Original research article

Challenges undertaking procedures requiring asepsis: a qualitative interview study with nurses

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SUMMARY

Background: Invasive devices and breaches to skin and mucous membranes increase susceptibility to infection. Nurses frequently undertake procedures requiring asepsis (PRAs) but report challenges and unwarranted variations in practice.

Objective: To explore nurses' experiences, perceived gaps in information and support needed to conduct PRAs.

Methods: We undertook qualitative interviews with 20 nurses in the health service in the United Kingdom September 2021-January 2022 employing approaches to sampling and data collection adopted in Grounded theory.

Results: Informants were employed in diverse clinical settings. They thought that outside operating theatres, attempts to maintain asepsis would inevitably be compromised but that much could still be done to contain risk of contaminating susceptible sites irrespective of circumstances. Suboptimal practice was reported and informants were unclear whether asepsis was needed to perform routine procedures (e. g. dressing chronic wounds, manipulating indwelling intravascular lines). Problems were attributed to inadequacies in nursing education, poor access to continuing professional development and carelessness of junior nurses and medical staff. Informants wanted more detailed guidelines to conduct PRAs. Senior nurses wanted procedures to be conducted in the same way regardless of circumstance. Nurses who undertook PRAs regularly suggested that guidelines should be flexible.

Conclusion: Need exists for detailed guidelines to inform PRAs, better access to clinical updating and improvements in pre-registration nursing education. To meet contemporary standards, guideline generation should adopt recognised methodology. Student nurses should be introduced to the knowledge and skills required to undertake and adjust PRAs according to circumstance during simulated practice before contact with real patients.

Introduction

Patients with invasive devices and breaches to skin and mucous membranes are highly susceptible to healthcare-associated infection (HCAI) [1–3]. Procedures are conducted aseptically to avoid contaminating susceptible sites [4]. Changes in the way that health care is delivered mean that increasing numbers of older people, the immunocompromised and patients with chronic conditions already predisposed to HCAI undergo invasive procedures [4]. Nurses' knowledge and opinions are important as they frequently undertake PRAs, are expected to assume leadership for infection prevention and other members of the multidisciplinary team look to them for guidance [5]. Nurses report variations in practice [6–8] and outside critical care units, challenges undertaking procedures requiring asepsis (PRAs) [9]. Specialist nurse-led teams can reduce HCAI for patients with invasive devices [10–13] and surgical incisions [14,15] but outside acute care, this support is not easy to access. Nurses working in settings regarded as low-risk such as primary care (e. g. general practice nurses) report greatest concern about PRAs [8, 9]. We undertook a qualitative study to explore experiences, gaps in information and support needed to undertake PRAs.

Methods

Objective

The aim of the study was to explore nurses' experiences, perceived gaps in information and support needed when conducting procedures requiring asepsis.

Informants and study setting

The study took place in the United Kingdom (UK). Informants were eligible to participate if they were qualified nurses undertaking PRAs as part of a varied workload or supervising others undertaking PRAs. We excluded nurses in specialist roles where much or all of their time is specifically devoted to PRAs (e. g. intravascular teams). We included informants in acute and non-acute settings to compare and contrast experiences and opinions.

Design

We undertook a qualitative interview study. Sampling, data collection and analysis were guided by the principles of Grounded theory [16]. This research methodology is used to explore informants' experiences of behaviour in complex situations and is particularly suited to obtaining insight into under-explored areas of enquiry [17].

Sample

Grounded theory methodology does not employ random sampling techniques. Recruitment is through a process called 'open sampling' intended to obtain information from a diverse sample of informants likely to hold a range of opinions and to have different experiences [16]. Initially the study was advertised via professional nursing organisations and through organisational emails and newsletters requesting individuals interested in the study to contact us. The data collector supplied potential informants with information about the study and a consent form. The interview was arranged at a mutually convenient time after the signed consent form had been returned. As the study progressed, sampling became increasingly

targeted to reach informants likely to hold different perspectives ('theoretical sampling'). For example, early recruits tended to be employed in acute settings. Deliberate attempts were made to recruit additional participants from the community and primary care through their specific forums and networks.

Data collection

Data were collected by semi-structured telephone interviews September 2021-January 2022. Each commenced by asking: 'How would you describe the aim of 'aseptic technique' where you work?' Follow-up questions explored the clinical setting in which informants were employed, characteristics of their patient populations, procedures most commonly performed, how PRAs were undertaken in different circumstances and perceived gaps in information and support. Data collection was conducted by one interviewer and continued until no new findings emerged ('saturation'). Interviews took 40-60 minutes with a mean of 50 minutes. Each interview was recorded, transcribed and analysed immediately. Data collection and analysis took place simultaneously in keeping with Grounded Theory methodology adopting constant comparative methods. In this approach the findings of interviews already conducted are used to frame additional questions as new insights emerge [17,18]. Detailed notes ('memos') were written after each interview and as data collection progressed, contrasts and comparisons between informants' opinions and experiences were documented in detail.

Analysis

Two members of the research team worked together adopting an iterative process to analysis (constant comparative analysis) integral to Grounded Theory [16]. Analysis took place in three stages: (1) the raw data were coded; (2) initial codes were combined into 'axial' codes to identify connections between the data; and (3) axial codes were combined into over-

arching ‘selective codes’ (see Supplementary data file). Adopting this approach, it is recommended that discrepancies in interpretation are discussed by members of the research team until consensus is achieved. This was unnecessary in our study as no major discrepancies arose. Throughout each interview, the data collector checked to ensure that they had interpreted information fully and accurately. In addition, transcripts were returned to three informants to check agreement [19].

Rigour

The Consolidated Criteria for Reporting Qualitative Research (COREQ) [20] were adopted. Reporting was in line with guidelines for good reporting of Grounded Theory [21].

Ethical approval

Ethical approval was granted by a university ethics committee (SREC 13 03 2019). All potential informants received verbal and written information before agreeing to take part and were assured that their identity and that of their employing organisation would not be disclosed in the project report or publications.

Results

All informants fulfilling the inclusion criteria were invited to participate and all (n=20) agreed (see Table I). One was male, the others female. Time since qualifying ranged from one to forty years. Five informants were in senior roles, four were ‘hybrid managers’ combining management with clinical work and three were employed in nurse education. The others were employed in clinical roles and were more junior. Informants were employed in a range of services across acute and non-acute settings in the NHS and independent sector in all four countries of the UK. Although participants were asked: ‘How would you describe the

aim of "aseptic technique" where you work?' they all proceeded to reflect not just on their current place of work but everywhere else they had been employed or witnessed practice. Those in senior roles had all had experience in community as well as more acute settings regardless of where they were currently employed and many of their remarks related to these previous experiences. Newly qualified nurses had all undertaken placements in acute and community settings and reflected on what they had observed in all settings.

[INSERT TABLE I HERE]

Four linked, over-arching themes (selective codes) were identified. These provide insight into the challenges of undertaking PRAs during routine nursing procedures; the importance of understanding the principles underpinning PRAs in order to adapt them under different circumstances; deficits in nursing education and opportunities for updating knowledge and skills considered necessary to undertake PRAs; and perceived need for more detailed guidelines to inform practice.

Understandings and beliefs around aseptic technique

This theme referred to understanding of what aseptic technique is, who takes responsibility for PRAs and barriers to maintaining asepsis.

Aseptic technique was described as a method of avoiding contamination to susceptible sites, primarily to protect the individual patient. Containing risks to other patients and to health workers was considered of secondary importance. A few informants used terminology ('key parts', 'key sites') adopted by the Aseptic Non-Touch Technique (ANTT©) framework widely used in the UK and other countries [22]. Informants suggested that outside the highly controlled conditions of operating theatres, ability to conduct procedures aseptically would

always be compromised but that nevertheless, much could be done to contain the risk of contaminating susceptible sites irrespective of circumstances:

‘Being sterile and being aseptic differ. You can’t be sterile outside theatre but you can employ techniques to maintain “aseptic-ness”.’ (Informant 14)

Informants described trying to maintain asepsis by ‘minimising touch’ and spoke about ‘trying to minimise risks’, ‘trying to prevent contamination’, ‘being as clean as possible under the circumstances’ and ‘trying to protect sterility’. The greatest challenges were described in non-acute settings, especially when procedures were conducted in patients’ homes where responsibility for undertaking PRAs was always assumed by nursing, not medical staff. The most pressing concerns were inability to control the environment, especially where there were ‘sinks that you wouldn’t want to touch’ and ‘nothing to dry your hands on’. Informants were anxious not to cause offence by appearing to criticise patients’ living conditions and standards of hygiene:

‘You don’t know what you’re going into. You’re in somebody’s home and it’s not very clean. In some places you can’t wash your hands, you’re dependent on your alcohol gel. You have to assess the environment. You keep the site as ‘aseptic’ as possible, you have your sterile field open and the cat walks through it or the patient doesn’t realise and touches something. You have to respect that it’s the patient’s home. They have to be happy.’ (Informant 16)

There was considerable debate about when and how PRAs should be conducted. Some informants suggested that asepsis would always be required when dressing chronic wounds to avoid introducing anti-microbially resistant pathogens. Others thought that trying to prevent

contamination in chronic wounds was ‘silly’ because pathogens would already be present. There was confusion over when to use sterile gloves:

‘People think you need sterile gloves for a PIC (peripherally inserted cannula). You only need sterile gloves when you’re trying to prevent something getting into the PIC line, not for all the procedure.’ (Informant 11)

Informants who managed patients with indwelling intravascular lines knew that devices intended for long-term use are designed to ‘cuff’ to prevent microbial invasion. They questioned the need for asepsis when manipulating lines left in situ:

‘For Hickman lines there’s a disc –it’s an effective barrier (against pathogens)’. (Informant 17)

Promoting standards was an important part of clinical managers’ responsibility and regarded as an uphill task. Those in intensive care units and acute wards criticised newly qualified nurses and medical staff for ‘cutting corners’ and taking ‘short-cuts’. Poor habits were attributed to casual attitudes and ‘drift’ in practice over time, often harshly expressed: ‘negligence’, ‘carelessness’ and ‘lack of accountability’, resulting in the need to ‘police staff’ and issue constant reminders to avoid ‘slacking’.

The importance of understanding the principles of asepsis

Ability to conduct PRAs in different circumstances was thought to depend on understanding the principles underpinning asepsis, using this knowledge to adapt a given procedure

according to the environment in which it was being undertaken and motivation to uphold standards:

‘Knowing the principles is important, knowing how to prevent micro-organisms entering the site to reduce risks of infection.’ (Informant 11)

The consequences of *not* understanding the principles of asepsis was viewed as potentially serious: wasteful, inappropriate use of consumables, inability to adjust when new equipment was introduced and unsafe practice, especially when short-cuts were attempted, endangering patient safety.

‘What if the dressing pack changes? Then the procedure doesn’t work. You can’t do the hospital way in people’s homes. It doesn’t work. You need the principles and how to apply them.’ (Informant 2)

Reported practice varied according to clinical setting. In critical care units, strict adherence to protocols was described. Assisting medical staff when central venous lines were sited was considered essential to ensure that junior doctors adhered to clinical protocols. In the emergency department there was greater leeway. Dressing trolleys were set up and sterile fields created to insert urethral catheters but it was considered permissible to undertake minor procedures (e. g. venepuncture) without setting up a sterile field. Informants employed in primary and domiciliary care faced the greatest challenges. They described setting up sterile fields on dining room tables or the carpet, ‘doing the best you can’ and ‘being as clean as you can’.

Deficiencies in teaching and updating

Carelessness and not understanding the principles of asepsis were attributed to deficiencies in pre-registration nursing education and the reported inability of many nurses to access continuing professional development (CPD) once qualified. Nurse educators and recently qualified nurses reported that skills necessary to undertake PRAs were introduced early in the course. Instruction was said to be provided by university staff during classroom-based sessions in which students were shown how to undertake straightforward surgical wound dressings and administer intramuscular injections in ward-based scenarios with emphasis on practicalities (e. g. how to clean dressing trolleys, technique used to don personal protective equipment) rather than the principles of asepsis. Participants reported that more complex PRAs and adapting them in community clinics and the home were not addressed until students undertook clinical placements later in the course. They described ad hoc arrangements and considered that much depended on time constraints in busy clinical areas and the enthusiasm of clinical staff expected to provide mentorship. There was a suggestion that pre-registration teaching was largely irrelevant with real learning commencing post-qualification. Clinical nurses were critical of the student nurses they were expected to supervise. Students were considered to have insufficient practical experience with lack of consistency between individuals and between those from different universities:

‘We get third year undergraduate student nurses. They often don’t know much and they aren’t allowed to do lots of things. They don’t have much practical experience and what they have had is not consistent.’ (Informant 12).

Among informants who had been qualified for some time, there was a perception that standards had declined since withdraw of the formal competency assessment for aseptic

technique phased out in the 1990s when nurse training in the UK moved from a ward-based, apprentice-style approach to higher education. Informants commented on inadequacies in basic training and variations between what was taught in different universities.

‘My major concern is about nursing education and lack of the old formal assessment You need to think about what you’re touching, when to put on sterile gloves. I was taught the old way with a trolley.’ (Informant 4)

Conversely nurse educators blamed decline in standards on practitioners. Senior clinical nurses and educators shared the same concerns about lack of competency assessment in pre-registration courses, however.

Participants’ reports of arrangements for CPD varied enormously. They reported that on intensive care units all newly recruited nurses were assessed before being allowed to practise without supervision and the importance of asepsis was frequently re-visited during regularly held training days. Arrangements were perceived to be less satisfactory on general wards and to have been disrupted during the COVID-19 pandemic through staff shortages and lack of time. There were reports that training had been cancelled or moved online which was considered less effective. In some cases, reconfiguration of clinical areas was reported to have had a detrimental impact on ability to conduct PRAs. For example, treatment rooms previously used to site intravascular lines were reported to have been commandeered to provide additional bedspace and still out of commission. Informants in primary and community settings claimed that they did not receive any CPD although caseloads included acutely sick patients with indwelling invasive devices.

‘The acute trusts have good provision. GP practices vary depending on the manager.’ (Informant 5)

Cost was identified as a major obstacle in primary care where training budgets were held by non-clinical managers:

‘A lot of people at home need acute care - ventilators and lines. The carers don’t know about guidance, nothing about hand hygiene or PPE. The fundamentals aren’t there, they aren’t trained.’(Informant 10)

Need for improved guidelines

Informants wanted to keep abreast of changes in clinical practice and feel confident adapting aseptic technique safely when new equipment and procedures were introduced.

‘Aseptic technique needs a re-think. We need more clarity about what it is and to reach a common understanding.’ (Informant 5)

They could identify a number of areas where clarification was needed to inform existing practice: whether asepsis could be substituted for ‘clean’ technique when dressing chronic wounds; how often line dressings should be changed; how often bungs and hubs on intravascular lines should be disinfected and changed; and when to don sterile gloves. The need for more detailed guidelines to address these issues was highlighted. Benefits suggested would include: parity between organisations; improved adherence to protocols; ability to assess competency before registration; monitor proficiency post-qualification; and spend less time compiling ‘in-house’ guidelines and protocols. Opinions about the content of the new

guidelines differed. All senior nurses were in favour of adopting the same approach in all settings and for all procedures. All nurses directly responsible for undertaking PRAs suggested that generic guidelines would need to be sufficiently flexible to reflect differing circumstances and patient needs.

'A policy saying that aseptic technique should be the same everywhere would be highly problematic –you can't apply the same technique in all settings.' (Informant 7)

Discussion

Statement of principal findings

Informants thought that outside operating theatres, attempts to maintain asepsis would inevitably be compromised but that much could still be done to contain risk of contaminating susceptible sites irrespective of circumstances. Suboptimal practice was reported and they were unclear whether asepsis was required to perform routine procedures (e. g. dressing chronic wounds, manipulating indwelling intravascular lines). The main challenges were reported to be inadequacies in nursing education, poor access to CPD and carelessness of junior nurses and medical staff. All informants wanted more detailed guidelines to conduct PRAs. Senior nurses wanted procedures to be undertaken in the same way regardless of circumstance but nurses who undertook PRAs regularly suggested that guidelines should be flexible. This is exacerbated by a lack of agreement about what is meant by the terms 'asepsis' and 'aseptic technique' and how much variation in practice is acceptable.

Comparison to other studies

Our findings corroborate earlier research: variations concerning when procedures should be conducted aseptically and how PRAs should be performed [6, 7, 8]; inadequacies in teaching and competency assessment for pre-registration students in the UK [23] and other countries

[24]; poor access to CPD post-qualification, especially for nurses in primary and domiciliary care [9]; and lack of emphasis on the principles of asepsis [23]. Opinions concerning need for asepsis when dressing chronic wounds and precisely at which points to don sterile gloves for a specific PRA differed. Ours is not the first study to establish a 'blame culture' when nurses describe barriers and enablers to implementing infection prevention strategies. Other authors have remarked on a tendency for individuals to present themselves as competent and knowledgeable about infection prevention while criticising colleagues [25,26].

Informants in our study expressed a need for more detailed guidance and better preparation to undertake PRAs, corroborating a growing body of opinion and research [6–9,23,24]. The ANTT© framework [27] currently in use is described as being designed for all settings where aseptic technique is conducted but practitioners are required to undertake their own risk assessment when they decide whether or not a specific procedure requires asepsis. Informants in our study described situations requiring nuanced decision-making related to the management of chronic wounds, specific issues related to the management of intravascular lines and when to don sterile gloves not addressed by ANTT© or other guidelines addressing PRAs [4,28,29]. Uncertainty may be exacerbated by conflicts between what was taught, research, guidance, employers policies, and professional codes; particularly as there is no national guidance in the United Kingdom.

Implications for policy, practice and future research

Although policy-makers consider that maintaining asepsis is of paramount importance as part of any strategy to prevent infection and reduce risks of antimicrobial resistance [5,30], existing guidance has not been developed according to the rigorous methodology required by organisations such as NICE. PRAs may have been overlooked because they form part of

other specific procedures to prevent infection (e. g. insertion and management of different types of invasive devices, wound management) and are not regarded as a 'stand-alone' procedure. Moreover, the principles underpinning PRAs are well established and there is an assumption that all health professionals understand their aims and when they should be conducted [31]. New guidelines to support the conduct of PRAs will need to be developed to meet contemporary standards and adopt recognised methodology: recommendations must be transparent, include stakeholder participation and have a defined schedule for updating. As it is unlikely that a single approach will be appropriate in all situations, a range of implementation tools will also be required to support uptake in diverse clinical settings. Key questions include the degree of standardisation required during PRAs, how much variation can be allowed under different circumstances and whether there should be different guidelines for hospital and community settings and for different procedures. For example, chronic wounds can heal despite heavy contamination with nosocomial pathogens [32]. More explicit guidance could help reduce the 'blame culture' surrounding PRAs [26]. Future studies could explore how the management of chronic wounds can be modified while maintaining patient safety and containing risks of cross-contamination and cross-infection. Data should be collected from other professional groups who undertake PRAs in different clinical settings and with different types of patients. There is a dearth of robust research to support how complex PRAs should be undertaken but lack of rigorously conducted research has not precluded development of guidelines for hand hygiene [33] or their acceptance internationally [34]. The Grading of Recommendations, Assessment, Development and Evaluations (GRADE) are of particular value in situations where strength of the evidence is equivocal [35, 36]. Stakeholder opinion should be sought from nurses who undertake PRAs as they are more likely to be aware of anomalies in practice than those in senior positions removed from direct care. Findings from this study and previous research indicate need for

better preparation to undertake PRAs [6,7, 9, 23,24] introduced before students undertake clinical placements to enable them to protect patients and themselves [39]. A successful approach adopted in medical education introduces students to key principles of infection prevention during simulated practice with feedback in small groups before they contact real patients [38]. This approach would relieve clinical staff of pressure to teach inexperienced student nurses and increase quality and consistency of care, although it could also exacerbate any theory-practice gap that currently exists if teaching is removed from practice. In addition to education and guidelines, contextual barriers to implementation may need to be addressed as well interprofessional dynamics when PRAs are undertaken; and an appropriate range of implementation tools developed.

Strengths and limitations

Approaches to sampling and analysis were major strengths of our study. They enabled us to reach nurses with diverse opinions and experiences and explore new issues as they emerged, discussing them in depth with successive informants. We acknowledge two weaknesses. Firstly, bias cannot be ruled out as informants were recruited via professional networks and organisations. The study is therefore likely to have attracted nurses particularly interested in asepsis, especially those concerned about poor practice. Secondly it was necessary to accept informants' views at face value. Without direct observation, it is impossible to know whether descriptions of poor practice were valid.

Conclusion

Although nurses routinely undertake PRAs, ours appears to be the first in-depth study to explore challenges encountered and preparation for safe practice. It has identified need for detailed guidelines to inform the conduct of PRAs, better access to clinical updating and

improvements in pre-registration nurse education. To meet contemporary standards, guideline generation should adopt recognised methodology, and new interventions tested rigorously before being adopted. Nursing education could adopt approaches successfully reported elsewhere by reflecting the changing evidence base in teaching and through regular updating.

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References

[1] European Centre for Disease Prevention and Control. Point prevalence survey of healthcare-associated infections and antimicrobial use in European acute care hospitals : 2011 2012. LU: Publications Office; 2013.

[2] Frykberg RG, Banks J. Challenges in the Treatment of Chronic Wounds. Adv Wound Care (New Rochelle) 2015;4:560–82. https://doi.org/10.1089/wound.2015.0635.

[3] Stamm WE. Infections Related to Medical Devices. Ann Intern Med 1978;89:764. https://doi.org/10.7326/0003-4819-89-5-764.

[4] National Institute for Health and Care Excellence. Overview | Healthcare-associated infections: prevention and control in primary and community care | Guidance | NICE 2012. https://www.nice.org.uk/guidance/cg139 (accessed February 10, 2022).

[5] Department of Health. UK 5 Year Antimicrobial Resistance Strategy 2013 to 2018. GOVUK 2013. https://www.gov.uk/government/publications/uk-5-year-antimicrobial-resistance-strategy-2013-to-2018 (accessed October 14, 2022).

[6] Aziz AM. Variations in aseptic technique and implications for infection control. British Journal of Nursing 2009;18:26–31. https://doi.org/10.12968/bjon.2009.18.1.32073.

[7] Preston RM. Aseptic technique: evidence-based approach for patient safety. British Journal of Nursing 2005;14:540–6. https://doi.org/10.12968/bjon.2005.14.10.18102.

[8] Unsworth J, Collins J. Performing an aseptic technique in a community setting: fact or fiction? Primary Health Care 2011;12:42–51. https://doi.org/10.1017/S1463423610000198.

[9] Gould D, Hawker C, Chudleigh J, Drey N, Gallagher R, Purssell E. Survey with content analysis to explore nurses' satisfaction with opportunities to undertake continuing professional education in relation to aseptic technique. Nurse Education Today 2021;98:104749. https://doi.org/10.1016/j.nedt.2021.104749.

[10] Holder C, Overton E, Kalaf S, Wong D, Holdsworh J, Yun M, et al. Impact of Expansion of Vascular Access Team on Central-line–Associated Bloodstream Infections. Infect Control Hosp Epidemiol 2020;41:s260–s260. https://doi.org/10.1017/ice.2020.825.

[11] Khan R, Al-Dorzi HM, Al-Attas K, Ahmed FW, Marini AM, Mundekkadan S, et al. The impact of implementing multifaceted interventions on the prevention of ventilator-associated pneumonia. American Journal of Infection Control 2016;44:320–6. https://doi.org/10.1016/j.ajic.2015.09.025.

[12] Martillo M, Zarbiv S, Gupta R, Brito A, Shittu A, Kohli-Seth R. A comprehensive vascular access service can reduce catheter-associated bloodstream infections and promote the appropriate use of vascular access devices. American Journal of Infection Control 2020;48:460–4. https://doi.org/10.1016/j.ajic.2019.08.019.

[13] Savage TJ, Lynch AD, Oddera SE. Implementation of a Vascular Access Team to Reduce Central Line Usage and Prevent Central Line-Associated Bloodstream Infections. Journal of Infusion Nursing 2019;42:193–6. https://doi.org/10.1097/NAN.0000000000000328.

[14] Baxter E. A midwifery-led prevalence programme for caesarean section surgical site infections. Journal of Hospital Infection 2021;109:78–81. https://doi.org/10.1016/j.jhin.2020.12.008.

[15] Rochon M, Makhecha S, Morais C, Luff D, Richardson L, Persaud-Rai B, et al. Quality improvement approach to reducing readmission for surgical site infection. Wounds 2016;12:26–31.

[16] Strauss AL, Corbin JM, editors. Grounded theory in practice. Thousand Oaks: Sage Publications; 1997.

[17] Hallberg LR-M. The “core category” of grounded theory: Making constant comparisons. International Journal of Qualitative Studies on Health and Well-Being 2006;1:141–8. https://doi.org/10.1080/17482620600858399.

[18] Sbaraini A, Carter SM, Evans RW, Blinkhorn A. How to do a grounded theory study: a worked example of a study of dental practices. BMC Med Res Methodol 2011;11:128. https://doi.org/10.1186/1471-2288-11-128.

[19] Birt L, Scott S, Cavers D, Campbell C, Walter F. Member Checking: A Tool to Enhance Trustworthiness or Merely a Nod to Validation? Qual Health Res 2016;26:1802–11. https://doi.org/10.1177/1049732316654870.

[20] Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. International Journal for Quality in Health Care 2007;19:349–57. https://doi.org/10.1093/intqhc/mzm042.

[21] Urquhart C, Lehmann H, Myers MD. Putting the ‘theory’ back into grounded theory: guidelines for grounded theory studies in information systems: Guidelines for grounded theory studies in information systems. Information Systems Journal 2009;20:357–81. https://doi.org/10.1111/j.1365-2575.2009.00328.x.

[22] Rowley S, Clare S, Macqueen S, Molyneux R. ANTT v2: An updated practice framework for aseptic technique. British Journal of Nursing 2010;19:S5–11. https://doi.org/10.12968/bjon.2010.19.Sup1.47079.

[23] Hawker C, Courtenay M, Wigglesworth N, Gould D. National cross-sectional survey to explore preparation to undertake aseptic technique in pre-registration nursing curricula in the United Kingdom. Nurse Education Today 2020;90:104415. https://doi.org/10.1016/j.nedt.2020.104415.

[24] Hawker C, Gould D, Courtenay M, Edwards D. Undergraduate nursing students' education and training in aseptic technique: A mixed methods systematic review. J Adv Nurs 2022;78:63–77. https://doi.org/10.1111/jan.14974.

[25] Jackson C, Lowton K, Griffiths P. Infection prevention as "a show": A qualitative study of nurses' infection prevention behaviours. International Journal of Nursing Studies 2014;51:400–8. https://doi.org/10.1016/j.ijnurstu.2013.07.002.

[26] Morrow E, Griffiths P, Rao GG, Flaxman D. "Somebody else's problem?" Staff perceptions of the sources and control of meticillin-resistant Staphylococcus aureus. American Journal of Infection Control 2011;39:284–91. https://doi.org/10.1016/j.ajic.2010.06.018.

[27] Clare S, Rowley S. Implementing the Aseptic Non Touch Technique (ANTT®) clinical practice framework for aseptic technique: a pragmatic evaluation using a mixed methods approach in two London hospitals. Journal of Infection Prevention 2018;19:6–15. https://doi.org/10.1177/1757177417720996.

[28] Loveday HP, Wilson JA, Pratt RJ, Golsorkhi M, Tingle A, Bak A, et al. epic3: National Evidence-Based Guidelines for Preventing Healthcare-Associated Infections in NHS Hospitals in England. Journal of Hospital Infection 2014;86:S1–70. https://doi.org/10.1016/S0195-6701(13)60012-2.

[29] National Infection Prevention and Control Manual. National Infection Prevention and Control Manual: Glossary n.d. https://www.nipcm.scot.nhs.uk/glossary/ (accessed February 10, 2022).

[30] Department of Health and Social Care. Antimicrobial resistance: UK launches 5-year action plan and 20-year vision. GOVUK 2019. https://www.gov.uk/government/news/antimicrobial-resistance-uk-launches-5-year-action-plan-and-20-year-vision (accessed June 18, 2022).

[31] Fox NJ. Scientific Theory Choice and Social Structure: The Case of Joseph Lister's Antisepsis, Humoral Theory and Asepsis. Hist Sci 1988;26:367–97. https://doi.org/10.1177/007327538802600402.

[32] Wound, Ostomy and Continence Nurses' Society (WOCN). Clean vs. Sterile Dressing Techniques for Management of Chronic Wounds: A Fact Sheet. Journal of Wound, Ostomy & Continence Nursing 2012;39:S30–4. https://doi.org/10.1097/WON.0b013e3182478e06.

[33] World Health Organization. WHO Guidelines on Hand Hygiene in Health Care. Geneva: World Health Organization; 2009.

[34] Allegranzi B, Gayet-Ageron A, Damani N, Bengaly L, McLaws M-L, Moro M-L, et al. Global implementation of WHO's multimodal strategy for improvement of hand hygiene: a quasi-experimental study. The Lancet Infectious Diseases 2013;13:843–51. https://doi.org/10.1016/S1473-3099(13)70163-4.

[35] Schünemann H, Brożek J, Guyatt G, Oxman A. GRADE handbook 2013. https://gdt.gradepro.org/app/handbook/handbook.html#h.9rdbelsnu4iy (accessed October 14, 2022).

[36] Alonso-Coello P, Schünemann HJ, Moberg J, Brignardello-Petersen R, Akl EA, Davoli M, et al. GRADE Evidence to Decision (EtD) frameworks: a systematic and transparent approach to making well informed healthcare choices. 1: Introduction. BMJ 2016:i2016. https://doi.org/10.1136/bmj.i2016.

[37] Gould DJ, Chudleigh J, Purssell E, Hawker C, Gaze S, James D, et al. Survey to explore understanding of the principles of aseptic technique: Qualitative content analysis with descriptive analysis of confidence and training. American Journal of Infection Control 2018;46:393–6. https://doi.org/10.1016/j.ajic.2017.10.008.

[38] Gould DJ, Moralejo D, Drey N, Chudleigh JH, Taljaard M. Interventions to improve hand hygiene compliance in patient care. Cochrane Database of Systematic Reviews 2017;2017. https://doi.org/10.1002/14651858.CD005186.pub4.

[39] Rannikko J, Hakkarainen K. COVID-19 is here to stay: how to teach protection. Journal of Hospital Infection 2022;126:123–4. https://doi.org/10.1016/j.jhin.2022.04.013.

Senior role at national level	2
Senior role at organisational level *	3
Nurse educators	3
Clinical manager acute care	2
Clinical manager oncology	1
Clinical manager community	1
Frontline practitioner: acute care	3
Frontline practitioner: oncology	2
Frontline practitioner: community	2
Frontline practitioner: primary care	1

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Table I. Characteristics of the informants