

**BIOSCIENCES IN NURSE EDUCATION: IS THE CURRICULUM FIT FOR PRACTICE?
LECTURERS' VIEWS AND RECOMMENDATIONS FROM ACROSS THE UK.**

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ABSTRACT

Aims & Objectives

This study aims to review the biosciences component of pre-registration nursing programmes in higher education institutions across the United Kingdom through the experiences and perceptions of lecturers involved in nursing education.

Background

Studies suggest that some qualified nurses lack confidence in explaining the bio-scientific rationale for their clinical practice. Biosciences can be difficult to understand and integrate into clinical decision-making and require protected time within pre-registration nurse education. In the absence of explicit national guidelines, it is unclear as to the depth and extent biosciences are taught across different institutions and the level achieved at the point of registration.

Design

A survey approach was adopted to generate quantitative and qualitative feedback.

Methods

Data were collected using a semi-structured questionnaire seeking the experiences and views of lecturers involved in teaching biosciences to nursing students across the United Kingdom. Data received from 10 institutions were analysed using descriptive statistics and thematic analysis.

Results

Lecturers reported that the hours of taught biosciences ranged from 20-113 hours, principally within the first year. This represents between 0.4%-2.4% of time within a pre-registration nursing programme (4600 hours). Large group lectures predominate, supplemented by smaller group or practical work, and online materials. The biosciences are

assessed specifically in half the institutions surveyed and as part of integrated assessments in the rest. In relation to student feedback, all respondents stated that students consistently requested more time and greater priority for biosciences in their programme.

Conclusions

This survey suggests that the number of hours spent teaching biosciences is minimal and varies widely between higher education institutions. All respondents expressed concern about the challenges of teaching difficult bio-scientific concepts to large groups in such limited time and called for greater clarity in national guidelines to ensure that all nurses are adequately educated and assessed in bioscience subjects.

Relevance to clinical practice

Failure to understand the biosciences underpinning care has implications for safe and competent nursing.

Key words: Biosciences, pre-registration, nurse education, quality assurance, patient care, clinical decision-making

What does this paper contribute to the wider global clinical community?':

This paper:

- Represents the experiences and recommendations of lecturers providing biosciences teaching for pre-registration nursing programmes in 10 UK higher education institutions
- Identifies a wide variation in delivery methods, assessment strategies and time dedicated for biosciences teaching in programmes across the UK
- Recommends the development of a quality assurance framework, incorporating minimum outcomes for the biosciences, to meet pre-registration standards at the point of registration to enhance patient safety and care.

INTRODUCTION

The nursing role and nurse education have changed markedly. What was once nurse training has moved from a hospital-based apprenticeship system to the introduction of academic programmes, culminating in United Kingdom (UK)-wide degree-level programmes in 2011 (Nursing and Midwifery Council (NMC) 2010). There has been a shift to establish nursing as an academic profession underpinned by a distinct body of knowledge. Whilst nursing education has evolved, the nursing role has undergone greater change, with nurses expected to be autonomous practitioners, delivering nurse-led services and undertaking independent prescribing in practice environments that are dynamic, unpredictable and reactive. The role is becoming more demanding and complex. Clarity is, therefore, required concerning nurses' contribution to health care and what knowledge base supports the nursing role. Whilst it is acknowledged that nurses require a range of knowledge types to inform clinical decision-making and deliver holistic care, there has been, and continues to be, a debate about the role of biosciences in nursing and nursing education.

The nursing role as defined by 6C's (NHS England 2012), and publications such as Report of the Mid Staffordshire NHS Foundation Trust Public Inquiry (Francis 2013), emphasise the 'compassion' and 'caring' aspects of nursing and the behavioural aspects of nursing roles. The third 'C' - 'competence' – acknowledges the expertise and technical knowledge required to deliver effective care and treatment (NHS England 2012). The neglect of underpinning scientific knowledge, however, reinforces the concerns put forward by Wynne *et al.* (1997) nearly two decades ago. These authors argued that neglect of the biological and physical sciences has led to an imbalance in nursing knowledge which hinders nurses' ability to practice safely. Indeed, increasing numbers of adverse patient outcomes related to patient care are being reported (Neuberger 2013) alongside evidence that 'at risk' or deteriorating patients are not always identified (Levett-Jones *et al.* 2010). The increased expectations of

the nursing role in the 21st century, we suggest, reinforce that pre-registration education should be built on firm scientific foundations to achieve the levels of competence expected and demonstrable through the instrumental and expressive components of caring (Woodward 1997).

The Biosciences in Nursing Education (BiNE) Group was set up in 2012 as a specialist reference group of the Higher Education Academy (HEA) Health and Social Care Cluster. The group brings together academics with experience in pre-and post-registration nurse education from across the UK to share, discuss and develop biosciences education, scholarship and research. The group comprises over 30 experienced nursing and biosciences academics whose work includes teaching biosciences to nursing students in 17 UK higher education institutions (HEIs). The BiNE group defines 'biosciences education' as including anatomy, physiology pathophysiology, biochemistry, genetics, cell biology, pharmacology, and microbiology.

The BINE membership expressed concerns about the level, content, teaching, assessment and application of biosciences knowledge in nursing programmes. Questions were raised about whether nurses, at the point of registration today, have sufficient biosciences knowledge to deliver safe, evidenced-informed care. These concerns formed an important driver for this survey.

This article presents the results from a larger study which seeks to profile the biosciences education currently offered in nursing programmes across the UK. This, part 1, represents the results relating to the pre-registration nursing programme. Part 2, focusing on continuing professional education, is planned.

BACKGROUND

In the UK, the biosciences knowledge required by newly qualified nurses remains ill-defined both in terms of actual content and level of understanding. Whilst, at the point of registration, nurses must demonstrate achievement of education standards (NMC 2010) there is no nationally defined curriculum. It remains up to individual HEIs to specify the theoretical content of the programme whilst meeting NMC standards.

Internationally, there has been a long history concerning the role of biosciences in nursing education and a wealth of literature focused on the learning and teaching of biosciences in pre-registration curricula. Davis (2010) highlighted a document by Wilson (1975) as an important start-point for research into biosciences in nursing. This history acknowledges the relevance of the biosciences for evidence-informed nursing practice, holistic care and patient safety (Wynne *et al.* 1997, Prowse *et al.* 2005, Smales 2010). There has also been recurring themes of; insufficient biosciences in programmes and evidence that students want to know more (Nicoll *et al.* 1996, Davis 2010); who should teach the biosciences (Casey 1996, Larcombe *et al.* 2003, Cash 2005); and the difficulties students have learning and applying the biosciences to their practice (Clancy *et al.* 2000, McKee 2002, McVicar *et al.* 2010, Craft *et al.* 2013). Studies also explore innovative teaching and assessment strategies to enhance biosciences knowledge and students' ability to apply the biosciences to clinical situations (Gresty *et al.* 2003, Koch *et al.* 2010, Al-Modhefer *et al.* 2010, Efstathiou *et al.* 2012, McVicar *et al.* 2014).

Until the late 1970s, a medical model of care predominated in nursing (Davis, 2010). However, this philosophy changed from the 1980s as nursing attempted to characterise its unique role within healthcare. At this point, the psychosocial aspects of patient care were

given much greater attention. This new focus brought with it a reduction in the biosciences into programmes and raised concerns from several nurse educators (Wynne *et al.* 1997).

This history has relevance today. Many nurse educators continue to equate the inclusion of the biosciences in the nursing curriculum as promoting a medical model of care. In addition, the lack of biosciences knowledge of many nurse lecturers is an issue and can perpetuate the problem by reducing the biosciences content of programmes.

Nursing students are reported to have more positive attitudes to biosciences than their lecturers (Friedel *et al.* 2005). Ashelford *et al.* (2014) report that students are emphatic about the need to study and understand the biosciences in order to provide safe, holistic patient care and have credibility with their patients and within the multi-professional team. The level of biosciences in pre-registration programmes, and required at the point of registration, continues to be debated.

The themes identified in the literature, together with the issues reported from the BiNE membership, raise significant concerns about the ability of nurses to understand the scientific rationale for their practice. This study advances the evidence by surveying pre-registration programmes across multiple UK HEIs following the introduction of graduate level entry to the nursing register.

The aims of this study were to:

- Explore the experiences, concerns and recommendations of BiNE members about biosciences in nurse education

- Capture and evaluate current provision of biosciences learning and teaching in pre-registration programmes across the UK
- Provide evidence on which to base recommendations as to how future educational provision can improve student experiences of biosciences and to ensure future graduates are competent safe practitioners.

METHODS

Design

A survey approach consisting of a semi-structured questionnaire was adopted. Both open ended and closed questions were incorporated to generate quantitative and qualitative feedback. BiNE members were asked to reflect on their experiences, detail their concerns and make recommendations as to how future educational provision can better prepare student learning of biosciences in pre-registration programmes.

The questionnaire addressed the main themes covered in the literature alongside concerns raised by BiNE members. These included:

- Science entry requirements for pre-registration programmes
- Prioritisation and time allocated to biosciences within pre-registration programmes
- How biosciences are taught and assessed
- How biosciences knowledge and teaching are viewed and prioritised by nursing colleagues and in curriculum development
- Student feedback about biosciences

The questionnaire was piloted by four BiNE members and minor modifications made before circulation.

Data collection

The questionnaire was distributed via email to 30 registered BiNE members across 14 UK HEIs. Members belonging to the same HEI were asked to provide a collated response to ensure only one response per HEI. Responses from 10 HEIs were received representing the views of 22 BiNE members. Responses were allocated number to anonymise the data.

Analysis

Descriptive statistics were used to analyse quantitative data. Qualitative data derived from open ended questions were analysed inductively and coded and categorised to identify key themes.

Ethical considerations

Following review by the Higher Education Academy (HEA) Health and Social Care Cluster, ethical approval was deemed unnecessary due to the audit nature of the survey.

RESULTS

Science entry requirements for pre-registration programmes

Ten questionnaires were returned representing HEIs across the UK. Of these, 5 required science at either GCSE and/or A-level (Table 1). However, science did not necessarily mean natural/life sciences but could be social sciences. Five required no science at all.

Insert Table 1 here

The issue of science entry requirements revealed differing views across the institutions. Six respondents would like to see science within entry requirements, with two HEIs recommending that the NMC review national entry requirements to include science:

it would be better if (GCSE science) were an NMC requirement (HEI 7).

One HEI reported that those without biology struggle during first year. Another reported that lack of biology as entry requirement meant that only a very basic level of science could be taught:

accepting students with a wide range of prior knowledge of bioscience tends to limit progress of a cohort of students (HEI 5).

Others were not convinced that barring those with poor science background would be appropriate, suggesting that it is the ability to learn concepts that is more important. Also, this approach may affect recruitment to programmes and potentially good students could be lost. The tension between raising the level of bioscience entry requirements and widening participation was noted:

..increasing the entry requirements to include A-level biology or chemistry would reduce the need for teaching foundations in these subjects in first year. However, in adding additional requirements we could fail to recruit some very good candidates (HEI 5).

One recommendation was *'to encourage HEIs to 'work with colleges of further education to increase the level of biosciences within the access to nursing courses'* (HEI 4).

Time allocated to teaching biosciences:

A wide disparity between HEIs regarding the number of contact hours for biosciences teaching emerged. Table 2 illustrates the contact hours across pre-registration programmes, including tutorials and laboratories, but excluding directed study time.

Insert Table 2 here

As expected, the number of hours allocated to biosciences in year one was greater than in subsequent years. This reflects the number of contact hours in higher education which normally decrease as students' progress through their programme. The mean number of hours spent teaching biosciences in the first year was 54.3, decreasing to 21 in year two, and 14.6 in year three. In year 1, the range of contact hours varied between 8-75 hours. In year two, for adult nursing, the range differed from 10-40 hours, and in year three, from 0-40 hours. Two institutions reported different hours for different fields of nursing, with Learning Disability and Mental Health fields receiving less taught biosciences. Across the pre-registration programmes, the total amount of taught time spent on biosciences varies between 20-113 hours.

In response to how biosciences are delivered, three HEIs had stand-alone biosciences modules in year one. At nine HEIs, biosciences are integrated or a theme within the curriculum particularly in years two and three, using either case study, clinical scenario or enquiry based learning (EBL) approaches. One HEI had separate biosciences lectures in years 2 and 3.

There were concerns raised by lecturers. Seven expressed a need for more time/ higher priority in the curriculum for biosciences teaching:

There is not enough classroom time dedicated to teaching bioscience..As it is highly conceptual, it needs to be explained, and related to clinical practice (HEI 6).

.. students are not getting enough biology teaching to interpret practice (HEI 9).

There was also concern about the standard of the biosciences achieved at the point of registration and that current levels of biosciences knowledge will not equip nurses for the extended responsibilities arising from changes in healthcare:

What level should we expect to start teaching at and at what level of bioscience should students achieve at the point of registration (HEI 8).

...with increased responsibility the need for a newly qualified nurse to have a better understanding of the biosciences has never been more important. Whilst the biosciences should not dominate a nursing curriculum, anatomy, physiology and pharmacology need to be given higher priority (HEI 4).

A related theme emerged involving the difficulties lecturers' experienced in being able to build upon scientific principles to develop students' understanding and application of biosciences to practice:

difficult to progress ideas and concepts in biosciences coherently after the initial shared module in year 1 because the biosciences are tied to nursing themes in modules (HEI 3)

...materials are delivered by different teams thru [sic] the 3 years – it's then difficult to identify who has done what and to what extent (HEI 10).

Teaching and learning strategies:

All HEIs reported using lectures as the predominant teaching method due to the large numbers of students involved. This heavy reliance on lectures caused concern among respondents particularly when students have such varied science knowledge:

Large intakes in a lecture tutorial format, whilst useful for economies of scale, do not facilitate learning for weaker students with little prior knowledge or developed study skills (HEI 5)

Due to the restrictions imposed on the health sciences team and staffing issues there is far too much emphasis on lectures rather than more applied, practical based teaching (HEI 1),

All HEIs supplement lectures with other teaching methods to enhance learning and application of biosciences. These included follow up tutorials, 'small group' teaching and practical/ laboratory sessions although 'small' groups were often in excess of 25 students. Practical /laboratory classes were viewed as very beneficial for those offering these and are popular with students, particularly for kinaesthetic learners. However, these often require specific facilities, equipment & technical support and as a result only 2 institutions offered practice/laboratory classes:

Other methods were used to integrate bioscience within clinical scenarios, including case studies/vignettes, enquiry/problem based learning, and clinical skills/simulation workshops. However, it was noted that:

Life Science can get lost in shared sessions and tutorials and, in assessments, students can often pass integrated assessments yet "fail" the life science (HEI 2).

Another approach is directed/open learning often using e-learning. This strategy is popular as it reduces the time spent in class thus reducing pressure on staff, rooms and equipment. Instead, the students are required to commit allocated time to studying particular concepts

without face-to-face lecturer contact. The lecturer involvement is in finding, creating and adapting suitable resources and checking that students are learning effectively. However, there are time, resource and specialist IT expertise implications. Staff who create their own resources may require training in IT, recording and editing. Concerns were expressed about relying on these methods particularly for students whose science background is weak:

Simply getting students to do self-directed or directed study is not the answer, unless a solid science background is already established (HEI 7).

Despite the resource implications, participants recommended more practical sessions, more application/integration of theory and practice, more time for small group sessions and more assessment of biosciences:

The application of biosciences to nursing should be a key priority within any nursing curriculum (HEI 4).

However, all appeared acutely aware that, with increasing student intakes, this presents challenges for programme leads. In addition, the pre-registration programme is under pressure to cover an extensive range of subjects resulting in intense competition among subject specialists for curricular time.

Assessment strategies:

Lecturers identified the range of assessment strategies offered for the biosciences within the pre-registration programmes. Half of the programmes included specific biosciences focussed assessments in year one and one HEI included a biosciences exam in year two. In addition, biosciences are included as part of integrated assessments in nine HEIs, during years two and three.

Lecturers raised concerns about the assessment of the biosciences in their institution. When biosciences assessments are held in year 1, they highlighted the risk that the content is learnt for the exam but then forgotten if not developed in other assessments:

As only assessment is in year one learned for OSCE, it can then be forgotten due to lack of revisiting or reinforcement in other areas of the curriculum. There is not enough assessment that directly tests student knowledge and application of biosciences (HEI1)

40% pass mark for MCQ test at year one is a start but with multiple resits it means that students are likely to pass with limited understanding and thereafter manage to hide biological ignorance in integrated assessments (HEI2)

Biosciences lecturers were supportive of including biosciences in integrated and applied assessments. They were, however, not routinely involved in developing or marking these. Comments were made that integrated assessments contain significantly less biosciences content and these are marked by nurse lecturers and practitioners who are often ill-prepared to assess accuracy of biosciences knowledge:

Difficulties experienced in developing explicit criteria to enhance inclusion of biosciences to appropriate level in year 2/3 assessments. Academics do not appear confident to identify inaccurate/accurate information relating to biosciences. Students expected to include evidence of biosciences in practice learning portfolios but this is non-existent and mentors do not appear to facilitate this integration in clinical practice (HEI8)

A&P knowledge should be applied throughout the course and evidence provided within the portfolio. This is not assessed by the bioscience lecturers (HEI 7)

How biosciences knowledge and teaching are prioritised by nursing colleagues and in curriculum development

All respondents reported that low priority is given to biosciences but also acknowledged that there are great pressures on curricular time:

In the battle ground that often represents curriculum development the biosciences are underrepresented. This has a negative impact on the students' perceptions of the importance of biosciences to nursing (HEI 4)

Most lecturers reported that nursing colleagues agreed in principle that biosciences are important but, in reality, respondents felt this was not given sufficient priority and that some colleagues did not value their specialist input:

Bioscience knowledge is, by some, considered important (child and adult fields). Mental health colleagues generally regard biosciences as irrelevant to mental health nursing. It is considered to take up time in the curriculum that could be used for 'nursing content' and seen as something that should be integrated or applied. There is a general lack of understanding that students have to understand the principles and have a baseline knowledge before this can start to be applied or integrated and also that students need support to enable this integration – that it will not happen 'by chance' (HEI 8)

General lack of support for the need of biosciences knowledge from some colleagues. The assumption is that nurses need to know communication and skills and should be more hands on. (HEI 3)

Several HEIs employed specialist biosciences lecturers from different faculties/schools to teach the biosciences and this was usually delivered in year 1. Concerns were raised from these biosciences teaching teams in relation to their status and involvement in teaching and curriculum development:

Specialist Bioscience teachersdo first year lectures but were not involved in developing curriculum and have expressed concern that they cannot teach the material in the time allowed (HEI 2)

The biological science lecturer has felt isolated and unsupported by nurse academics and constantly battling to raise the profile and significance of the biosciences in the curriculum despite excellent student evaluations and requests for more of this content (HEI8).

Some respondents commented that nurse lecturers were either reluctant to teach biosciences topics themselves or did not see the relevance for nursing roles:

Other nurse academics are reluctant to engage in bioscience teaching or to develop their knowledge and understanding in order to contribute to this teaching. Some believe that they have this knowledge but their lecture notes suggest inaccuracies. Others do not see the relevance of the biosciences for nursing roles - often relating back to their own pre-registration/nursing careers decades ago (HEI 8).

It was reported that hours spent on the biosciences had declined markedly over the years:

Modular courses and changes in resources have meant less face –to-face hours over the last decade. Nursing colleagues tend to keep as many hours as possible for themselves; thus causing biosciences to be side-lined and diluted (HEI 3)

In relation to this, there were many concerns over the safe practice of nurses due to lack of biosciences knowledge:

Not covering this knowledge then endangers patients, leads to increased death rates and poor quality of nursing care. Care is not holistic unless the pts [patient's] clinical dimension is fully addressed (HEI 10)

Respondents recommended that biosciences should be given higher priority:

With well taught science, we can improve the quality of nursing care, reduce morbidity and save lives. And help the clinical teams in much wiser ways (HEI 10)

Some felt the only way this would be achieved would be setting national standards /outcomes endorsed by the NMC:

Again I believe that the NMC must specify the minimum requirements for the science curriculum. Universities may differ in the emphasis but there must be a minimum... (HEI 2)

National outcomes for level of bioscience knowledge at the point of graduation would help to change the mindset of nursing colleagues with entrenched views about their own 'training' and lack awareness about the changing role of the nurse ... (HEI 8).

Respondents from two HEIs highlighted the low numbers of nursing lecturers with biosciences qualifications and recommended this needed addressing before biosciences knowledge is insufficient to underpin safe, competent practice:

Nursing academics to develop their level of knowledge about biosciences/pathophysiology to reduce reliance on a few (HEI 8).

Student feedback

Respondents commented on issues raised by students through course evaluations / National Student Survey (NSS) findings. It appears that the majority want more taught time spent on these subjects, regardless of how much biosciences teaching they receive:

The vast majority of students see bioscience as important and want much more taught time in the subjects (HEI 6)

Students request more of this content viewing it as 'what they expected to be taught in a nursing programme (HEI 8)

The students' value biosciences content and those teaching it very highly, despite the high volume of content to cover in limited time:

Well taught, the students love it and will say that they have learnt so much of value to their patient care (HEI 10)

Lecturers from three institutions commented that students found biosciences topics challenging, particularly if they had poor science background:

They often state they find it difficult, (especially those without A level science) but want more of it and enjoy the subject (HEI 5).

Overall, student feedback from most institutions highlighted the importance and value they placed on the biosciences to underpin safe practice and patient care:

They often feel not enough time is dedicated to the subject which they feel is important and relevant for practice (HEI1)

DISCUSSION

The challenges of teaching biosciences to nurses are well documented (Caon *et al* 1993, McVicar *et al.* 2001, McVicar 2009). This survey supports the findings that a lack of science entry criteria, large student intakes, no explicit national guidelines for biosciences continue to be common problems for those who teach biosciences within HEIs. This, along with increasing competition with other subject areas within a crowded curriculum, are reported to have detrimental effects on student attempts to learn, apply and integrate biosciences into their care and practice. Biosciences in current pre-registration curricula may, therefore, be unfit preparation for new Registrants.

The study confirms the disparity in taught hours for biosciences within HEIs across the UK with total teaching hours varying from 20-113 hours. This represents 0.4-2.4% of hours in a pre-registration nursing programme of 4600 hours and is reported to be declining further despite two decades of evidence that the amount of taught biosciences in nursing

programmes is inadequate (Nicoll *et al.* 1996, Jordan *et al.* 1997, Clancy *et al.* 2000, McVicar *et al.* 2010, Davis 2010).

To counteract the decline in taught hours, lecturers are using additional innovative methods to enhance biosciences learning including online materials, reusable learning objects (RLOs) and practical sessions. Larcombe *et al.* (2003) reported that laboratory-based basic science sessions can work well when delivered in collaboration with a nurse lecturer to highlight the relevance to nursing practice. More recent studies (Gretsy *et al.* 2003, Green *et al.* 2006, Koch *et al.* 2010) suggest e-learning and blended learning approaches are being utilised to supplement learning. These strategies are, however, not without their challenges. Students have to be motivated to use e-learning (Farrell 2006), technical support is necessary and, to meet students' diverse learning preferences, blending e-learning with face-to-face teaching should be offered. Currently, evidence on the effectiveness of these methods is limited (McVicar *et al.* 2014). The 'bioscience problem' in nurse education is unlikely to be solved by reducing access to effective biosciences teaching and shifting the emphasis on to students to undertake directed study.

As reported previously (Caen 1993, Clancy *et al.* 2000, McGee 2002, Gretsy 2003, McVicar 2009, McVicar *et al.* 2010 Craft *et al.* 2013), many students find learning and applying biosciences difficult and can become very anxious particularly if they have not studied any life sciences prior to entering nurse education. This could be addressed by changing entry criteria. Respondents in this study were, however, divided about the benefits of this as it may prevent suitable candidates from entering the profession. Nevertheless, applicants may benefit from updating or pre-course preparation for the biosciences.

Whilst students report finding biosciences challenging, this survey reinforces that nursing students also consider biosciences to be essential to deliver holistic evidence-informed patient care and underpin safe practice. Unfortunately, students experience nursing lecturers and mentors who often lack an appreciation and/or knowledge of the biosciences themselves. It is also clear that students need to gain an understanding of the application of biosciences to practice. This raises the issue of who should teach biosciences to nurses. There is no doubt that both biosciences knowledge of the teaching staff and its application to practice are crucial (Casey 1996). Abstract concepts with no clinical link are difficult to grasp. As reported here and in the literature, some nursing lecturers feel inadequately prepared or lack confidence to teach biosciences (Nicoll *et al.* 1996) and have difficulty simplifying the subject for students (Green *et al.* 2000). Students value subject experts who possess the ability to explain scientific concepts in understandable terminology and appreciate how this underpins practice and decision-making in clinical settings. All respondents report receiving positive evaluations for the varied teaching methods and the application of biosciences to nursing. Whilst there is a strong argument that the ideal lecturer is a nurse or health care professional with a bioscience degree (Friedel *et al.* 2005, Smales 2010), respondents identified that lecturers with such dual qualifications are rare. In this survey, those that do the teaching are often either scientists or nurses without science qualifications. A collaborative approach, involving nursing educators working closely with biosciences lecturers could provide the best solution to this problem. This is a recommendation endorsed by Larcombe *et al.* (2003) and Wynne *et al.* (1997). Unfortunately, this joint working approach is not routinely encountered.

There is insufficient involvement of biosciences subject specialists in curriculum design across provision in half of the HEIs surveyed. As curriculum space is at a premium, it would be beneficial to involve biosciences lecturers in curriculum and assessment planning to maximise the opportunities to improve application to practice. Responders identified that only with specific NMC outcomes or quality benchmarking frameworks would the situation

improve. Rather than working collaboratively with nursing programme leads, biosciences lecturers report feeling side-lined and marginalized. Justifying space within the curriculum is a constant battle despite repeated student-requests to increase the time allocated to the biosciences.

Creativity in assessing biosciences is also recommended. Multiple choice questions (MCQ) feature particularly in year 1 of programmes. These are considered useful for assessing knowledge retention (Brake 2005) but may not encourage deep learning (McCoubrie 2004). Integrated assessments, including case studies and OSCEs, are identified as being used within several HEIs. OSCE's can be used to assess application and integration of knowledge (Mitchell *et al.* 2009). The importance of involving lecturers who are knowledgeable in the biosciences to support the development of specific criteria relating to biosciences knowledge and the marking process was reinforced by respondents. The use of integrated assessments may also encourage lecturers and mentors to collaborate in assessing students' underpinning biosciences knowledge and their ability to integrate and communicate this in their clinical decision-making.

Whilst respondents focused principally on biosciences education within HEIs, concerns about the level of biosciences knowledge of some mentors were also raised. Creating collaborative opportunities to enhance the teaching, learning and assessment of the biosciences in practice appears unexplored in these HEIs alongside recognition of the support needs of mentors. These merit further exploration. Clarke (1995) suggested that nurses who act as mentors in the clinical areas do not have the knowledge in an explicit enough form to teach in an applied way and the problems for students will be perpetuated if new cohorts of qualified nurses cannot articulate the relevance of biological sciences as a basis for nursing care. More recently, Friedel *et al.* (2005) and Logan *et al.* (2011) identified

that some nurse educators and mentors may not have sufficient biosciences knowledge to help nursing students apply this knowledge to practice. Following the requirement for graduate-level entry to nursing, it appears timely to re-examine the role of, and support for, mentors who facilitate students to apply and integrate biosciences in practice. In addition, opportunities exist to review programmes and implement a framework which explicitly and incrementally supports students to (1) develop an understanding of the biosciences, (2) apply the biosciences to practice/field-specific examples and (3) integrate biosciences into clinical decision-making within both HEIs and practice settings to ensure that pre-registration curricula are fit for practice.

Recommendations

This survey makes recommendations to enhance biosciences in pre-registration programmes and ensure pre-registration curricula are fit for practice including:

1. Developing national outcomes for the biosciences to be achieved at the point of registration to ensure greater emphasis and curricula time on biosciences within programmes
2. Incorporating a wider range of teaching, learning and assessment strategies for biosciences in each year of the programme to facilitate understanding, application and integration of biosciences knowledge
3. Ensuring assessments in HEIs and practice include specific criteria relating to the biosciences
4. Engaging biosciences expertise in curriculum design, delivery and assessment and to support lecturers and mentors with biosciences teaching

5. Acting on students' feedback regarding demand for, and support required to learn, apply and integrate biosciences into their practice

CONCLUSION

The teaching of biosciences, their application to clinical practice and integration in clinical decision-making to inform evidence-based holistic patient care needs to improve. Forty years of evidence has documented the 'bioscience problem' and the challenges faced by students, educators and practitioners, as well as the detrimental implications for patient care and safety. Nurses should not only base their practice on sound biological knowledge but should be seen and heard to do so if they are to enhance their credibility with patients and clients not to mention their employers (Clarke 1995). Credibility within the multi-disciplinary team is also important as nurses' advocate for their patients. This survey reinforces the wide variation in content, delivery, assessment and level of biosciences teaching across UK institutions raising concerns about nurses' biosciences knowledge at the point of Registration and whether pre-registration biosciences curricula are fit for practice. In the absence of national guidance relating to the biosciences, the BiNE group is using its collective expertise to progress the debate from problem identification to solution focused. By producing a Quality Assurance Framework for the Biosciences in Nurse Education, the BiNE group will promote minimum outcomes guidance for the biosciences to be achieved by nursing students at the point of Registration.

RELEVENCE TO PRACTICE

The nursing workforce is under great pressure to adapt to new discoveries in our understanding of health and illness, new treatment techniques, new drugs and a greater demand for health services. Because of the increasing complexity of illness and expectations that nurses will prescribe medications, biosciences are becoming even more

important. The nursing curriculum must adapt to these changes but not lose sight of the fundamental requirement that nurses know and understand the structure and function of the human body in health and illness. Failure to understand the biosciences underpinning care has implications for safe and competent nursing.

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Tables

Table 1. Minimum science entry qualifications

Entrance requirement	Number of HEIs
No science qualification	5
GCSE science*	4
A-level science*	2

* Science includes social science as well as natural/life science

Table 2. Number of contact hours of bioscience teaching

Year of study	Mean hours (Range)
1	54.3 (8-75)
2	21 (10-40)
3	14.6 (0-40)