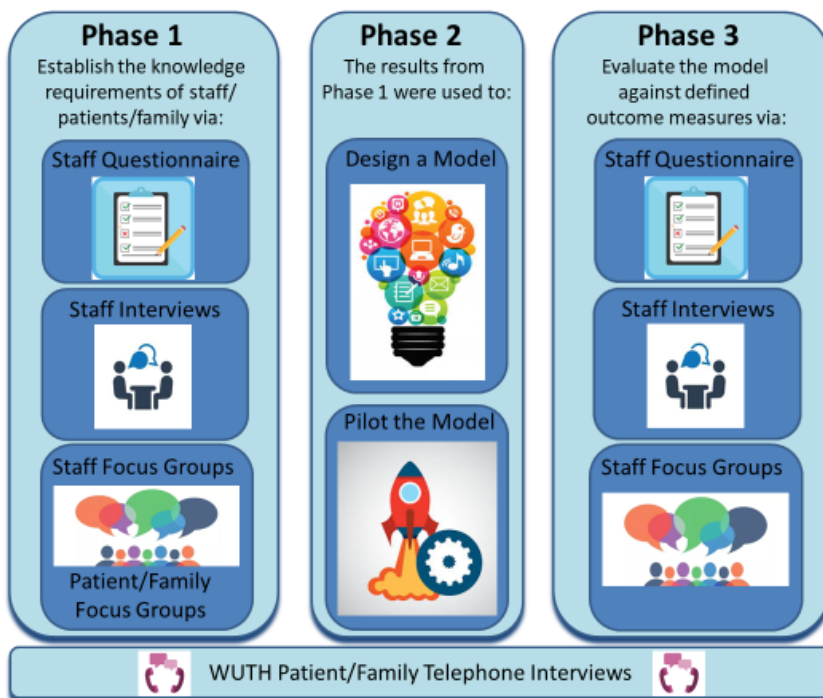
Figure 1: The phases of the study

- Phase 1: Identify the knowledge requirements of critical care staff, patients and their family members
- Phase 2: Design and implement a knowledge mobilisation model for a critical care environment
- Phase 3: Evaluate the knowledge mobilisation model and estimate the ROI of implementing the model

3.2 Participant groups

The study had two participant groups:

Participant group 1 - Critical care staff: Clinically-trained staff working in the critical care unit at Wirral University Teaching Hospital (WUTH) NHS Foundation Trust. Staffing levels fluctuated throughout the study period, but when

recruitment began there were approximately 12 consultants, 20 doctors and 100 nurses (132 in total) working in the critical care unit.

Participant group 2 - Critical care patients and family members: Adults who had been admitted, or who had a family member admitted to the critical care unit at Wirral University Teaching Hospital (WUTH) NHS Foundation Trust. Patients and their family members were excluded from the study if they met the following criteria:
- Were deemed by staff to be not appropriate to participate, for example, were experiencing delirium
- Had dementia or other neurological disorders
- Had expected adverse outcomes
- Were subsequently re-admitted to the hospital (established during phone contact)
- In total, 25 patients and 20 family members were recruited for the qualitative aspect of the study (interviews and focus groups).

3.3 Measures

In phase 3 the knowledge mobilisation model was evaluated against a series of measures derived from Brettle et al (2016) and the Knowledge for Healthcare Value and Impact Toolkit (Health Education England).

Outcome measures were:
- Updating knowledge and skills
- Service development/delivery
- Improved quality of care
- Advice to patient/carer
- Improved patient care experience
- Increased patient involvement/shared decision making
- Improved access to patient information
- Cost savings and return on investment

3.4 Analysis

All individual interviews and focus groups were recorded using a digital recorder, which was transcribed verbatim by the study researcher in preparation of thematic analysis. To provide anonymity all participants were given a randomised study number known only to the researcher, with other identifying information, (for example names) being redacted from the transcripts.

Thematic analysis was used to identify and describe ideas emerging from the data. The process of coding was undertaken in 6 phases as outlined by Braun and Clarke (2006):
I. *Data familiarisation*; is achieved by reading and re-reading the transcripts.
II. *Creating initial codes*; simply put a code is when a complete thought has been identified as containing information about a particular topic. It is a way of organising the data you have collected into the relevant points. The 'code' is the topic the thought relates to. For example "I didn't know we had a library" includes information about knowledge about the library as well as library user information. A code does not have to come from a complete sentence, it can be part of a sentence as well. Each complete thought from the transcripts is given a 'code' based upon the topic contained within that thought.

III. *Identifying themes within codes*; the analysis will now consist of a large amount of codes. The codes are then organised together into themes. Themes essentially contain many codes which relate to a similar subject.

IV. *Reviewing themes*; the themes are then reviewed and reorganised. Some themes are removed as they don't have enough supporting evidence. Other themes are joined together as the information they contain is very similar. Each theme should be distinct.

V. *Defining themes*; themes are then organised into a broader story and how they relate to each other. Often larger themes will include smaller themes (called subthemes) to ensure that themes reflect how diverse information can be related to each other.

VI. *Writing a final report*; to provide the information is an accessible and informative way for others.

The coding of the data was undertaken by the project research associates and with support and verification of interpretation from the project management team.

The data captured in staff questionnaires from study phases one and three provided ordinal data which was used for frequency analyses. Respondent total varied across questions as some staff chose to omit answering some questions.

The data from telephone interviews provided both ordinal data and qualitative data. This data was reviewed and interpreted in line with the focus group data to investigate similarities or differences within group (patients discharged over the duration of the research study) and between group (between the patients/family in the nationwide focus groups).

4. Phase 1: Identifying knowledge requirements

Phase 1 identified the knowledge requirements of critical care staff, patients and family members using quantitative (questionnaires) and qualitative (interviews) methods.

4.1 Data collection methods for critical care staff

4.1.1 Questionnaire

Questionnaires (Appendix 1) were used in phase 1 to capture the views of critical care staff.

Staff members were asked to indicate their agreement, using a Likert scale, with a series of statements on the ways that knowledge was discovered, discussed and applied in the critical care department. Respondents were given the option to leave contact information to indicate that they wished to participate in interviews. Questionnaire data was entered for analysis and participants were given randomised numbers. The details of respondents were kept separately and only known to the researcher, thus anonymity of responses was maintained.

Recruitment was conducted by the researcher (SK) on the critical care unit using posters, information displayed in staff areas, requests at meetings and training days, direct requests from the researcher during working hours or by voluntarily completing form made available in the staff room. A participant information sheet was provided (Appendix 3) and consent implied by completion of the questionnaire.

4.1.2 Interviews and focus groups

Interview data was captured to triangulate and provide greater depth to the data gathered from questionnaires. Some staff members may have participated in both the questionnaire and interview, though numbers are unknown due to the anonymity of questionnaires. Recruitment was conducted by the researcher (SK) on the critical care unit using posters, information displayed in staff areas, requests at meetings and training days, direct requests from the researcher during working hours. A participant information sheet (Appendix 3) was provided and consent was obtained (Appendix 4). All interviews were conducted in the hospital. Interviews were semi-structured with 10 prompt questions (Appendix 2). Consideration was made that all staff groups (doctors, nurses and allied health professionals) were represented. Data collection ended once saturation of themes from staff interviews was reached.

The questionnaire and interview and focus group schedule were designed to guide the development of a knowledge mobilisation model, including the activities requiring library support, the format and method of support delivery and the perceptions of library and knowledge support.

Data was collected from 98 members of critical care staff (75% of all staff in the critical care department):
- 63 completed questionnaires (collected between March to May 2016): 46 nurses, 15 doctors, 2 Allied Health Professionals
- 15 staff individual interviews (conducted between April to July 2016): 10 nurses, 4 doctors, 1 pharmacist;
- 20 participants (18 nurses, 2 consultants) took part in 4 staff group interviews (between May to June 2016)

4.2 Data collection methods for patients and family

4.2.1 Interviews and focus groups

Patients and family members were recruited by the research team in the critical care unit during their critical care stay and participated in an individual or focus group following discharge. Additional participants (n=4) were recruited via ICUSteps, a critical care charity; an advert was placed on the ICUSteps research participation database.

The interview schedule (Appendix 6) was designed to establish the knowledge requirements of the patient and family member during a stay in critical care, including type of support, format and timing. While this data did not inform the knowledge mobilisation model directly, it provided context for the research team. All participants received the participant information sheet (Appendix 5) and signed the informed consent form (Appendix 4) prior to being interviewed.

Patient and family member focus group

Data was collected from 45 patients and family members in total.
- 20 participants from 2 focus group (conducted in November 2016) consisting of patients (n=10) and family members (n=10)
- 25 interviews (conducted between October 2016 and February 2018), consisting of patients (n=15) and family members (n=10)

4.3 Findings

Data obtained in phase 1 established the knowledge requirements of critical care staff, patients and family members. Questionnaire responses and themes identified in interviews and focus groups were triangulated to ensure the validity

of the responses. Interviews were audio- recorded, transcribed, and analysed thematically (Braun & Clarke, 2006). The research team used thematic analysis (Braun and Clarke, 2006).

4.3.1 The knowledge requirements of critical care staff

Critical care staff required knowledge to be:
- Available to support all aspects of care;
- Visible and accessible to everyone;
- Available through multiple channels, both face-to-face and online;
- Discussed and shared between colleagues.

4.3.2 Knowledge support was required for all aspects of care

This finding was identified in phase 1 questionnaire data. Staff expressed a clear desire for knowledge to support all aspects of care, from making clinical decisions to discussions with the patient. Over 90% of staff agreed that having access to knowledge improved their decision-making and improved their communication with patients and family.

More broadly, knowledge was also required by staff to support long-term service delivery; 95% agreed that they required support for service developments.

Interview data reinforced the need for staff to feel well-informed, particularly when communicating with patients:

> *"It's good for the families to hear us explaining things and you can say, it's been shown scientifically that if we do this... it's going to be for their benefit. As long as you know what the most current things are."* (Nurse)

4.3.3 Knowledge support needs to be visible, accessible and available to everyone

Staff wanted knowledge to be easy to find, easy to understand and easy to share. Despite a desire and willingness to discover new knowledge, often lack of time, pressure on resources and limited experience in knowledge-seeking were factors that prevented this.

Over half of staff members (54%) agreed that evidence-based practice was currently supported by the library service. However, it was clear that there was an opportunity to raise awareness about the range of services provided:

> *"Yeah you see I don't know the complete thing about what the library service does. I know what it does…the books, but there's a lot of other things they do don't they?"* (Nurse)

As is common in many NHS Trusts, the library was situated in a separate building in the hospital, which was considered a barrier:

"…and it's physically going over [to the library], because we just don't…if you've got twenty minutes…you're not going to do that." (Nurse)

Some staff also expressed anxiety about approaching the library service for support, and felt inexperienced in finding and sharing knowledge:

"…you're frightened to go to the library…Because you think 'oh no they're going to think I'm silly and I can't do things and I should be doing that.'" (Nurse)

Staff needed knowledge to enhance all aspects of the care they provided to patients and it needed to be easy for them to do this within the limitations of time and resources.

4.3.4 Knowledge should be available through multiple channels

Critical care staff work shifts that span all 24 hours of the day, and had individual preferences for accessing knowledge. A large majority of staff (95%) wanted knowledge support to be provided in person. However, many also searched online to find up-to-date knowledge to support their work. Many used online search engines such as Google as a starting point, and some nurses used the Cheshire and Mersey Adult Critical Care Network website (www.cmccn.nhs.uk) that provided up-to-date guidelines and other procedural-related information. Some methods of communication to reach all members of staff were already established, including noticeboards, department-wide emails and groups on social media such as Facebook and What's App. Using multiple communication channels across the team of 132 staff presented the best opportunity to disseminate knowledge.

Interview data reinforced the need for knowledge to be provided through multiple channels and in different formats:

"If we could have the librarian on the unit for a couple of hours…go round each patient research what they've got, stick it in their notes or you know ask the nurses what do they want, or the doctors or the pharmacists." (Nurse)

"I prefer to initially do it myself, so going looking on the internet if I can't find it then I'll go and speak to someone who's more expert in that area." (Consultant)

4.3.5 Discussing and sharing knowledge with colleagues was desired

The evidence-base in critical care is complex and often conflicting. Staff relied heavily on the experience of their colleagues to inform decision-making and welcomed opportunities to discuss patients' conditions and treatment with each other. Interpersonal relationships between staff were highly valued and were used as a vehicle to exchange knowledge. Staff welcomed the opportunity for peer-to-peer learning and discussions; most wanted knowledge support to be provided in person (95%) and in education sessions (85%). Peer-to-peer learning was embedded in existing ways of working; nurses shared both verbal and written information with each other, often at the patient bedside.

Consultants and allied health professionals gained information from colleagues in other specialities, particularly when dealing with difficult cases:

> "*I think you can get an awful lot of information talking to colleagues or you know, both within your own specialty or other specialties and that's done in the workplace, that's face-to-face, that may be in a formal MDT [multidisciplinary team], it may be while you're doing a theatre list and you talk to your surgeon and you talk about a case".* (Consultant)

Knowledge was most likely to be shared across staff groups during the daily ward rounds, though some felt this was not the best opportunity for learning, given the urgency of patient care. Lack of time and resources meant that many nurses relied on peers (senior nurses and nurse educators) to cascade knowledge to them.

In order to meet these needs and nurture a culture of evidence based practice, a model of knowledge mobilisation would need to support all aspects of care; be flexible, visible and easily accessible to staff; provide opportunities for peer-to-peer learning complemented by online sources of knowledge; raise awareness of the support available from the clinical librarian, and be supportive of staff with limited experience of knowledge-seeking.

4.3.6   The knowledge requirements of critical care patients and their families

Critical care patients and their families wanted knowledge about their condition and treatment that was:
- Primarily delivered via the bedside nurse;
- Repeated and reinforced at appropriate milestones of care;
- In multiple formats (both verbal and paper);
- Complemented by their own knowledge in the form of photographs or diaries.

4.3.7   The bedside nurse was the main source of knowledge

The nurse's role in providing daily updates on patient prognosis and goals, as well as offering comfort, was highly valued by the patient and family. The constant presence of the bedside nurse offered reassurance; several patients described the bedside nurse as a 'friend':

> "*...they're with you for twelve hours, aren't they? So I kind of was chatting to them about them and me, you know so you do strike up a bit of a...in inverted commas 'a friendship' with them...They've got time to speak to you about those sorts of things because they're there.*" (Patient)

Patients and family members expressed a huge degree of trust in the knowledge imparted by nurses and doctors. This level of trust was evident in the view that in emergency situations patients and family members did not feel they needed to be involved in decision-making. All patients and family members were happy to defer to the expertise of the staff to ensure that the best possible care was given:

"I was just in their hands and just totally trusted that it was going to be the right decision whatever they did, for whatever it was… Actually I just want to say 'well you're the doctor…you decide.'" (Patient)

The bedside nurse was viewed as being approachable, reassuring, knowledgeable and trustworthy, and their close presence meant that they became a preferred source of knowledge for the patient and family.

4.3.8 Knowledge needs to be repeated and reinforced at appropriate milestones of care

Patients and family members often experienced barriers to communication while in critical care, related to their condition and the environment. Delirium, hearing loss and general confusion meant that many patients needed information to be repeated:

"I needed it repeating again and again. Yeah, maybe at the beginning and again and then maybe on the discharge, a nice big letter. I needed it again and again." (Patient)

Severe disturbances such as hallucinations and nightmares affected the ability to retain and recall knowledge. Family members felt anxious and were keen for their understanding of their relative's condition to be repeated and reinforced by staff.

Both patients and family members felt it was important to receive information at the right time, when approaching milestones in the care of the patient:

"You want to know immediately. What the immediate plan is. You know over the next day or so, and then depending on what happens to that plan, you want to know what their next plan is. You want information immediately about what the initial plan is." (Patient)

Two milestones were identified: firstly, when the patient was moved from critical care to a ward and, secondly, when the patient returned home from the hospital. When being discharged from hospital, many felt reassured by the discharge leaflet that provided additional information about the follow-up clinic and after-care:

"… when you come out ' this might happen, this might happen' so actually, although I thought 'I don't really want to read it all and know what might happen' it was quite nice for example when my hair started falling out three months later, I looked in the book and it said 'this might happen' and I thought 'ahh ok that's what it's going to be, I'm not going to panic about it', because that's one of the things that can happen. So that was a brilliant piece of information." (Patient)

The delivery and timing of knowledge was important to the patient and the family; having the right knowledge to hand at the right time reduced any additional anxiety or confusion.

4.3.9 Knowledge was preferred in multiple formats

Patients and families had individual preferences for the format of knowledge. Knowledge that was obtained at milestones of care (e.g. discharge from the hospital) was preferred in paper format, with a preference for day-to-day knowledge-sharing with staff to be verbal:

> *"I think to start giving people pieces of paper. I think it sort of almost says 'we can't be bothered talking to you, read that'…Definitely. Human face to face for information. I don't really think you want to be given bits of paper."* (Patient)

Many expressed a need to retain paper-based knowledge as a memory prompt and to be able to refer back to it when they were more able to absorb the information:

> *"Being in a coma you don't remember anything, and then the meningitis took my memory, took my hearing…all those things added up to not remembering yesterday. To have a paper copy of your information every time, would have been handy."* (Patient)

One patient carried the discharge documents with them whenever they left the house, as they were worried that their condition could recur:

> *"…so I kind of took those [discharge papers] everywhere with me, when I went anywhere in case we were out for the day, and I just thought 'ooh if I feel ill I've got my paper with me and I can then say this is what happened to me'…I then went back in and out a few time afterwards …and got more discharge papers…"* (Patient)

During their stay in critical care, the personal nature of verbal exchanges was appreciated, while paper-based sources of knowledge served an important purpose as a record of the patient's illness. Many felt that it was important to keep this documentation for future reference or recollection.

4.3.10 The patient and family as a source of knowledge

During their stay in critical care, several patients and family members created new knowledge by taking photographs or keeping diaries. Nursing staff encouraged the use of diaries and many also wrote in them. Both patients and family members felt that documenting the experience of critical care was of great importance for two reasons. Firstly, it allowed family members and staff to keep up-to-date with the patient's progress. Secondly, looking back at photographs and diaries supported recovery from critical illness:

> *"After the event, there were three weeks of my life that were totalling missing and I needed to put it together again, both in a technical way as a nurse would do and in a personal way. So the nurse's side would have been brilliant for me…I got all my notes, but they're very technical."* (Patient)

This new knowledge created by the patient or family member became an alternative and complementary record to the often impersonal medical notes, and was captured by family members as a way of telling the story of the experience of their loved one:

"I think it's right with the diaries, when you've got your medical notes it's all medical lingo, but with the diaries it's more of a personal so 'oh you sat up today xx' or 'better today'." (Patient)

The findings of phase 1 of the study demonstrated that the role of the bedside nurse is pivotal in ensuring that that knowledge requirements of the patient and family are met. A combination of verbal and paper-based knowledge was preferred, repeated frequently and ideally provided at specific milestones. A desire to document the significance of the critical care experience was expressed, and this was done by creating new knowledge in the form of diaries and photographs, tailored to the preferences of the individual patient.

5. Phase 2: Design and implementation of a knowledge mobilisation model

In phase 2 a model of knowledge mobilisation was designed and implemented following findings from phase 1.

5.1 Designing the model

In phase 1, findings from questionnaires, interviews and focus groups with critical care staff highlighted that staff required knowledge to be:

- Available to support all aspects of care
- Visible and accessible to everyone
- Available through multiple channels, both face-to-face and online
- Discussed and shared between colleagues to encourage a culture of evidence based practice.

Staff found seeking and applying knowledge to be challenging for many reasons including lack of time, pressure on resources and limited experience of knowledge-seeking, therefore the model was designed to be as flexible as possible in response. Phase 1 findings also demonstrated that the model needed to raise awareness of the range of ways that the clinical librarian could provide support. To do this it was necessary for the clinical librarian to work alongside staff, develop personal relationships with them and demonstrate the value of having a clinical librarian in the team in an informal and approachable way. These findings informed the design and development of a knowledge and mobilisation model that is outlined further in this section.

5.2 Implementing the model

The knowledge mobilisation model was implemented for a 15 month period between September 2016 and December 2017. Delivery of the model was led by the clinical librarian with support from the wider library team.

15 hours per week of clinical librarian time was dedicated to delivering the model. The time was split into 4 x 3.75 hour sessions across different days and times of the week to enable contact with as many staff members as possible. No desk space in the critical care department was available, so the clinical librarian worked in the critical care unit itself, working at the nurses station, and participated in ward-based activities, such as ward round, when required. A laptop and iPad were available to the clinical librarian to facilitate access to online resources and email. In addition to being present on the critical care unit, the clinical librarian attended departmental team meetings, case-based discussions, educational activities (e.g. Journal Club) and was integrated into inductions for new staff (both nurses and junior doctors).

A bright yellow polo t-shirt was worn by the clinical librarian to identify job title and enhance visibility in the department. Library-branded pens were distributed by the clinical librarian to promote the service.
The model comprised of a range of activities selected based on the data collected in phase 1 as well as practical considerations, such as resource availability and working hours.

At the outset of the 15 month period, the model consisted of the following activities:

Pop-up Library: Specific, advertised days and hours each week when the clinical librarian was physically present in critical care, talking with staff, answering questions and offering knowledge-related support. Data collected in phase 1

identified that staff lacked time and resources to access knowledge support, so care was taken to ensure that the clinical librarian was visible and accessible in the unit. The clinical librarian made time to get to know the staff, joining them in the break room and at the bedside, to build a trusting relationship with staff.

Book box: A small collection of relevant book titles selected by the clinical librarian for staff to read, kept in a departmental office. This overcame the physical barriers of attending the library. As the titles were handpicked for the staff, it ensured that the information was relevant to the staff needs encouraging information seeking.

Academic study support: Scheduled, advertised training sessions on topics including academic writing, information searching skills, critical appraisal skills, referencing and proofreading were provided. These sessions were primarily aimed at nursing staff undertaking academic study, and were designed to nurture confidence levels and encourage knowledge-seeking behaviour.

Evidence searching support: A systematic and thorough review of the evidence was undertaken by the clinical librarian on topics requested by critical care staff. This service, although previously available from the library service, was delivered in the critical care environment, with search questions being picked up during ward rounds, at the bedside, at departmental meetings and during conversations with staff. This embedded approach to evidence support was designed to save staff time, overcome resource limitations and encourage an evidence-based culture across all staff groups in the department.

Noticeboard: A dedicated noticeboard in the critical care corridor was obtained to display details of upcoming training sessions, advertised pop-up library times, and provided paper-based copies of material available online, such as journal articles. A photograph of the clinical librarian and contact details were clearly displayed. The content of the noticeboard was designed to be accessible and inclusive to all staff groups, particularly those who lacked confidence in assessing online sources of knowledge, and those who worked night shifts and wouldn't necessarily meet the clinical librarian on the unit.

Journal club support: A consultant-led departmental journal club was held each month, in which junior doctors would take it in turn to present and discuss a recently published research paper. To enhance the existing format, library support was offered to presenters in identifying, appraising and presenting suitable studies. This activity was traditionally an educational opportunity for doctors, despite an open invitation to all staff. The clinical librarian encouraged nurses to attend and present, advertised journal club in advance, and following journal club shared copies of the research paper discussed.

Online journal club: Phase 1 findings identified that many members of staff wanted more opportunities for discussions with colleagues. Many were unable to attend departmental activities, so it was hoped that a virtual journal club, hosted on the Facebook group, would complement the existing face to face journal club. A research paper was selected by the clinical librarian with input and suggestions from staff, who were invited to read the paper and contribute to the online discussion at a time convenient to them.

Facebook group: In response to the desire expressed in phase 1 findings for peer-to-peer learning opportunities, a private, online forum moderated by the clinical librarian was created. The purpose of this group was to share knowledge and learning between colleagues, across all staff groups. By the end of phase 2 the group had over 50 members. Facebook was chosen as the preferred platform as many staff were already using a similar Facebook group to arrange shift swaps and organise social events.

5.3 Refining the model

The knowledge mobilisation model was refined over a 15-month period in response to observations by the clinical librarian and informal suggestions from critical care staff. Most activities were continued, a number were added, some were adapted and some were removed from the model.

Questions of the month: Following discussions with the journal club lead that journal club offered an opportunity for wider discussions around evidence based practice, 'Questions of the month' was introduced in month 3 of the model. 'Questions of the month' - one-page, quick reference evidence summaries - were presented by the clinical librarian at journal club to prompt a wider discussion. Topics related to patients or conditions recently observed in the critical care unit were selected, such as *Management of bronchopleural fistula* and *Immunotherapy in critical care,* so that they were directly relevant to clinical practice.

Newsletters: Requests from senior nurses and doctors led to the clinical librarian coordinating and publishing a monthly, critical care newsletter from month 2 of the model containing news, events and features from critical care staff. This led to additional requests from consultants for support with reformatting clinical governance updates into a "Learning Lessons" newsletter.

Critical Care Evidence Bite: The role of charcoal in drug poisoning — May 2018

Activated charcoal is the most frequently employed method of gastrointestinal decontamination in the developed world. Typically administered as a single dose, its tremendous surface area permits the binding of many drugs and toxins in the gastrointestinal lumen, reducing their systemic absorption[1].

Single dose activated charcoal (SDAC)
AC is most likely to benefit patients when administered while toxin remains in the stomach. Traditionally, this period is thought to be within one hour of poison ingestion, but the potential for benefit when administered later cannot be excluded[2].

The majority of data supporting the efficacy of activated charcoal come from in vitro and animal data or volunteer trials. Randomized controlled trials of poisoned patients treated with activated charcoal have failed to demonstrate a consistent impact on clinically important outcomes[2].

Multiple-dose activated charcoal (MDAC)
In some instances, patients may benefit from the repeated administration of activated charcoal (MDAC). MDAC may be helpful in life-threatening ingestions of the following medications, but evidence is limited and opinions among toxicologists vary: Carbamazepine, Dapsone, Phenobarbital, Quinine, Theophylline, Acetylsalicylic acid (aspirin), Phenytoin[2].

Volunteer and animal data suggest that MDAC increases elimination of several toxins (eg, amitriptyline, digoxin, disopyramide, nadolol, piroxicam), but clinical data are currently insufficient to support the routine use of MDAC in these exposures[2].

Hemoperfusion
Hemoperfusion refers to the circulation of blood through an extracorporeal circuit containing an adsorbent such as activated charcoal or polystyrene resin. In contrast to HD circuits, hemoperfusion devices contain thin, highly porous membranes and adsorbents that provide a large surface area to directly bind toxins[3].

Drugs adsorbed by activated charcoal can be extracted by hemoperfusion, and the rate of removal may exceed that achieved with hemodialysis[3].

High extraction ratios and clearance rates, however, do not necessarily predict improved clinical outcomes. No controlled clinical studies in poisoned patients have been performed to determine if hemoperfusion reduces morbidity or mortality as compared with supportive measures[3].

More reading
1. Activated charcoal for acute overdose: a reappraisal. British Journal of Clinical Pharmacology. 2016 Mar; 81(3): 482–487.
2. UpToDate, Gastrointestinal decontamination of the poisoned patient (OpenAthens login required off site; app also available)
3. UpToDate, Enhanced elimination of poisons (OpenAthens login required off site; app also available)

For more details or to request an electronic copy of the below, or if you'd like an Evidence Bite on another topic, please contact the Library & Knowledge Service at wuth.lks@nhs.net or ext. 8610.

Facebook Messenger: Due to the clinical librarian's presence on Facebook and visibility in posting to the Facebook group, critical care staff began using Facebook Messenger to ask questions and make requests. It was an easy and convenient way for clinical care staff to contact the clinical librarian, in particular for those who worked night shifts. Interestingly this method of communication was not advertised by the clinical librarian and was initiated by critical care staff, predominantly nurses.

Evidence Bites: One-page summaries of the evidence on specific topics, called 'Evidence Bites', were produced by the clinical librarian from month 10 of the model following observations that staff would prefer a shorter, more accessible summary of the evidence. Evidence Bites highlighted key messages in a digestible and accessible format and were disseminated to staff in paper and electronic formats.

One-to-one training: Regular, scheduled training sessions on evidence searching, critical appraisal and academic writing were offered to staff from the outset of the model being implemented.

Once those staff who were interested had attended, demand for scheduled sessions dwindled, so from month 4 training was offered on an individual and ad hoc basis.

Pop Up Library: Pop Up Library scheduled sessions ceased after month 4 as demand for support spread across the whole working week.

6. Phase 3: Evaluating the model and measuring return on investment

6.1 Data collection methods

6.1.1 Questionnaires

In phase 3, critical care staff were asked to complete questionnaires and interviews to evaluate the knowledge mobilisation model and explore the potential ROI.

A questionnaire that evaluated the knowledge mobilisation model collected data from all critical care staff (Appendix 7). Staff members were asked to indicate their agreement, using a Likert scale, with a series of statements on the impact of the model. Respondents were given the option to leave contact information to indicate that they wished to participate in interviews. Questionnaire data was entered for analysis and participants were given randomised numbers. The details of respondents were kept separately and only known to the researcher, thus anonymity of responses was maintained. Recruitment was conducted by the researcher (SK) on the critical care unit using posters, information displayed in staff areas, requests at meetings and training days, direct requests from the researcher during working hours or by voluntarily completing form made available in the staff room. A participant information sheet (Appendix 3) was provided and consent implied by completion of the questionnaire.

Interview data was captured to triangulate and provide greater depth to the data gathered from questionnaires. Some staff members may have participated in both the questionnaire and interview, though numbers are unknown due to the anonymity of questionnaires. Recruitment for interviews was conducted by the researcher (SK) on the critical care unit using posters, information displayed in staff areas, requests at meetings and training days, direct requests from the researcher during working hours. A participant information sheet (Appendix 3) was provided and consent was obtained (Appendix 4). All interviews were conducted in the hospital. Interviews were semi-structured with 10 prompt questions (Appendix 8). Interviews were audio-recorded, transcribed, and analysed using thematic analysis (Braun & Clarke, 2006).

Questionnaire data was collected from 36 respondents (27 nurses; 5 doctors; 4 allied health professionals). Data from questionnaires were triangulated with data from 14 staff interviews (12 nurses, 2 consultants) and 2 focus groups (8 nurses). An additional 24 interviews with staff who had used the knowledge mobilisation model were undertaken for the ROI analysis (see section Return on Investment analysis).

6.2 Most used activities

Findings from phase 3 questionnaires indicated that the activities that were most used by critical care staff were the noticeboard, journal club, the newsletter(s) and Pop Up Library [Table 1].

Activity	Staff used (%)

Noticeboard	59
Journal Club	43
Newsletter(s)	43
Pop-up Library	37
Facebook group	34
At the library	34
Evidence searching support	27
Academic study support	26
Questions of the month	23
Online journal club	20
Book box	17

Table 1. Usage of activities from the knowledge mobilisation model

Noticeboard: The noticeboard was the most utilised aspect of the model, used by 59% of respondents. Following a request from a member of staff during consultation, a noticeboard outside the staff break room was adopted and used to promote library support. The noticeboard enabled a low cost, low tech communication channel with staff that was accessible to all staff and visible in an area of the department with good footfall.

Journal club: Journal club was the second most used activity (43% of respondents). During phase 1 data collection it became apparent that there was a misunderstanding between staff regarding who could attend journal club. The research team took great care to publicise the meetings to all staff and encourage attendance. By the end of the study, although attendance at journal club was still predominantly by doctors, more nurses were attending and participating:

> *"…the journal club…it has been publicised a little bit better… it's good to see that nurses are getting more involved and that they are getting invited into them. And that's been helpful."* (Nurse)

Newsletters: Following requests from staff, a 'Lessons Learned' newsletter and a staff newsletter were developed and disseminated across the department. The 'Lessons Learned' newsletter highlighted learning from safety incidents while the staff newsletter shared news around new staff, staff achievements and current projects. Newsletters were one of

the most used aspects of the model (43%) and both were developed in partnership with senior critical care staff including matron and consultants. Newsletters were shared on the staff noticeboard, in the break room and via the Facebook group.

Pop Up Library: The Pop Up Library was used by 37% of respondents, was developed in response to data from phase 1 which identified several barriers that were faced by critical care staff in accessing knowledge, including time and resources. It meant the clinical librarian was embedded in the daily workings of the critical care department. Interview data illustrated that the Pop Up Library made the biggest impact on staff; when interviewed, many discussed using library services simply due to the on-unit presence of the librarian:

Other activities: Support for academic study was received by several of the interviewees who reported that it supported their studies and improved their confidence:

> *"Like I say I think it is good for …especially staff you know who are doing a course and haven't done one for a while. I think it takes some of that anxiety away…"* (Nurse)

Evidence search support was provided to staff for a variety of purposes: to support academic pursuits, to expand knowledge on a clinical topic, to support departmental activities such as the newsletter, or to help improve services.

The Facebook group and online journal club were discussed interchangeably in staff interviews. Most staff members discussed a wider impact that had been felt offline. Several staff described how discussions occurring in the Facebook group led to increased peer-to-peer knowledge-sharing offline. There appeared to still be issues surrounding a lack of confidence in the staff, which impacted their willingness to post within these groups:

> *"It was reaching more people than it looked like it was, because everyone feels a bit like 'oooh' (mimics hiding)."* (Nurse)

> *"…she started to do a Facebook group and that was the biggest thing that I found helped. Critical care have got their own group and she would put articles on of interest. And that was what was very good about things. And then it caused discussions. So I found that very good…Yeah there was a lot on the ward, but there was a couple of things that was brought up…but anyway it caused people to start talking about things."* (Nurse)

By the end of the study, there had been a shift to a greater awareness amongst staff about the availability of the physical library space in the hospital; only 11% of respondents were unaware of the support available from the library at the end of phase 3. The presence of the Pop Up Library may explain these findings; simply put, staff no longer had to go to the library, the library came to them:

> *"I can speak for me and say that I asked (librarian), whilst she was actually on the unit, for research… So, she was able to get me all the research, all the latest research, without me having to go trawling out, she was just there, immediately, on-site. So if found that actually very, very useful. So she was able to give me a list of all the latest research."* (Nurse)

The activities most used by staff - noticeboard, journal club, newsletters and Pop Up Library - were low-tech approaches to mobilising knowledge, reflecting a culture where staff were more confident and willing to share knowledge face-to-face than online. The most-used activities share some interesting characteristics: they were integrated into existing

initiatives in the department, and required minimal behaviour change by staff. Journal club and newsletters were activities that were developed alongside members of staff, often senior and influential individuals; this undoubtedly encouraged usage. Journal club and Pop Up Library are highly relational activities that involve face-to-face discussion between colleagues. Knowledge was more readily and successfully exchanged from peer-to-peer rather than by department-wide initiatives, highlighting the importance of individual relationships and trust between colleagues. This helps us to uncover why these aspects of the model were most successful: those activities which reflected existing culture and behaviour, those that were merged with existing departmental activities, and those that were championed by key influencers in the department.

6.3 Findings of the evaluation

Findings demonstrated that the knowledge mobilisation model:
- supported staff learning and education;
- improved the quality of care;
- nurtured an evidence-based culture;
- generated a positive financial value.

6.3.1 The model supported staff learning and education

Critical care is a unique specialty and requires staff to be highly trained. The knowledge mobilisation model supported learning and education across all staff groups; from discussions about the evidence base in journal club to nurses pursuing academic qualifications. Phase 3 questionnaire data illustrated that 59% of staff agreed that the model supported the delivery of education / training and 37% reported that their knowledge and skills had been updated as a result of the model.

Since the clinical librarian was embedded in the team there was a reduced need for staff to leave their workplace to access study support.

Critical care staff were required to demonstrate their continuing professional development and comply with a range of standards from regulatory and professional bodies, including the General Medical Council (GMC) and the Nursing and Midwifery Council (NMC). 47% of respondents agreed that the knowledge mobilisation model enabled them to comply with regulatory and professional standards.

All staff were expected to continue learning during their career in critical care, often this meant pursuing an academic qualification. For nurses in particular this move into academia was a source of uncertainty and anxiety. The responsive presence of the clinical librarian ensured that many of these nurses were supported to achieve their qualification.

The embedded nature of the clinical librarian role meant that this support was provided alongside day-to-day working, sometimes at the bedside. The clinical librarian was also invited to multi-disciplinary team meetings and journal club where knowledge-related discussions could be encouraged.

6.3.2 The model improved the quality of care

Over half of respondents (52%) agreed that the model supported the quality of care. The clinical librarian was approached to support individual instances of patient care, particularly by nursing staff:

> *"We had a Jehovah's Witness patient, do you remember? And there were aspects of her care and about blood, and taking arterial blood gasses and we involved (librarian) in that…I think then we were able to get further information then, which then prompted us to get one of the Jehovah's witness family in, and we had a talk with the Jehovah's Witnesses. So I'm sure one of the staff would have asked her about that. And we were given handouts and stuff so that we can read."* (Nurse)

Critical care is a fast-paced specialty in which treatments and guidance can frequently change; the evidence base can be conflicting and decisions about patient care are complex. The model encouraged discussions about the evidence base between colleagues:

> *"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."* (Junior doctor)

Staff reported that the knowledge mobilisation model helped them to follow clinical guidelines (54%), meet quality standards (49%) and revise care pathways (47%), thus supporting staff to navigate the complexities of decision-making:

> *"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)

When faced with pressures on their time and resources, critical care staff were able to utilise the skills of the clinical librarian in providing the evidence to support the development of guidelines and care pathways:

> *"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."* (Junior doctor)

6.3.3 The model nurtured an evidence-based culture

As well as supporting educational activities such as journal club, the model had an indirect impact on a wider culture of evidence-based practice. As a result of the knowledge mobilisation model there was a more inclusive atmosphere regarding meetings, with nurse attendance significantly increased and a greater openness generally amongst staff:

> *"Making sure that the emails are going out to all the nursing staff, that they're invited…There has been nurses asking me specific things 'well actually we are doing teaching on this, try to come along, on Friday'. I suppose we're trying…we're working on that if you like. I think there's going to be a cultural change in medicine over the next…you know it's already happening big time and I think it will continue to happen, so level the playing field a little bit more hopefully."* (Consultant)

With the clinical librarian working in close proximity with the critical care team, visible in the department, at meetings and known by many of the staff, the role acted as a prompt for discussions about learning, invited questions to be asked, and facilitated discussions about the evidence base both face-to-face and online:

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

6.4 Return on Investment (ROI) analysis

Return on investment (ROI) is a type of cost-benefit analysis in which intervention costs are compared with total monetised benefits. Few studies have evaluated the ROI of clinical librarians in hospital settings and there appears to be no evidence of a standardised or validated tool for assessing ROI (Madden et al., 2016). In these few studies, outcomes were often chosen on an ad hoc basis depending on whether the outcomes could be measured and monetised.

ROI was estimated from quantitative and qualitative data collected from a purposive sample of critical care staff who utilised the knowledge mobilisation model during the study period. Participants were recruited by the researcher (NH) in person or by email. All staff members in the purposive sample received a participant information sheet (Appendix 6), signed a consent form (Appendix 7), completed an ROI questionnaire (Appendix 8) and participated in a short interview of up to 30 minutes (Appendix 9). Interviews were conducted one-to-one, except for a single group interview which included three junior nurses (Band 5) and two senior nurses (Band 7). Interviews were audio-recorded, transcribed, and analysed using thematic analysis (Braun & Clarke, 2006).

From the qualitative and quantitative data, 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:
1. Net benefits = total benefits – total costs
2. Benefit cost ratio = total benefits/total costs
3. ROI = [(total benefits – total costs)/total costs] x 100

The total costs of implementing the knowledge mobilisation model 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 critical care staff, and from financial information provided by administrative staff on the unit. Based on previous research studies (Weightman & Williamson, 2005) and from content analysis of interviews, the following outcome categories emerged:
1) Time savings for critical care staff
2) Professional development for nurses
3) Improved patient care

The logic model 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:
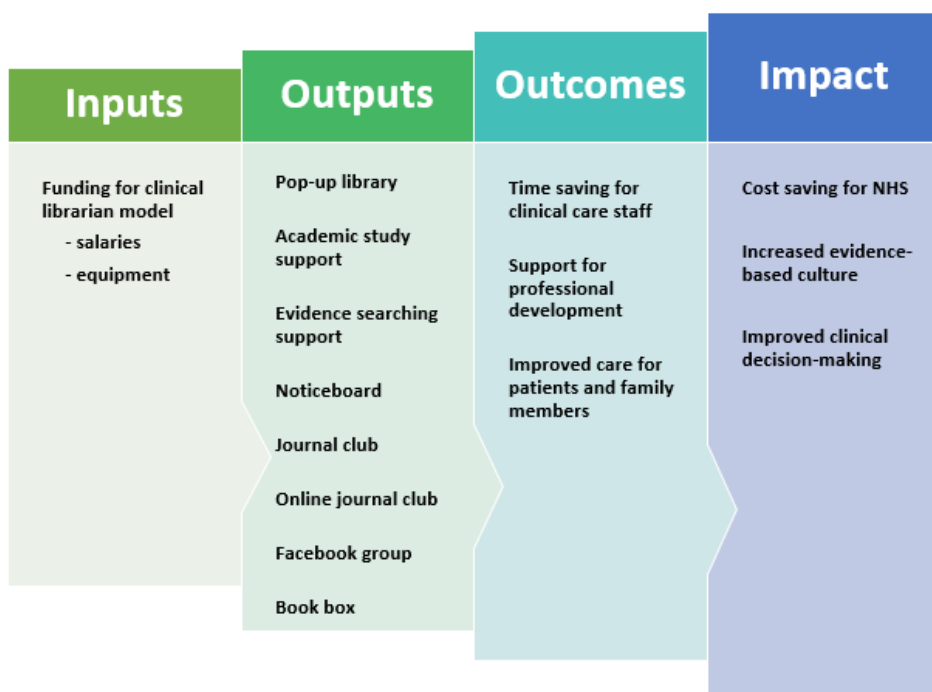
Figure 2: Knowledge mobilisation logic model

The ROI analysis compared the total costs with the total monetised benefits of implementing the model. The ROI analysis indicated that for every £1 invested in the knowledge mobilisation model, a financial value of £1.18 to £3.03 was generated in time saving, enhanced professional development and improved patient care.

6.4.1 Total costs: salary and equipment costs

Salary costs included hiring a Band 6 clinical librarian at 0.4 FTE (15 hours per week). For the 15-month intervention, total salary costs were £15,382 (Royal College of Nursing, 2017).

Total equipment costs were £2,007, including:
- Laptop and accessories (£1,389)
- iPad and case (£535)
- Audio recorder (£54)
- Bright yellow polo T-shirts (£29)

Total costs for salary and equipment were £17,389.

6.4.2 Total benefits

Total benefits of employing a clinical librarian were estimated by considering:

- Time saving for critical care nurses, junior doctors and consultants.
- Professional development for nurses enrolled in postgraduate training.

· Improved care for patients and family members.

6.4.3 Time saving to critical care staff

After the 15-month intervention, the ROI questionnaire asked critical care staff to indicate the number of hours saved per month by utilising clinical librarian services. Results showed that the clinical librarian saved 1,560 hours of critical care staff time. Most of the time saving was claimed by nursing staff (85%) and 15% reported by junior doctors and consultants (Table 2). Using median hourly rate pay scales critical care staff, the value of the total time saving was estimated at £26,312 (Royal College of Nursing, 2017; NHS Employers, 2017).

Band level (n= # of staff)	Total hours saved over 15 months	Salary per hour/per person (£)	Total value of time savings (£)
Band 5 nurses (n=8)	750	12.11[1]	9,082
Band 6 nurses (n=3)	225	14.79[1]	3,328
Band 7 nurses (n=7)	360	17.49[1]	6,296
Junior doctors (n=2)	90	18.73[2]	1,686
Consultants (n=4)	138	42.90[2]	5,920
Totals (n=24 staff)	1,560		26,312

[1] **Royal College of Nursing (2017)**

[2] **NHS Employers (2017)**

Table 2: Time saving to critical care staff

Time saving was also evident from interviews with nurses and junior doctors/consultants who utilised the model:

"I remember one particular incident, where she actually researched for me. I had a HF 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)

"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)

"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)

"It was a brilliant service, because it was so time-saving." (Nurse)

"The clinical librarian cut down on all that studying time immensely." (Nurse)

"Without the clinical librarian, we haven't got time to go and research, and there isn't someone there to ask." (Nurse)

"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)

6.4.4 Support for professional development of critical care nurses

ROI questionnaires from critical care nurses indicated that they used the model primarily for academic study and professional development.

6.4.4.1 Professional development support for junior nurses

During the study, at least 50% of critical care nurses on every unit 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.

In this study, findings from questionnaires and interviews revealed that Band 5 nurses experienced a considerable amount of support from the model in completing the mandatory Postgraduate Certificate Course in Critical Care, offered at a nearby university. The postgraduate course 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 course was required of all critical care nurses who worked for a minimum of 18 hours per week on the unit, and who cared for Level 3 patients (i.e., those requiring advanced respiratory support or monitoring for two or more organ systems). In addition, nurses were required to have a minimum of 12 months' post-registration experience in critical care before enrolling.

In 2015 and 2016, two junior nurses per year dropped out of the Postgraduate Certificate Course, costing the NHS more than £3,000 in pre-paid tuition (University of Chester, 2019). When the knowledge mobilisation model was implemented in 2017, the percentage of enrolled nurses completing the course increased from 71% to 100% (Table 2). It is likely that the implementation of the model in 2017 prevented an additional two nurses from dropping out, representing a cost saving of £3,136 (2016 prices).

Post-graduate 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%)	1,542[1]	3,084
2016	7	5 (71%)	2 (29%)	1,568[1]	3,136
2017	12	12 (100%	0 (0%)	1,625[1]	0

[1]**University of Chester (2019)**

Table 3: Completion rates for Postgraduate Certificate Course in Critical Care

Clinical librarian support for junior nurses enrolled in postgraduate training was also evident from the interviews:

"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)

"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)

"*I needed help with the most basic things, my logins, how to access Athens, how to do evidence searches*." (Nurse)

"Oh God, I don't think I could have done the ITU Course without her." (Nurse)

"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)

6.4.4.2 Case study: Professional development for senior nurses

Professional development is an important part of career advancement in nursing. Frequently, nurses pursue academic studies alongside their clinical work. During the time when the knowledge mobilisation model was implemented, Nurse A was an experienced Band 6 nurse working on the critical care unit.

The support offered by the knowledge mobilisation model enabled Nurse A to complete a master's in Advanced Practice, progressing from Band 6 to Band 8a and resulting in a minimum pay increase of £4,803 per year (RCN, 2017) (Table 4). Although this pay increase does not reflect directly in cost savings to the NHS, it offers a proxy value for the professional development and career advancement made possible by the model.

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[1]	£40,028[1]	£4,803

[1] **Royal College of Nursing (2017)**

Table 4: Value of career advancement

An interview with Nurse A indicated the degree of support received from the model:

"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 [patient lying face down] 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)

6.4.5   Improved care for patients and family members

Critical incident technique (CIT) in healthcare measures how a specific incident contributes to improved patient outcomes. Using CIT, specific incidents are chosen because they are likely to illustrate a focused and accurate reflection of impact. Used as a valid evaluation method by organisations in health care and education, CIT is recommended as a 'robust' and 'tried and trusted method of demonstrating impact' for research involving clinical librarian services (Brettle et al., 2016).

6.4.5.1 Critical incident: Improved patient care

During the first month of the knowledge mobilisation model (October 2016), a female 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 needed emergency assistance. 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. During this time, consultants and nurses provided verbal information on the severity of her asthmatic attack to the patient and her husband. The clinical librarian supported the process with appropriate written information on the patient's condition and the process of recovering from a traumatic episode.

After a few days, the ventilator was removed and medication reduced. As a result, the patient experienced a sudden episode of delirium, including hallucinations, which caused great distress to both herself and her husband. Fortunately, the clinical librarian was on duty, and quickly provided her husband with relevant information on delirium. This

information enabled him to understand what was happening, and to feel more calm and at ease. This also enabled him to explain what was happening to his wife who was extremely agitated and confused.

When the patient's condition stabilised and the couple were preparing to return home, the clinical librarian provided information to the patient and her husband on post-traumatic stress disorder (PTSD). 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 asthmatic attack and delirium.

In follow-up conversations with critical care staff, both the patient and her husband reported how traumatised they were by the experience of the patient's acute illness and delirium, and how grateful they were for the written information and verbal support provided by the clinical librarian. Consequently, both the patient and her husband made a successful recovery without requiring any treatment for managing PTSD.

6.4.5.2 Cost avoidance from preventing PTSD

PTSD in critical illness survivors and their family members results in a high economic cost to the NHS. PTSD occurs in approximately 22% (one in five) of survivors of critical illness (Parker et al., 2015). Additionally, 33% (one in three) 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).

To treat PTSD, the NICE guidelines suggest 8 to 12 sessions of trauma-focused psychological treatment lasting between 60 to 90 minutes at a cost of approximately £190 per session (Curtis & Burns, 2016). If the couple had required specialist treatment for PTSD, the cost would have been approximately £1,904 for 8 to 12 sessions. However, 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 husband was estimated at £1,047 (Table 5).

	Probability of acquiring PTSD in critical care	Mean cost per person of treating PTSD (8 to 12 sessions)	Mean cost per person of treating PTSD from total critical care admissions
Patient with life-threatening illness	**22%** (Parker et al., 2015)	**£1904[1]**	**£419** (22% probability)
Family member of patient with life-threatening illness	**33%** (Azoulay et al., 2005)	**£1904[1]**	**£628** (33% probability)
Total cost of PTSD sessions		**£3,808**	**£1,047**

[1] Curtis and Burns (2016)

Table 5: Financial value of avoiding PTSD sessions

Although this case study describes one critical incident of improved patient care due to the clinical librarian intervention, interviews with staff suggested a potentially larger impact on patient care:

"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)

6.4.6 Sensitivity analysis

The monetised benefits of the knowledge mobilisation model were based on assumptions made from available quantitative and qualitative evidence. Sensitivity analysis investigated the robustness of these findings by considering changes in key assumptions and comparing the assumptions in the base case with a more conservative case to present a reasonable range of ROI metrics (Table 6).

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 dropout 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 £4,803	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.

Table 6: Base case and conservative case assumptions

6.4.7 ROI metrics: Net benefits, benefit cost ratio and return on investment

To estimate the ROI from the employer perspective, the monetised benefits of the knowledge mobilisation model were compared with the total costs for both base case and conservative case scenarios (Table 7).

Outcomes	Base case scenario	Conservative case scenario
1. Time saving	£26,312	£13,156
2. Support for professional development Improved completion rate in postgrad training Value of career advancement	£3,136 £4,803	£1,568 £4,803
3. Critical incident of improved patient care	£1,047	£1,047
Total monetised benefits	**£35,298**	**£20,574**
Total costs	**£17,389**	**£17,389**
Net benefits	**£17,909**	**£3,185**
Benefit cost ratio	**3.03**	**1.18**
ROI = [(benefits - costs)/costs] x 100	**103%**	**18%**

Table 7: Monetised outcomes compared with total costs

For both base case and conservative case scenarios, the model generated a positive financial value from time saving, support for professional development and improved patient care. The ROI analysis indicated that for every £1 invested in the knowledge mobilisation model, a financial value of £1.18 to £3.03 was generated in time saving, enhanced professional development and improved patient care.

6.4.8 Additional non-monetised outcomes

Findings from this ROI analysis revealed that the model produced a positive ROI. In addition, interviews with staff members indicate further outcomes, which were difficult to monetise, such as improved staff culture. The following statements were indicative:

"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)

"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 the ward several days a week, and much more accessible." (Nurse)

6.5 Clinical librarian reflections on the model

6.5.1 Reflective log

A reflective log was kept by the clinical librarian during the 15-month period that the model was implemented to track observations relating to relationships and behaviour, as well as personal reflections. Key observations from the reflective log are summarised below.

6.5.1.1 Building trust with critical care staff and patients

Working in the critical care unit itself presented challenges and opportunities for the clinical librarian. Working in close proximity to the patients' bedside meant that contact with critical care staff was immediate. This resulted in the building of positive relationships and trust between the clinical librarian and critical care staff. It allowed a greater insight into clinical practices, departmental culture and relationships with the patient and family. It enabled the clinical librarian to observe opportunities for enhancing the knowledge mobilisation model. However, it also meant that the clinical librarian worked in closer contact with acutely unwell patients, as well as witnessing conditions and procedures that could be distressing. Resilience and adaptability were required to work in this environment.

6.5.1.2 Building awareness of the clinical librarian role

The model began with an intense period of awareness-raising throughout the critical care department. Several promotional tools were successful enablers for conversations and contact with staff. The clinical librarian wore a t-shirt which displayed 'Library & Knowledge Service'. Promotional pens were distributed to staff and both acted as a conversation starter. Posters were displayed on the back of toilet cubicle doors, contact details were detailed on posters and the noticeboard.

A change in the awareness of staff was noted at around month 3 of the model. On entering the critical care department, the clinical librarian began to be greeted by staff saying, "Oh, I need to speak to you!" Generally people did not make contact by email or phone but waited until the clinical librarian was visible in the department. Awareness was a two-way process; it was essential for the clinical librarian to have an insight into departmental culture, for example, understanding that nurses did not like to discuss work topics while on their break.

Being visible in the department resulted in several opportunities that might not have been realised otherwise. Involving the clinical librarian in some aspects of care, e.g. patient information, was a new concept for a lot of staff, so being "in

the right place at the right time" and being involved in conversations presented an opportunity for the clinical librarian to be a part of critical care work.

6.5.1.3 Support from senior members of staff

Championing by senior members of staff (matron, consultants) encouraged uptake of library support. The matron considered the clinical librarian "one of the team". One of the senior nursing staff actively encouraged colleagues to join the Facebook group. Consultants advised junior doctors to contact the clinical librarian for support. Word of mouth was extremely powerful in encouraging engagement with the model, particularly amongst nurses, many of whom approached the clinical librarian for support on the recommendation of a friend.

6.5.1.4 Methods of communication

Critical care staff demonstrated a clear preference for some methods of communication to others. Those preferred in relation to the model were the noticeboard, personal contact and Facebook / Facebook Messenger, which were all more popular than email or telephone. It became important for the clinical librarian to exploit all available methods of communication to suit the needs and preferences of staff; one piece of information was often delivered in different ways to expand reach, such as via social media, noticeboard and email. Harnessing existing behaviours (such as the use of Facebook) meant that knowledge could be shared in a way that didn't require people to change their behaviour.

6.5.1.5 Being a source of evidence-based information

Accessing library support to enhance the information given to patients and family members was a new concept to most critical care staff. Those who did require support wanted evidence to support their own knowledge and enable them to give a more robust response. One junior nurse was caring for a patient with community acquired pneumonia who was 8 weeks pregnant. The patient had been asking the nurse whether her pregnancy would be affected by pneumonia and the nurse did not know how to respond. The clinical librarian signposted some evidence which was used to help the nurse formulate a response to the patient. On another occasion, the clinical librarian was approached by a senior nurse to find some evidence-based information to reassure the relatives of a patient who was hallucinating as a result of being administered ketamine. On both occasions the knowledge of both the nurse and the patient or family member was increased; the confidence of the nurse was supported and the patient or family member had printed information to refer to.

6.5.1.6 From a fixed to flexible working pattern

Delivering the model presented some challenges for the clinical librarian. Limiting the model to 15 hours a week became more difficult as demand for support increased. Originally the model had been designed in 4 x 3.75 slots to spread cover across the working week. In practice, however, it was not practical to stick to these time slots, especially as staff began to contact the clinical librarian via Facebook Messenger, sometimes at unsociable hours. As the needs of staff changed and the clinical librarian was involved in more work in the department, those time slots became more fluid and support was delivered as and when necessary.

6.5.1.7 Delivery of the model

External organisational factors influenced delivery of the model. During the study a new paperless IT system was introduced, which changed the way that staff accessed information online, meant there were computers at the bedside, less time to participate in educational activities, and that staff were under even more pressure. Times when hospital was in full capacity meant that staff were too busy to talk to the clinical librarian.

6.5.1.8 Participation in the journal club

Clinical librarian support was positively welcomed by critical care staff, though some aspects of the model were more successful in engaging staff than others. The virtual journal club, hosted on Facebook, was intended to generate an online discussion about research. Engagement with the journal club was minimal, with just a handful of staff posting comments to the discussion. However, staff revealed in confidence to the clinical librarian that it did prompt some of them to read and discuss the materials offline. The journal club was adapted and relaunched as a monthly reading event that highlighted a piece of reading, not necessarily a research study, but a blog post, news item, opinion piece or report, that encouraged critical thinking in a less academic way.

6.5.1.9 Practical limitations

Some activities within the knowledge mobilisation model could not feasibly overcome the barriers of time, resources and culture encountered by staff. Staff specifically requested some activities during the design of the model - including a book box on the unit to prevent visits to the library in person and thus saving time for staff. However, despite being part of the original design of the model, the book box was withdrawn during phase 2 after several books went missing and could not be replaced. Scheduled training sessions were also requested by staff; however, in practice, few were able to attend due to workload pressures and so scheduled sessions were discontinued. The research team reflected that although there was a desire from staff to participate in further reading and educational sessions, practical elements of the job prevented them from doing so.

6.5.1.10   The development of meaningful relationships within a clinical team

One of the key reflections of the clinical librarian during delivery of the model was the value of nurturing trusting relationships with staff. Despite having an existing relationship with the critical care department, it was not until the clinical librarian was embedded in the team that meaningful relationships with staff were developed, encouraging them to make use of the library model in a way that they otherwise would not have done. The model was delivered for 15 months, after which time some of those relationships were just beginning to form, suggesting that time and patience is necessary in building long-term, meaningful relationships with a clinical team.

7. Discussion

7.1 Strengths and limitations

This study had several strengths. This was the first study to design, implement and evaluate a clinical librarian-led model of knowledge mobilisation specific to critical care. Triangulation of methods strengthen findings as this allows respondents to expand upon responses to give better context to the findings. Inclusion of prompt questions in the interviews and focus groups encouraged participants to expand upon their responses, producing rich data. The interviews and focus groups were respondent led therefore providing more detail for complex issues. The purposive sampling recruitment method ensured all staff roles were invited to participate. Good rapport was established between the research and participants, which helped to elicit findings on areas not previously considered.

In analysing the ROI of the clinical librarian this study was the first to evaluate the financial value of a clinical librarian in critical care despite the lack of standardised tools or templates. The validity of results were strengthened by gathering and comparing quantitative information from the locally developed self-report questionnaire with supporting qualitative information from interviews. The outcomes measures used - time saving, support for professional development and contribution to patient care - have been recommended in previous systematic reviews of clinical librarian services (Weightman & Williamson, 2005).

The study also had some limitations. The generalisability of the findings are limited by the fact that the study was performed within a single intensive care unit at only one UK hospital. The data collection methods used (questionnaires and interviews) are subject to response bias and presentational bias. The anonymity and confidentiality of responses was clearly communicated to respondents but may still have impacted responses, particularly as the research team included colleagues from the hospital.

In relation to the ROI analysis, the outcome measure which generated 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. This is a small study that involved a purposive sample of 24 health professionals who reported benefits from a clinical librarian intervention. In general, clinical librarian studies that measure financial impact tend to be small and lack robust methods of ROI (Madden et al., 2016).

8. Conclusions

In critical care where the evidence base can be complex, staff have a clear need for knowledge support; this need can feasibly be met by a clinical librarian-led model of knowledge mobilisation.

8.1 A model of knowledge mobilisation for critical care staff

The model of knowledge mobilisation in this study helped critical care staff to learn, develop and improve the quality of their care. It nurtured an evidence-based culture across the department and generated a positive financial value from saving staff time, supporting their professional development and improving patient care.

Knowledge mobilisation models should make it easy for critical care staff to find, share and apply knowledge to their practice. Care should be taken to raise awareness amongst staff about the support available and a model should be supportive to those who may feel inexperienced in knowledge-seeking. A model of knowledge mobilisation should be offered through face-to-face as well as online channels. Opportunities for staff to share experience, discuss the evidence base and learn from each other should be available to ensure effective knowledge mobilisation.

A model of knowledge mobilisation needs to be flexible and responsive in nature. The knowledge requirements of staff change over time and the model needed to adapt to these changing needs. The model of knowledge mobilisation developed in this study was delivered initially in 4 x 3.75 hour time slots. As the model progressed and began to align with departmental ways of working, this pattern became impractical and so delivery of the model was not scheduled to set times or days.

Those aspects of the model that were most successful (noticeboard, journal club, Pop Up Library and newsletters) were those that reflected existing culture and behaviour, those that were integrated with existing departmental activities, and those that were championed by key influencers in the department.

8.2 Knowledge support for the patient and family

The bedside nurse occupies a unique and pivotal role in knowledge sharing with the patient and their family, due to their reassuring presence and the trusting relationship they build with families. Due to the serious nature of critical illness, both patients and family members experience psychological and emotional issues which affect their ability to retain and absorb knowledge.

To support patients and their families, knowledge needs to be repeated and reinforced at appropriate milestones in care. Knowledge shared with the patient and their family should be tailored to their individual preferences and provided both verbally and in paper format. Families should be offered the opportunity to create their own alternative account of their critical care experience using photographs and diaries.

8.3 Clinical librarian roles

Working in an embedded way allowed the clinical librarian to develop positive relationships and build trust with staff; this was an important factor in encouraging use of the knowledge mobilisation model. It also allowed the clinical librarian to experience behaviour and culture in the department and gain a greater understanding of how knowledge requirements could be met.

Visibility of the clinical librarian was necessary to nurture an evidence-based culture. Awareness of the model was increased by using multiple communications channels, both face-to-face and online. This allowed the model to reach staff with different preferences and working patterns. The aspects of the model that were most successful (noticeboard, journal club, pop up library, newsletters) did not require staff to change their behaviour to a great extent, were championed by key influencers in the department and were aligned with existing ways of working.

Since the success of a model of knowledge mobilisation is so dependent on building meaningful relationships with staff, it is important that sufficient time and patience is afforded to clinical librarians working in embedded roles, before their contribution can truly be measured. This would allow the impact on long-term outcomes, such as staff culture, to be measured.

8.4 Return on investment

This study showed that a clinical librarian-led knowledge mobilisation model in critical care unit could generate value for money. The ROI analysis indicated that for every £1 invested in the knowledge mobilisation model, a financial value in a range from £1.18 to £3.03 was generated. This was a conservative and cautious analysis; data suggested that there are further outcomes which are difficult to monetise, for example, improved staff culture. Quantitative and qualitative data indicated that time saving, support for professional development and improved patient care were important outcomes. A core set of validated outcomes are required to enable direct comparison of results and to justify continued expansion and investment in clinical librarian services.

This study has developed and tested an approach to ROI analysis in clinical librarian services. This approach should be further tested and refined in future studies.

9. Recommendations

1. Critical care units should consider employing a clinical librarian to support staff, patients and family members and recognise that this can be done in a way that generates a financial return.
2. NHS Trusts should recognise their responsibility to support the knowledge requirements of staff to enhance patient care, and the contribution of the clinical librarian role to this.
3. Further studies are needed to:
   a. evaluate clinical librarian interventions in other critical care departments and other healthcare settings;
   b. investigate further the financial return of employing a clinical librarian in a multidisciplinary healthcare team.

4. Training and development opportunities should be developed specifically to support knowledge specialists to work in embedded roles.

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