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Abstract

Background: Aseptic technique is a core nursing skill. Sound preparation is required during pre-registration nursing education to enable student nurses to acquire the knowledge and skills necessary to prevent and control healthcare-associated infection and promote patient safety. Few studies have explored nursing students' education and training in aseptic technique.

Objectives: To investigate what, when and how pre-registration nursing students are taught aseptic technique and how they are assessed in undergraduate, pre-registration nursing programmes in the United Kingdom.

Design: National cross-sectional survey exploring preparation to undertake aseptic technique in pre-registration nursing curricula in the United Kingdom

Setting: Universities providing undergraduate, pre-registration adult nursing programmes in the United Kingdom.

Participants: Nurse educators

Methods: Structured telephone interviews were conducted with nurse educators. Descriptive and inferential statistical data analyses were undertaken.

Results: Response rate was 70% (n=49/70). A variety of different learning and teaching methods were reported to be in use. Teaching in relation to aseptic technique took place in conjunction with teaching in relation to different clinical procedures rather than placing emphasis on the principles of asepsis per se and how to transfer them to different procedures and situations. Wide variation in teaching time; use of multiple guidelines; inaccuracy in the principles identified by educators as taught to students; and limited opportunity for regular, criteria based competency assessment were apparent across programmes.

Conclusions: Pre-registration preparation in relation to aseptic technique requires improvement. There is a need to develop a working definition of aseptic technique. The generalisability of these findings in other healthcare students needs to be explored.

Keywords- Nursing students, aseptic technique, cross-sectional survey, undergraduate, education and training.

1.INTRODUCTION

Healthcare-associated infections (HCAs) are the most common adverse events in healthcare and have a significant impact on patients (World Health Organization (WHO) 2011). Healthcare professionals have a duty to protect patients from HCAs (Department of Health (DoH) 2015). Greater emphasis on infection prevention has resulted in significant decline in HCAI since 2000 in the United Kingdom (UK) and elsewhere (The Health Foundation 2015). Further progress could be achieved if health workers' adherence to infection prevention protocols could be further increased (WHO 2016a). Whilst considerable advances have been made with hand hygiene and antimicrobial prescribing policy (Gould et al 2017a, b, c), other key areas of practice have attracted less attention, notably aseptic technique. This is an important gap in knowledge as international (WHO 2015; 2016a; 2016b) and national policy (DoH 2003; DoH 2014; O'Neill 2016; DoH 2019) highlight its importance and identify nurses as the professional group best-placed to lead improvements in practice development and implementation. Little is known about what, when and how aseptic technique is taught and assessed in undergraduate nursing programmes.

2.BACKGROUND

Aseptic technique is one of many core skills that all nursing students are required to learn (see for example the Nursing and Midwifery Council (NMC) 2018, Nursing and Midwifery Board of Australia 2013). Competency has been a professional requirement in the UK for some time, identified formerly in the NMC Essential Skills Clusters (NMC 2010) and now in the standards of proficiency for registered nurses (NMC 2018). Students have reported differences between what they are taught about aseptic technique in university and what they have observed and are taught in clinical practice (Ward 2010; 2011). Variations in the practice of aseptic technique by healthcare professionals has been reported in the UK (Aziz 2009), and have led to the introduction of a new approach to practice called the Aseptic Non-Touch technique (ANTT[®]) to standardise aseptic technique in the NHS (Rowley 2001). The ANTT[®] Clinical Practice Framework consists of a set of principles and safeguards to be applied during all invasive procedures (The Association for Safe Aseptic Practice (ASAP 2019). ANTT[®] is characterised by the underlying principle of protecting 'key parts' and 'key sites' from contamination (Fraise and Bradley 2009). However, a non-touch technique is regarded as a safeguard rather than a principle (ASAP 2019).

Research exploring nursing students' education and training in aseptic technique is sparse. Studies have investigated the effectiveness of different learning/teaching approaches in clinical skills development with a focus on aseptic technique (O'Neill 2001; Jeffries et al. 2002; Melby et al. 2007; Wright et al. 2008 Watts et al. 2009; Walsh et al.2011). Other studies have explored nursing students' experiences of infection prevention practice, and reported poor role models for aseptic technique in clinical placements (Ribu et al. 2003; Geller et al. 2010; Ward 2010, 2011, 2012a, 2012b; Gould and Drey 2013; Carter et al. 2017).

Only three studies have explored nursing students' knowledge, understanding and competency in aseptic technique (Davey 1997; Gonzalez and Sole 2014; Carter et al. 2017). In Davey's (1997) qualitative study using in-depth interviews and a written exercise, second year Australian nursing students' (n=18) demonstrated greater understanding of the aim and procedure than the underlying principles of aseptic technique. A descriptive, pilot study by Gonzalez and Sole (2014) in the United States of America (USA) used video recorded observations to assess nursing students' (n=13) competency in urinary catheterisation in the simulated environment and to identify the breaches in asepsis that most frequently took place. Seven students breached aseptic technique despite reporting that they were confident and had previously been assessed as competent in simulation (Gonzalez and Sole 2014). In Carter et al.'s (2017) USA national survey exploring the relationship between time spent in infection prevention education and nursing students' (n=3678) knowledge, attitudes and practices of aseptic technique, 99% of students agreed that they understood the meaning of aseptic technique. Most students (63%) reported receiving aseptic technique education through simulation and nearly a third (32%) had received 1-3 hours of education. Carter et al' s (2017) study provides some insight into how aseptic technique is taught and the time spent in aseptic technique education as reported by students.

The studies described above, although limited in terms of scope and approach to sampling, indicate that students lack knowledge, understanding and competency in aseptic technique with the potential to jeopardise patient safety. The study described below fills an important gap in the literature. No previous study has comprehensively explored when, what and how undergraduate nursing students are taught aseptic technique and assessed in university and clinical practice.

3.METHODS

The aim of this cross-sectional survey was to investigate when, what and how undergraduate nursing students are taught and assessed with regards to aseptic technique in pre-registration nursing programmes in the UK.

3.1 Study design

A national cross-sectional survey was undertaken to explore preparation to undertake aseptic technique in pre-registration nursing curricula in the UK.

3.2. Settings and participants

All universities (n=72) in the UK delivering pre-registration undergraduate adult nursing programmes were identified from the search facility on the NMC website. The chief executive in each nursing department was identified from the university website and approached by email to invite participation and suggest the member of staff best placed to complete the survey. The nominated participant was then informed about the purpose of the study via email and invited to participate. Participants received verbal and written information about the study and were provided with the opportunity to discuss any concerns they may have had prior to signing the consent form.

3.3 Data collection

In order to ensure internal validity, the survey questions were developed in conjunction with an expert panel and pilot-tested. Members of the expert panel were chosen for their expertise. The panel comprised four lecturers, a practice facilitator, a skills tutor, a researcher and two infection prevention experts. Eight panel members came from Cardiff University, seven selected by the researcher and the other was the researcher's supervisor. There was one external and independent panel member, an infection prevention and control expert from another university who was recommended by the researcher's supervisor.

The expert panel were involved in the initial development, testing and review of questions in the structured interview schedule. An internal pilot study was conducted

in the researcher's own university to test and refine the interview schedule and data collection process. Pilot telephone interviews were conducted with two programme managers for the undergraduate, pre-registration adult nursing programme at Cardiff University. Two external pilot sites were chosen from the small finite population of universities (n=72) delivering pre-registration adult nursing programmes. Two pilot interviews were conducted with lecturers involved in infection prevention teaching in each university. No further modifications were necessary following the external pilot study. After the pilot study, structured telephone interviews were conducted with educators at a mutually convenient time once signed consent forms had been returned.

3.4 Ethical Considerations

Ethical approval was granted by the ethics committee of the School of Healthcare Sciences, Cardiff university. Participants were informed that participation was voluntary, that they could withdraw from the study at any time and that their identity and that of their organisation would not be revealed in any publication.

3.5 Analysis

Descriptive and inferential statistical analyses were undertaken using the Statistical Package for the Social Sciences IBM SPSS Version 25. Descriptive statistical analyses (frequency distributions, measures of central tendency and dispersion) were used to describe, summarise and identify patterns in the data in relation to when, what and how aseptic technique is taught and assessed across undergraduate programmes. Inferential statistical analysis was performed to explore relationships between variables. Non-parametric statistical tests were employed because data were not normally distributed.

The Chi-square test was used to explore relationships between nominal variables or the Fisher's exact test, where the expected frequency was less than 5 in a cell of a contingency table. Cramer's V was calculated to test the strength of the relationship between nominal variables. A Mann Whitney U test was used to explore if there was any statistical difference in time spent teaching aseptic technique between programmes with one or two student intakes per year. A Mantel Haenszel test was

used to look for any associations between cohort size and different teaching and assessment methods.

4.RESULTS

4.1 Response rate and respondent characteristics

Response rate for the survey was 70% (n=49). Most respondents (n= 32, 65.3%) were lecturers or senior lecturers for adult nursing or clinical skills/simulation. Different programme variables for responding universities are presented in Table 1.

4.2 When is aseptic technique taught in programmes?

Most respondents (n=34, 69.3%) reported that aseptic technique was taught throughout the three year programme. A high number of universities reported teaching aseptic technique applied to wound care in the first 91.8% (n=45) and second year 63.8 % (n=30). Aseptic technique applied to injection technique was most commonly taught in the first year, reported by 67.3 % (n=33) of universities. Most universities reported teaching urinary catheterisation 78.7% (n=37) and care of intravenous infusions and devices 63.8% (n=30) in the second year of their programmes.

4.3 What is taught about aseptic technique?

All respondents reported that teaching was underpinned by one or more clinical guidelines. The majority of universities (71.4%) identified the use of two or three different guidelines (see Table 2). ANTT[®] guidelines were mentioned by 46.9% (n=23) respondents (see Table 3). Forty different responses were given by nurse educators when questioned about the principles underlying aseptic technique taught to students. Of these six were judged by the research team to reflect the underlying principle of aseptic technique of protecting susceptible sites from contamination (see Table 4). The remaining 34 responses were not classified as principles and categorised as relating to professional standards, steps undertaken during the clinical procedure, generic infection prevention precautions and miscellaneous information (see Table 5 for examples). Bivariate statistical analysis did not identify any relationship between universities reporting use of ANTT[®] guidelines and identification

of ANTT[®] principles. There was no significant relationship between mention of non-touch technique and reported use of ANTT[®] ($\chi^2 = 3.79$ $p = 0.052$).

4.4 How is aseptic technique taught?

Wide variation in time spent teaching aseptic technique was reported between programmes. Total teaching time ranged from 180-3840 minutes, with a mean total time of 1207.7 minutes (SD \pm 843.9). A Mann Whitney U test found no statistical difference in time spent teaching aseptic technique and the number of student intakes per annum ($p > 0.05$). A Kruskal Wallis test showed no significant differences in teaching time and cohort size ($p > 0.05$). Aseptic technique was reported to be taught by nurse educators in 97.9% ($n = 47$) of universities. Seven (14.7%) participants reported input from infection prevention nurses. A Mantel Haenszel test for trend found a statistically significant relationship for cohort size and involvement of infection prevention nurses ($p = 0.011$).

A range of different teaching methods were reported: practical demonstration by nurse educators 89.9% ($n = 44$), simulation 85.7% ($n = 42$) and e-learning 79.6% ($n = 39$) were reported most often. Bivariate statistical analysis confirmed a significant relationship for number of intakes and reported use of skills stations (where students are required to perform one or more skills/clinical procedures requiring an aseptic technique) ($\chi^2(1) = 4.43$ $p = 0.035$). Cramer's $V = 0.301$ showed moderate effect size. The majority 93.8% ($n = 45/48$) of universities, expected students to prepare before taught sessions by completing pre-reading or e-learning.

Opportunity for all students to practice aseptic technique in university was reported by 93.8% ($n = 45$) of participants. No relationship was found between number of intakes or cohort size, and opportunity for all students to practice aseptic technique in university. Sixty nine percent ($n = 33$) of universities reported that they offered students the opportunity to practise aseptic technique outside formal teaching time. A Chi square test confirmed no statistical significant association between the number of intakes ($\chi^2(1) = 1.76$ $p = 0.184$) and opportunity to practice aseptic technique outside formal teaching time. Nurse educators when asked to make recommendations for change to the way aseptic technique is taught, most commonly identified the need for more time for teaching 26.1% ($n = 12$) and for students to practice 19.6% ($n = 9$) aseptic technique. Different methods of feedback on performance of aseptic technique were

reported, with facilitator (100%) and peer feedback (81.3%) being the most common. No relationship was found between number of intakes or cohort size and different methods of feedback upon performance.

4.5 How is aseptic technique assessed?

Nearly half the participants reported that summative assessment of knowledge 45.8% (n=22) or performance 27% (n=13) of aseptic technique took place in the university, most frequently occurring in the first year of the programme 65.4% (n=17) and 61.5 (n=8). An OSCE/OSCA was the most common summative assessment method, reported by 76.9% (n=10) of participants. No relationships were found between number of intakes or cohort size; and different methods of summative assessment of knowledge or performance. Thirty three percent (n=15) of participants identified that they would like a university-based summative assessment for aseptic technique to be included in their programmes.

The majority, 95.9% (n=47), of participants reported that their programmes had a summative assessment of students' competency in aseptic technique during clinical placements. A high number of universities reported assessing competency in years two: 95.7% (n=47) and three: 87.2% (n=41) than year one 36.2% (n=17). Thirty six percent (n=16), of participants reported that competency was assessed in every year of the programme. Few participants 6.4% (n=3) reported use of ANTT or criteria-based competency assessment to assess students' competency during clinical placements.

5.DISCUSSION

The findings of this survey demonstrate wide variation in the amount of teaching between universities and variability in what nursing students may be taught about aseptic technique by educators in pre-registration nursing programmes. Furthermore, in some cases, there was evidence to suggest that there may be inaccuracy in the principles of aseptic technique taught to students. Another important finding is the lack of regular, criteria based competency based assessment of students' performance of aseptic technique. Collectively, these findings suggest that more could be done to prepare nursing students to undertake aseptic technique.

Few significant relationships were found between different programme variables and the use of different teaching and assessment methods, suggesting that programme size had no influence upon educational delivery. A statistically significant relationship was found between cohort size and involvement of infection prevention nurses, suggesting that, the larger the cohort size, the greater number of infection prevention nurses involved. In programmes with larger student intakes more staff are required to facilitate sessions, increasing the likelihood of drawing upon the expertise of infection prevention nurses to assist. A significant relationship was found between the number of student intakes and reported use of skills stations, inferring that skills stations are more likely to be used in programmes with two intakes per year than one intake. Skills stations may be more efficient, allowing students to practice over a shorter period of time requiring less staff time, making them more likely to be used in programmes where the frequency of teaching aseptic technique is high.

This study is the first to explore in detail what, when and how undergraduate nursing students are taught and assessed with regards to aseptic technique in UK pre-registration nursing programmes since the introduction of ANTT[®] (Rowley 2001) and NMC Essential Skills Clusters (NMC 2010). The survey is unique in providing an educators' perspective upon preparation for undertaking aseptic technique in pre-registration nursing curricula. The survey findings suggest that ANTT[®] has not been integrated into the pre-registration nursing curricula by all universities. The survey findings cannot provide any explanation as to why aseptic technique may be taught or assessed in a particular way in some universities and not others.

The survey findings provide a more comprehensive and detailed understanding of when aseptic technique is taught in pre-registration programmes than earlier studies (Melby et al. 1997; O'Neill 2001; Jeffries et al. 2002; Wright et al. 2008; Watts et al. 2009). Aseptic technique was more widely taught with application to wound care than any other clinical procedure. It was reported to be taught applied to different types of clinical procedures with increasing complexity across different years of the programme. Students were not prepared to undertake aseptic technique in all types of clinical procedures which they might encounter such as wound, urinary catheters and IV infusions/devices prior to their first clinical placement. This may suggest the use of a spiral curriculum approach whereby basic concepts or ideas are introduced and repeatedly revisited and built upon until they are fully understood by students (Bruner 1960). A spiral curriculum requires sequencing and linkage to be made

between different sessions in an upwards spiral as the student progresses through the programme for meaningful learning (Chambers et al. 2013). The survey did not enquire about the nature of the curricular approach used by institutions, however, the findings suggest that such an approach was not adopted and the teaching of aseptic technique was piecemeal. Although previous studies have explored strategies used to develop nursing students' skills in aseptic technique (Melby et al. 1997; O'Neill 2001; Jeffries et al. 2002; Wright et al. 2008; Watts et al. 2009), there is no evidence available that has investigated curricular approaches used.

No previous study has attempted to identify what principles of aseptic technique are taught to students or how they are taught. Educators' inability to differentiate between principles, professional standards and steps of aseptic procedures is concerning. Educators have a professional and ethical responsibility to teach aseptic technique, a core skill, accurately (NMC 2010; NMC 2018). Six different principles were identified by educators derived from the underlying principle of protecting susceptible sites from contamination (Ayliffe and English 2003). Four of these principles appear to resemble ANTT[®] principles or safeguards (ASAP 2019) (see Table 2). However, it can be argued that a non-touch technique is a principle rather than a safeguard and was in existence prior to the introduction of ANTT[®] (Ayliffe and English 2003). The distinction between safeguards and principles of ANTT[®] is unclear. Identification of key parts of equipment (e.g. needle) and key sites (e.g. wounds or indwelling devices) is classified as a safeguard and protection of key parts and key sites from micro-organisms as a principle (ASAP 2019).

The survey findings indicate much variability in the principles of aseptic technique taught to students (see Table 2 and 3) across programmes. Failure to teach one underlying principle of aseptic technique accurately may be responsible for the reported variations in practice and difficulty in applying the principles safely in practice upon patients, increasing the risk of infection. Nurses have the closest contact with patients and are the largest professional group (WHO 2018). Aseptic technique may be undertaken by nurses, almost every day in a range of settings (Aziz 2009; Rowley and Clare 2011; Gould et al. 2017a). It is easier for students to learn one fundamental principle than learn and recall multiple principles. It is no wonder that students have been found to lack knowledge, understanding and competency in aseptic technique (Davey 1997; Gonzalez and Sole 2014).

This is the only study to establish the guidelines underpinning the teaching of aseptic technique and uptake of ANTT[®] guidelines by universities. Multiple guidelines were identified as in use which may be confusing for students. Approximately half of respondents identified the use of ANTT[®] guidelines (ASAP 2019). The reason why some universities and not others have adopted ANTT[®] cannot be established from the survey. Educators may not be up to date with national infection prevention guidelines which mention ANTT[®] (Loveday et al. 2014; National Institute for Clinical Excellence 2017). The ANTT[®] guidelines are free but only available upon request from the ANTT website (ASAP 2019), which might influence the uptake of ANTT[®]. ANTT[®], originally conceived to standardise healthcare professionals' aseptic technique, may have overlooked targeting universities to implement ANTT[®] in pre-registration programmes. Attempts to standardise aseptic technique practice are unlikely to be effective unless they include students who are the future workforce.

This survey gains an educators' rather than students' perspective upon how aseptic technique is taught, and a whole programme view compared to Carter et al.'s (2017) survey. Total teaching time as reported by educators ranged from 3 to 64 hours, higher than reported in Carter et al.'s (2017) study, where 66% of students reported receiving between one to eight hours of aseptic technique education and 27% in excess of 8 hours, although the upper limit of time is unknown. Despite greater time for teaching being reported in this survey, educators identified the need for more time for teaching and for students to practice an aseptic technique, suggesting some dissatisfaction with current educational provision.

Simulation was the most common teaching method reported by 86% of respondents followed by e-learning (80%) corroborating Carter et al.'s (2017) findings in which the majority of students (63%) reported receiving most of their aseptic technique education in simulation. A limitation of Carter et al.'s (2017) survey is that the findings relied on accurate recall of time in education by students, some of which had not completed their programme.

This study increases understanding of how aseptic technique is assessed in pre-registration programmes. The survey findings revealed that students might not have regular assessment of aseptic technique in university or clinical placements. Only half of universities conducted a university-based summative assessment of students' performance of aseptic technique, most commonly an OSCE in the first year. In

Gonzalez and Sole's (2014) study, a first year competency assessment of aseptic technique in urinary catheterisation in the simulated environment was insufficient for skill mastery and retention. Early assessment enables errors or poor practice to be identified before they become ingrained. Nearly a third (32.6%) of educators wanted inclusion of a university based assessment of aseptic technique in programmes.

Over a third of universities (36%) assessed competency in clinical practice in each year of the programme. Similarly, in Stayt and Merriman (2013) survey evaluating nursing students' (n=421) perception of skill development in clinical placements, 63% of students reported never or only sometimes having the opportunity for mentor assessment of aseptic technique. Lack of opportunity for assessment is not consistent with competency-based education and may be detrimental to aseptic technique practice. These findings are consistent with the concerns expressed by many authors that the traditional, single competency assessment once an integral part of nursing training in the UK has disappeared (Takahashi 2000; Unsworth and Collins 2011; Gould et al. 2017a).

In the absence of a university-based assessment there is reliance upon assessment of students' competency in aseptic technique by mentors in clinical placements. Students were found to be assessed against subjective competency statements rather than objective performance criteria by mentors, qualified nurses who have been widely criticised for being poor role models (Geller et al. 2010; Ward 2010, 2011, 2012a, 2012b; Gould and Drey 2013). Use of performance criteria is preferable to judging practice against a competency statement which might be interpreted differently by mentors (Hunt et al. 2012; Bennett and McGowan 2014; Helminen et al. 2014; Almalkawi et al. 2018) given the reported variation in aseptic technique practice (Aziz 2009). Assessment of aseptic technique by mentors may lack rigour and consistency. Students and qualified nurses should be assessed against the same objective performance criteria (Rowley 2001; Ward 2011).

Greater time is devoted to teaching aseptic technique in some pre-registration programmes than others. Students may have less time than others to develop their knowledge and skills, despite having to achieve the same competencies (NMC 2010). Aseptic technique should be given the same priority across programmes given the need to prevent HCAI and reduce the risk of antimicrobial resistance (DoH 2003; DoH 2014; O'Neill 2016; WHO 2016a). Nurses have the closest contact with patients

and are the largest professional group (WHO 2018). Aseptic technique may be undertaken by nurses, almost every day in a range of settings (Aziz 2009; Rowley and Clare 2011; Gould et al. 2017a). It is imperative that students, the future workforce are prepared appropriately to prevent HCAI and reduce the risk of antimicrobial resistance (DoH 2003; DoH 2014; O'Neill 2016; WHO 2016a).

The survey findings provide an overview of education and training in aseptic technique in undergraduate, pre-registration nursing programmes in the UK at one point in time. More extensive research is required in the UK and elsewhere. It is recommended that future research should focus upon a more in-depth exploration of nursing students' learning and understanding of aseptic technique in undergraduate programmes using case-studies.

4.2 Limitations

A single educator from each university responded to the survey. The nominee might not have been best-placed to provide information. No data were collected upon staffing and resources in university to determine the influence upon educational delivery. Social desirability was a risk, with participants wanting to uphold the reputation of their university. There was no follow-up of non-responding universities or participants that declined to participate in the survey, therefore the motivation of participants that did or did not respond is unknown. It cannot be established whether those participating were any different from those who did not. The survey might have established whether a spiral curriculum was being used, and if so, whether it was effective.

6.CONCLUSIONS

The survey findings suggest that teaching and assessment of aseptic technique in undergraduate nursing programmes is sub-optimal and requires further investigation. Improving nursing students' education, training and assessment in aseptic technique is critical for raising the standard of aseptic technique practice in the future nursing workforce to reduce HCAI and the risk of antimicrobial resistance globally. A review of education, training and assessment in aseptic technique is required not only in undergraduate nursing programmes but in other healthcare professional programmes

where aseptic technique is taught. The survey findings may have implications for the teaching of other core skills in undergraduate nursing programmes.

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Table 1: Different programme variables

	Programme variables	n (%)
Mode of delivery	Full-time only	47 (95.9)
	Part-time only	1 (2.0)
	Full-time & Part-time routes	1 (2.0)
	Total	49 (100%)
Duration of full-time programmes	Three years	45 (93.8)
	Four years	1 (2.1)
	Three or Four year	2 (4.2)
	Total	48 (100%)
Intakes per academic year	One	23 (46.9)
	Two	25 (51.0)
	One or Two (different across sites)	1 (2.0)
	Total	49 (100%)
Cohort size	-Small ≤100 students	4 (8.2)
	-Medium 101-300 students	29 (59.2)
	-Large ≥301 students	16 (32.7)
	Total	49 (100%)

Table 2: Number of guidelines used by universities

Number of guidelines	n (%) of universities
1	7 (14.3)
2	18 (36.7)
3	17 (34.7)
4	2 (4.1)
5	4 (8.2)
6	1 (2.0)
	Total 49 (100%)

Table 3: Different types of guidelines identified as in use

Type of guidelines used	n (%) of universities
Royal Marsden Clinical Nursing Procedures	41 (83.7)
ANTT Clinical Practice Framework	23 (46.9)
NHS Trust/hospital guidelines	20 (40.8)
Clinical skills net	14 (28.6)
National Institute for Clinical Excellence (NICE) guidelines	10 (20.4)
Other Educational texts/online resources	6 (12.2)
Other National Guidelines	6 (12.2)
epic Guidelines	5 (10.2)
Royal College of Nursing (RCN) guidelines	2 (4.0)
Responses n=49 universities	

Table 4: Principles identified by nurse educators

'Principles' in rank order	n (%) of universities
1. Non-touch principle or technique**	38 (77.6)
2. Protection of key parts and key sites*	25 (51.0)
3. Identification of key parts and key sites**	25 (51.0)
4. Only sterile items come into contact with susceptible sites	24 (49.0)
5. Preventing cross-infection	14 (28.6)
6. Asepsis is the aim for all invasive procedures*	12 (24.5)
*ANTT [®] principles **ANTT [®] safeguards	

Table 5: Other responses not classified as principles

Examples of other aspects identified as taught principles	
Professional standards	Aseptic technique procedure related
Preparation (patient, environment, area or self)	Disinfect/clean work surfaces
Documentation	Checking sterile items are intact and in date
Communication/Explanation to patient	Clean hand, dirty hand
Consent	One wipe discard
Generic infection prevention precautions/knowledge	Miscellaneous
Hand hygiene	Use of clean technique
Personal protective equipment	Follow what mentor teaches
Safe disposal of equipment	No complacency
Basic Infective precautions	