



Development of consensus-based international antimicrobial stewardship competencies for undergraduate nurse education

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SUMMARY

Background: There is growing recognition by national and international policymakers of the contribution nurses make towards antimicrobial stewardship. Although undergraduate education provides an ideal opportunity to prepare nurses for antimicrobial stewardship roles and activities, only two-thirds of undergraduate nursing programmes incorporate any antimicrobial stewardship teaching and only 12% cover all the recommended antimicrobial stewardship principles. Nurses also report that they do not have a good knowledge of antibiotics, and many have not heard of the term antimicrobial stewardship.

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Undergraduate nurse education
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Aim: To provide international consensus on the antimicrobial stewardship competency descriptors appropriate for undergraduate nurse education.

Methods: A modified Delphi approach comprising two online surveys delivered to an international panel of 15 individuals reflecting expertise in prescribing and medicines management in the education and practice of nurses; and antimicrobial stewardship. Data collection took place between February and March 2019.

Findings: A total of 15 participants agreed to become members of the expert panel, of whom 13 (86%) completed round 1 questionnaire, and 13 (100%) completed round 2. Consensus was achieved, with consistently high levels of agreement across panel members, on six overarching competency domains and 63 descriptors, essential for antimicrobial stewardship practice.

Conclusion: The competency descriptors should be used to direct undergraduate nurse education and the antimicrobial stewardship practices of qualified nurses (including those working in new roles such as Nursing Associates) due to the high levels of agreement reached on competency descriptors.

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Introduction

Antimicrobial-resistant (AMR) infections cause approximately 700,000 deaths globally each year, which is predicted to rise to 10 million, combined with a cumulative cost of US\$100 trillion, by 2050 [1]. Antimicrobial stewardship (AMS), described as ‘a collection of co-ordinated interprofessional focused strategies to optimize antibiotic use by ensuring that every patient receives an antibiotic only when it is clinically indicated and then receives the appropriate antibiotic, at the right dose, duration and route of administration’ [2], requires collaboration between different healthcare providers [3–5].

Nurses are the largest single group in healthcare. Although an applied discipline, nursing is implemented differently based upon the social, political, and cultural climate within which it is practised. International and national nursing definitions and descriptions share key features including a common purpose, values, and functions, incorporating as its clientele individuals of all ages, families and groups [6–9]. Nurses worldwide perform numerous functions critical to the success of AMS programmes. Not only are nurses increasingly prescribers of antimicrobials, therefore making them key contributors to appropriate prescribing interventions, but they are also directly involved in patient- and medicine-related stewardship activities (such as timely antibiotic administration, specimen collection, monitoring treatment and adverse events) [10–14]. Nurses are also essential knowledge brokers at the centre of – and facilitators of – interprofessional collaborative practice necessary for optimal AMS practice [15,16]. Nurses can exert leadership to increase public education and awareness of AMR [9]. For example, general practice nurses are well placed to communicate AMR messages to the general public, school nurses are in an excellent position to communicate AMR messages to young people, and health visitors to communicate these messages to young families [9,3,17]. International and national policies include nurses as important to AMS efforts [3,11,18–21]. Furthermore, some evidence suggests that AMS interventions targeted at nurses may lead to improvements in overall volume and quality of antibiotic use [22–24].

Undergraduate healthcare professional education is a cornerstone for the containment of AMR, with a need to embrace a comprehensive and structured approach such as that adopted

by infectious diseases training programmes [16,25–27]. However, undergraduate healthcare professional students in the UK receive disparate stewardship education with only two-thirds of nursing programmes incorporating any AMS teaching and only 12% covering all of the recommended AMS principles [26]. Furthermore, although both undergraduate student nurses and qualified nurses believe that AMS is relevant to pre-registration nursing education, they report that they do not have a good knowledge of antibiotics, and many have not heard of the term AMS, with fewer nurses than doctors or pharmacists aware of the term [28–30]. These educational gaps surrounding AMR and AMS are likely to be replicated worldwide, meaning that newly qualified nurses are at great risk of compromising patient safety. It is therefore vital that undergraduate education prepares them for the role they will play in AMS programmes.

To enable the nursing profession to define its own scope of AMS practice, it is essential to identify the knowledge, skills, attitudes and behaviours expected of nurses for optimal use of antibiotics. Fifty-four national core competency descriptors in AMS have been previously developed for UK healthcare professional undergraduate education [16]. However, these competency descriptors represent a minimum standard. They will be emphasized to a greater or lesser extent depending on professional role, with each different profession requiring specific knowledge in order to achieve AMS competencies in a cohesive manner yet consistent with their role scope. This current research study was undertaken to provide international consensus on the AMS competency descriptors appropriate for undergraduate nurse education.

Methods

Ethical considerations

The School of Healthcare Sciences Research Governance and Ethics Committee, Cardiff University, provided ethical approval for the study (Reference number 607RE).

Design

In the absence of research evidence, and where there is a desire to gather opinion, structured or formal methods are

commonly used to reach consensus. The Delphi technique is a widely used formal consensus method which elicits the views of an expert panel on a topic using a series of data collection rounds [31]. A benefit of the Delphi technique is the potential to derive consensus across large numbers of participants who are geographically dispersed [31]. Furthermore, unlike traditional group meetings, the Delphi technique avoids meetings becoming dominated by one individual or influenced by coalitions between group members [31]. In a classic Delphi survey, the round 1 questionnaire collects qualitative data through open-ended questions. These data are then used to develop subsequent questionnaires [32,33]. As pre-existing national AMS competencies exist, the current study adopted a modified Delphi survey whereby these pre-existing competencies replaced the round 1 survey [16,31]. A modified Delphi is an appropriate option if pre-existing information is available [31].

Recruitment

As opposed to a random sample representative of the target population, 'experts' are employed by the Delphi technique as Delphi panel members. However, there is a lack of agreement as to what constitutes an 'expert' and it is recommended that explicit criteria are used to recruit participants [34]. The authors of the pre-existing AMS competencies highlight that the competencies will be emphasized to a greater or lesser extent depending upon professional role and advocate-testing and refining across the different healthcare professions [16]. The aim of our study was to provide international consensus on the AMS competency descriptors appropriate for undergraduate nurse education. Therefore, 'experts' in this study were nurses reflecting expertise in infection, including prescribing and medicines management in the education and practice of nurses; and antimicrobial stewardship.

Identification of expert panel members

Purposive and snowball sampling methods (i.e. a non-probability sampling technique whereby existing study participants identify potential future subjects) were used to recruit expert panel members across eight countries (including Brazil, UK, South Africa, US, Canada, Norway, Thailand, France) including one pan-African organisation. Using purposive methods, individuals in the 'international community of practice for nurses in AMS' (a group of nurses from several countries formed organically following the celebration of the first International Summit on Nurses in Antimicrobial Stewardship in London in 2016) who fulfilled the 'expert' criteria were identified and contacted by the researchers. Individuals who fulfilled 'expert' criteria were also identified through the Royal College of Nursing. Participants identified in this manner, then referred researchers to other potential participants (i.e. snowball sampling). All individuals contacted who fulfilled the 'expert' criteria were those experienced in AMS with advanced and specialist knowledge and working in clinical, managerial, education, and research roles.

Sample size

In line with sample size recommendations for a homogeneous sample, we aimed to recruit between 15 and 20

participants [35]. All those who expressed an interest in participating and who fulfilled our 'expert' definition were included.

Recruitment procedure

Fifteen individuals fulfilled the expert criteria and expressed enthusiasm to take part. Each participant received an e-mail containing the information sheet, and were given the opportunity to speak to a researcher to address any queries they may have had. All 15 agreed to participate. Implied consent to participate was provided through the completion of consensus survey questionnaires.

Data collection

Online Surveys – a tool for creating web surveys – was used to develop the two survey rounds. An e-mail (containing a link to online survey 1 and subsequently survey 2) was sent to each participant inviting them to take part. Each survey round was open for three weeks and follow-up reminder e-mails were sent at weekly intervals. Data collection took place between February and March 2019.

Round 1 questionnaire

The existing national AMS competencies appropriate for undergraduate healthcare professional education formed the content of the round 1 Delphi survey. Using a six-point Likert scale (1 = not at all important, 6 = extremely important) participants were asked to rate each descriptor with regards to importance [16]. An open-ended question at the end of each domain invited interpretation and feedback, and the identification of any additional descriptors thought to be missing.

Round 2 questionnaire

Prior to round 2, a report of the quantitative results of round 1 survey was circulated to panel members inviting interpretation and feedback. Descriptors for which there was a lack of agreement, those amended in the light of qualitative feedback, and additional descriptors identified by panel members, were included in survey round 2. This survey, administered in the same way as round 1, was only administered to those who had completed round 1. A summary of the Delphi process is shown in Figure 1.

Data analysis

The most frequently used method to achieve consensus in Delphi studies is median scores and interquartile ranges (IQRs) [36]. This method was also used to develop the published consensus based national antimicrobial stewardship competencies [16] and is considered robust [37]. Median scores and IQRs were calculated for descriptor responses, to characterize the answer category above and below which 50% of the answers fell. IQRs were used to represent the spread of the data and to assess the level of consensus per question. Consistent with previous studies [38,39,16], responses where the median was ≥ 5 (i.e. a high level of agreement that participants viewed it as important) with a small IQR (≤ 1.5) were considered important descriptors that had reached consensus across expert panel members. Qualitative responses were explored using content analysis [40].

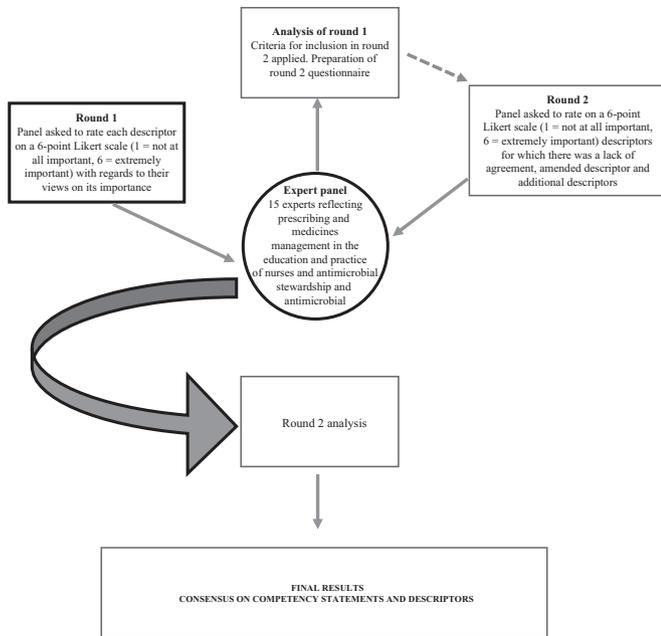


Figure 1. Summary of the Delphi process.

Results

Of the 15 participants who agreed to take part, 13 (86%) completed round 1 questionnaire, and 13 (100%) completed round 2 (Appendix, Table A1 for Expert Panel details).

Round 1 survey results

Of the 13 expert panel members who responded to the round 1 survey, there were high levels of agreement for all 54 competency descriptors with medians in the strong range of agreement (5 or 6 on the six-point Likert scale) (Appendix, Table A2). The strength of agreement was high for 53 descriptors (IQR ≤ 1.5) but lower for one descriptor, i.e. 'Demonstrating knowledge and awareness of international/national strategies on infection prevention and control and antimicrobial resistance such as Global Action Plan for AMR and Save Lives – Clean Your Hands (<http://www.who.int/gpsc/5may/en/>) and the UK Government's 5-year Antimicrobial Resistance Strategy'. Qualitative content analysis of open-ended responses identified 10 new descriptors (Appendix, Table A3). Four descriptors (including the descriptor above for which the strength of agreement was low) were amended in the light of qualitative feedback (Appendix, Table A3). These amended descriptors and the 10 new descriptors (14 in total) were taken forward to the round 2 survey.

Round 2 survey results

Thirteen participants (100%) responded to the second round. There were high levels of agreement for all 14 descriptors, with medians in the strong range of agreement (5 or 6 on the six-point Likert scale) (Appendix, Table A4). The strength of agreement was high for 13 descriptors (IQR ≤ 1.5) but lower for one descriptor, i.e. 'Describe the most common

mechanisms that micro-organisms use to impair antimicrobial action' (Appendix, Table A4). International consensus was reached on six overarching competency statements (subdivided into six domains) and 63 individual descriptors essential for AMS in nursing professional practice (Appendix).

Discussion

International AMS competencies were developed for undergraduate nurse education by use of a Delphi technique, a formal consensus process. The existing national AMS competencies for undergraduate healthcare professional education formed the content of the round 1 survey, and so the traditional round 1 of a Delphi survey was unnecessary [16]. Consensus was achieved, with consistently high levels of agreement across panel members, on six overarching competency domains representing the knowledge, skills, attitudes, and values that shape the judgements essential for AMS, and 63 descriptors reflecting learners' experience and type of practice setting. The integrative approach used by the framework enables descriptors to be integrated throughout nurse undergraduate education programmes facilitating the incremental building of AMS knowledge and skills [41,42].

Consensus was achieved on all but one of the 54 competency descriptors identified previously as a minimum standard for undergraduate healthcare professional education [16]. However, a further nine descriptors were identified as specific to nursing in order to achieve AMS competencies consistent with the roles of nurses. Such addition to the descriptors may simply reflect the variety of roles and responsibilities as well as expectations included within the remit of nurses worldwide. Some of these new competency descriptors focused upon patient care activities (e.g. specimen collection, treatment monitoring, interpreting laboratory results) and their utilization (e.g. recognizing the importance of adequate specimen collection during antimicrobial use, recognizing the response to antimicrobial treatment, interpreting culture and sensitivity results that demand prompt attention) to achieve optimal AMS practice. Other descriptors centred upon the central role of nurses as communicators and patient educators about AMR, e.g. enabling self-care for patients and promoting family engagement in infection prevention and control activities, or recognizing those patients and families in need of support to complete a course of antibiotics. These findings align with the nursing literature that describes the role of nursing stewardship education as recognizing and utilizing established nursing functions to synergize with optimal AMS goals and outcomes [43,44].

Nurses worldwide are involved in an array of patient care activities critical to the success of AMS programmes. Our competencies will provide evidence of AMS in nurse education programmes and learners' practice. They also provide a baseline for those involved in continuing education, with regards to the minimum standard required of nurses. In addition to guidance for nurses, they will also provide guidance for those working in new roles such as Nursing Associates in the UK [45]. Increasing numbers of nurses prescribe medicines (including antimicrobials) with prescribing competencies now embedded into nursing programmes. Within the UK, a novel approach to nursing practice and education has been initiated, with newly qualified nursing practitioners of the future graduating as being

able to demonstrate ‘the ability to progress to a prescribing qualification following registration’, thus changing the landscape of how and by whom healthcare is delivered [46]. Our framework will strengthen AMS in undergraduate programmes, in preparation for this role. The competencies may serve as a template to support international cadres of healthcare providers other than nurses, yet closely aligned to nursing responsibilities, such as community health workers or community birth attendants who may also have a role in AMS [47]. Furthermore, through the use of a locally delivered modified Delphi survey, these competency descriptors can be refined, expanded and focused to reflect the local situation in countries other than those represented in this study. For example, in some countries, legislation does not permit nurses to prescribe medicines. A locally delivered survey will enable refining of competency descriptors consistent with role scope.

We encourage those involved in undergraduate nurse education to map these competencies against existing curricula, adopting (and if necessary adapting) them and then evaluating their efficacy and relevance to nursing practice. Although the competencies may result in clinical improvements by addressing well-reported educational and attitudinal gaps about AMS among nurses, their effectiveness remains to be established. The competencies can be incorporated within the numerous learning opportunities integrated throughout undergraduate nurse education programmes, helping to refine existing resources, address shortfalls, and enabling AMS components to be clearly described and assessed. Additionally, our competency framework supports current and future standards of proficiency for registered nurses [48] and so can be used by regulators and professional bodies to inform proficiency standards and guidance.

Our findings should be integrated within national and international AMR action plans. This will ensure that the contribution of nursing is recognized, and that it can be demonstrated and monitored. Many AMR action plans are explicit at strategic level but may not always include implementation details. Refining and detailing the contribution of nurses provides a unique opportunity to demonstrate what other professionals can do in the implementation of AMS strategies and the difference they make. These competencies, and their inclusion within undergraduate nurse education programmes, should be promoted globally by schools of nursing and national councils of nursing. Nursing as a profession continues to evolve and build upon evidence-based research. As our understanding of how nurses can contribute to stewardship and support other healthcare professionals develops, these competencies will form a framework to provide continuous improvement in stewardship efforts.

The main strengths of this work are that it is based on responses from an international panel of defined experts, that it had a good response rate, and that it offers a framework of AMS competencies appropriate for undergraduate nurse education. This is the first nursing framework addressing AMR and AMS. However, there are some limitations. First, purposive and snowball sampling methods were used to recruit expert panel members. Although such experts were chosen to achieve a broad range of expertise, with experience of collaborative working, researching and designing nursing services, and involvement in national and international policy, only a small number of participants were included from each country and so may not reflect the full spectrum of nurses involved in AMS.

Therefore, our findings may not present an accurate picture of this population or be completely relevant to all nurses engaged in AMS interventions. Nevertheless we argue that multiple elements of these competencies reflect optimal nursing behaviours that are shared across different countries, clinical areas and domains and are already embedded in nursing practice and applied to the local situation.

Second, in an attempt to reduce attrition rate, the round 2 questionnaire was shortened by only including the descriptors from round 1 for which there was a lack of agreement. This meant that stability of responses was not assessed across the two survey rounds. However, interpretation and feedback was invited from participants on a report of the collated results which was shared with participants prior to survey round 2.

Finally, we acknowledge that these competency descriptors focus largely on clinical and bedside aspects, and may be further expanded and refined to explore other elements centred on leadership or executive and even political skills that may be increasingly seen as essential to enable clinical competence [49,50]. As AMR is recognized as a global and planetary matter driven by broad social determinants, such leadership skills may also be progressively adopted [51].

In conclusion, the competency descriptors should be used to direct undergraduate nurse education and the AMS practices of qualified nurses (including those working in new roles such as Nursing Associates) due to the high levels of agreement reached on competency descriptors. This will help to optimize AMS goals and outcomes. We encourage those involved in nurse education to map this framework to existing curricula and adopt and test competency descriptors.

Conflict of interest statement

E.C.S. is affiliated to the National Institute for Health Research (NIHR) Health Protection Research Unit (NIHR HPRU) [HPRU-2012-10047] in Healthcare Associated Infection and Antimicrobial Resistance at Imperial College London in partnership with Public Health England and is an NIHR Senior Nurse and Midwife Research Leader. E.C.S. has received a Wellcome ISSF Faculty postdoctoral fellowship, an Early Career Research Fellowship from the Antimicrobial Research Collaborative at Imperial College London, and acknowledges the support of the Florence Nightingale Foundation and the NIHR Imperial Patient Safety Translational Research Centre. The views expressed in this article are those of the authors and not necessarily those of the NIHR or the Department of Health and Social Care.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.jhin.2019.08.001>.

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