Biomedical scientist training officers' evaluation of integrated (co-terminus) Applied Biomedical Science BSc programmes: a multicentre study

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ABSTRACT

The introduction of the Institute of Biomedical Science (IBMS) portfolio for pre-registration training in 2003 allowed universities to develop integrated (co-terminus) biomedical science BSc programmes. Students undertake structured placements within clinical pathology laboratories as part of their degree. The clinical training and professional development of students is undertaken by training officers (TOs), who are experienced Health Professions Council (HPC)-registered biomedical scientists and usually also members of the IBMS. This study aims to evaluate TOs' perceptions of these integrated degrees as a means of delivering pre-registration training for biomedical scientists. A questionnaire to collect quantitative data and be completed anonymously was sent to TOs, via staff at participating universities. Items considered TOs' perceptions in four categories: how well students fitted into the laboratory team, their professional and scientific development, the impact of delivering integrated degrees on service delivery, and the commitment to training students. Surveys took place in 2007, 2008 and 2009 and involved TOs taking students from 10, 14 and 17 universities each year, respectively. The response rates to the survey were 60% in 2007, 34% in 2008 and 12% in 2009. Participants were representative in terms of age, gender and pathology discipline and had a broad range of experience with students. The overall mean score for TOs perceptions was 3.38 in 2007 which increased significantly to 3.99 in 2009 (Kruskall Wallis test $\chi^2 = 21.13$, $P<0.01$). Mean scores in three of the four categories were positive in 2007, although the impact on service delivery was perceived negatively. In all areas, means were significantly greater in 2009. The results indicate that TOs view the integrated degrees favourably and are happy with the scientific and professional development of students. Although designing training sessions suitable for undergraduates took extra work initially, TOs are committed to delivering the training.

KEY WORDS: Biomedical scientist.
Pre-registration training.
Student.
Training officer.

Introduction

Education and training for biomedical scientists in the United Kingdom has continually changed over the past 100 years to reflect both the requirements of the pathology service and the aspirations of individual practitioners.[1,2] In 2002, the Health Professions Council (HPC) became the statutory body for registration[3] and subsequently introduced its Standards of Proficiency,[4] which all registrants must meet. Trainees are expected to gather material evidence of their knowledge and competence within the workplace, which necessitates interactions with a range of practitioners from their own and other professional groups.[2,4] The Institute of Biomedical Science (IBMS) introduced the registration portfolio in 2003 and this is designed to guide trainee biomedical scientists to obtain and collate suitable evidence of their competence to practise to these standards.[5] Those who complete the portfolio successfully can also apply for Licentiate membership of the IBMS, which allows them to undertake further professional qualifications.[2] The portfolio is generic and is designed to encourage trainees to gain some experience in a range of pathology disciplines. There is also a requirement to demonstrate an awareness of the role of pathology in the wider healthcare context. The decision about whether the trainee meets the required standard of professional practice is made by an independent external verifier, who is a registrant biomedical scientist from another organisation and pathology discipline.

The pre-registration training for many professions which became regulated by the HPC in 2002 already comprised an integrated degree in which theoretical knowledge was combined with clinical placement experience.[6] At this time, the number of students on HPC-approved degree programmes such as physiotherapy and occupational therapy were increasing and there was a requirement for them to experience a wider range of placement experiences.[7] This meant that the university tutors and qualified staff in hospitals delivering the training had to work together to develop ways of running placements that would accommodate these changes.[7] The traditional system of training was to assign one member of staff to teach and mentor one student. However, by re-evaluating the purpose of placements and taking into account the perspective of students, who tend to benefit from working in groups, it was

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possible to redesign placement training into a model that saw two/three students to one trainer.[8,9]

The professional and clinical context of the NHS has also meant a move towards multiprofessional learning at pre-registration level,[10] and the new style of placement easily lends itself to this.[11] The training approach involves students working together to obtain information relating to questions or clinical scenarios set and assessed by the trainer (problem-based learning) and encouraging integration of theoretical knowledge and practical skills.

Similarly, in the late 1990s and early 2000s, undergraduate medical degrees in the UK were redesigned, to reduce the amount of factual information that students needed to learn and reproduce, in favour of a problem-based learning approach, centred on clinical conditions.[12] The other big change is that the degrees have moved away from a model in which the first two years were spent in the university, with little patient contact, to courses where students are sent out on placement from the first year of the programme. This has meant that staff in the departments taking students have needed to adjust their support for, and expectations of, them,[12] as they would have less theoretical background knowledge and also tend to be younger.

Immediately before the introduction of the IBMS registration portfolio, most trainee biomedical scientists met the requirements of an IBMS-accredited biomedical science BSc and the laboratory training separately. Many trainees were already graduates, while others attended university on a part-time basis while employed by the laboratory. When the registration portfolio became available, many university departments offering IBMS-accredited BSc Biomedical Science degrees took the opportunity to adapt their programmes to incorporate an element of professional placement training linked to the HPC standards. This brought pre-registration training for biomedical scientists into line with other professional groups, and it was also hoped that it would improve recruitment and retention.[13] As discussed for the other professional groups mentioned above, this change did require clinical staff to adjust their perspective on the needs and abilities of trainees. Most trainers were used to working with graduates who had some knowledge and understanding of the theoretical aspects of biomedical science and would usually be older than the average undergraduate.

University tutors and biomedical scientists in clinical pathology departments were encouraged to work together locally to design placement models which were feasible for the laboratories as well as suitable for the degree programme. Thus, there are several ways in which the placement training has been included within integrated (co-terminus) degrees. Some university departments use sandwich placements, where students are given structured training throughout one year spent in a pathology department. Others incorporate work-based learning modules into the degree programme during the academic year, either sending students to placement laboratories for one or two days per week or in blocks of several weeks, which may include the university vacations at Christmas, Easter and over the summer.

Regardless of the model of providing the academic and professional training components, students are afforded the opportunity to complete their BSc degree and the IBMS registration portfolio at about the same time – hence the term integrated degree. Each model permits the student either to rotate through a number of pathology departments or be based in a single discipline, depending on local arrangements and placement opportunities.

The IBMS began accrediting these integrated degrees in 2004 and currently 30 are offered in the UK, most of which carry the title of BSc (Hons) Applied Biomedical Science (ABMS).[14] Some of these programmes have also been approved by the HPC.[15] The first cohorts of students completed their degree programmes and became available for employment as registered practitioners in the summer of 2007.[16]

While on placement in a laboratory, the student will be guided and supervised by a training officer (TO). This person would be an HPC-registered biomedical scientist with at least three years' experience as a practitioner and ideally be a member of the IBMS.[17] Their main role is to identify training needs and opportunities for all staff within the department, as well as coordinate in-house training and competence assessment. Some TOs have studied for formal teaching qualifications and they can also take the IBMS Certificate of Expert Practice in Training.[18] Universities that run IBMS-accredited degrees usually offer training days in relevant areas such as teaching methods, reflective practice and gathering evidence for portfolios. Academic tutors work with laboratory staff to design suitable training tasks and provide support as appropriate, but during their time on placement the student will be supervised and guided by the TO. Biomedical scientists who are interested in training tend to commit to the TO role for a period of years. This means that the TO is well placed to assess not only how an individual student is progressing, but how they compare with other trainees.

As pre-registration training is important for any professional group, it is important that the experiences of qualified clinical staff and the students are evaluated, particularly when changes have been implemented. For example, Baldry, Currens and Bithell[19] surveyed physiotherapy clinical placement educators and students to gather their perceptions of the 2:1 placement model which had recently been introduced to UK courses. They used a mixture of questionnaires and interviews and found that staff were generally happy with organising placement training in this way, although some found adjusting to the new model stressful initially.[19]

Forte and Fowler[11] looked at the effect on tutors and students of the introduction of a university-based pre-placement module, where students from physiotherapy, occupational and radiotherapy courses were taught together at a university in London. One interesting finding was that staff from different professional groups reported the value of the opportunity to learn more about each other's jobs and also felt more confident about approaching them to discuss training and other issues.[11] It is also useful to know if any particular type of placement training is better than another, from the point of view of the calibre of the graduates produced. This does not appear to have been addressed extensively, but one systematic review of the literature on physiotherapy placements attempted to identify the gold standard for placement training.[20] This would be especially useful for staff who are writing new programmes or revising existing ones. However, the authors felt that there was a lack of good-quality published evidence to analyse. They

concluded that while design of a programme should take into account professional and regulatory body requirements, the training could be delivered in the manner considered to be feasible and suitable locally.

This study presents the findings of a survey of TOs involved in placement training for ABMS students across the UK. It was designed to assess TOs' perceptions of the placement element of the degree as an effective means of training, as well as the calibre of the students. The study began in 2007, when the first significant cohort of students graduated, allowing TOs to reflect on their experiences of the entire programme as a means of producing competent biomedical scientists. The results presented here form part of a wider evaluation of ABMS degrees, which included surveys of graduating students (in preparation) and employers of these new graduates.[16]

Materials and methods

A questionnaire was designed for pathology laboratory TOs to test their perceptions of a number of aspects of training within an integrated ABMS programme. The questions were written and then tested in a pilot study, during February 2006, involving practising pharmacists who trained MPharm placement students, and was found to perform well and to be statistically robust. The questions were further refined during a meeting of representatives from 13 university departments offering ABMS programmes and the IBMS in May 2006.

Questionnaire design

The questionnaire comprised a series of statements which respondents were asked to react to on a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). In this style of answer, a score of 3 or above indicates a generally positive attitude to the statement. Altogether, there were 25 items which intended to explore TOs' attitudes in four areas:

A How students fit in and become part of the laboratory team (six items)
B The students' professional and scientific development (eight items)
C The impact of training co-terminus students on service delivery (six items)
D Willingness to commit time and effort to be involved in the co-terminus programme (five items)

Participants were also asked to provide basic demographic information, including age, gender, discipline in pathology, the number of students they had trained in the previous five years, the number of years they have been a TO, and IBMS membership.

The questionnaires were distributed electronically to TOs who were known to be involved with an ABMS programme via the course leader or clinical placement tutor from their local university. Respondents were given a choice between printing a copy of the questionnaire, filling it in and returning it by post to their local contact or the project coordinator, or completing the questionnaire as an electronic document and returning it to the project coordinator by email. With this latter method of return, there was a guarantee that the document would be printed and the message deleted, in order to retain the respondent's anonymity.

The questionnaires were sent out towards the end of the academic year, to allow TOs to evaluate their experiences with, and opinions of, final-year students at the point of their graduation and registration as biomedical scientists.

Questionnaires were sent to laboratory TOs who were involved in training students from 10 universities in 2007, 14 universities in 2008 and 17 universities in 2009. All but two of the universities participating in the 2007 study were included in subsequent years, reflecting changes in the provision of ABMS courses being offered around the UK, which increased overall. As the questionnaire was returned anonymously, some respondents may have completed a questionnaire in consecutive years if they were still working in the same role and taking students associated with the same university. This was deliberate and respondents were actively encouraged to complete questionnaires every year, as it was considered that this would highlight any changes in perceptions.

The number of ABMS students on placement each year can vary, both within and between universities. This is due to differences in funding, availability of placement opportunities and individual student performance. This means that the number of TOs directly involved with the course can fluctuate. However, taking the information from all programmes, a notional average of 10 TOs per university programme was used for calculation purposes in this study.

Returned questionnaires were assigned a code, to indicate which university programme had sent students on placement to that TO's laboratory. This code was used in all analyses so that the name of the university associated with it remained confidential. This coding was used to group responses from TOs associated with the same programme and to designate the type of placement arrangement which students from that university undertook. These were designated as concurrent (attendance at university and placement laboratory occurs within the same academic term or semester), sandwich (a single continuous period of placement attendance of around 48 weeks, between level 5 [Year 2] and level 6 [Year 3] of university attendance), 'multiblock' (a series of short continuous periods of placement throughout the academic programme which range from to two to 15 weeks in duration) and single block (single continuous period of placement attendance of between eight and 14 weeks in the summer vacation).

The data were collated and analysed using SPSS v 16.0. Application of Tukey's exact test on the numerical data

Table 1. Number of questionnaires and response rate for each year of study.

Final collection date	Questionnaires received (suitable for further analysis)	Approximate total response rate (%)	Number of university programmes represented by respondents
November 2007	62 (60)	60	8
November 2008	48 (47)	34	6
November 2009	20 (19)	12	10

showed that normal distribution could not be assumed so non-parametric statistical tests were applied.

Results

Table 1 shows details about the questionnaires returned by TOs in each year of the study. It shows that while the number of universities represented by respondents was greatest in 2009, the number of questionnaires received was lowest that year. The response rate each year was calculated using the notional figure of 10 TOs for each university programme.

Demographics

During the study, questionnaires were analysed from a total of 73 (56%) females and 49 (38%) males (eight respondents did not state their gender). The mean age group was 40–49 (age range: ≤29 to ≥60). The majority of respondents (n=55 [2007], n=38 [2008] and n=19 [2009]) indicated that they were IBMS members. The main pathology disciplines were represented fairly equally among TOs participating in this study, with 28 from biochemistry, 35 from haematology and /or transfusion science, 28 from histopathology and/or cytology and 27 from microbiology (including virology). Taking respondents from all three years together, the average duration in the role of TO was 11.95 years (range: 1–30). They had been involved in the training of an average of four integrated degree students (range: 1–13).

Quantitative data

The Cronbach's alpha values for the overall set of items and the four scales were calculated for each year of data collection. It was found to be >0.7 in all cases, which is considered to indicate a statistically robust scale. Figure 1 shows the overall mean score for the entire 25-item scale, for all respondents, over the three years. It indicates a statistically significant increase in the overall mean over this time (Kruskall Wallis test χ^2 = 21.13, P<0.01). Table 2 gives a comparison of the mean scores from each of the scales (A–D) outlined above, again for all respondents for each year of the study. The Mann Whitney U test was applied to compare the means obtained in 2007 and 2009; results show a significant increase for all scores over time.

For three of the universities, replies were received from TOs across all three years of the study. These results were combined and, as shown in Figure 2, they show a similar pattern to that observed for all respondents in Table 2. The response rate for these three groups of TOs for each year were 83%, 93% and 37%, respectively. Comparison of means calculated for 2007 and 2009 indicated statistically significant differences between scores for the overall mean (z = –2.02, P<0.05), scales A (z= –1.96, P<0.05), C (z= –2.01, P<0.05) and D (z= –2.17, P<0.05) but not scale B (z= –1.52, P>0.1).

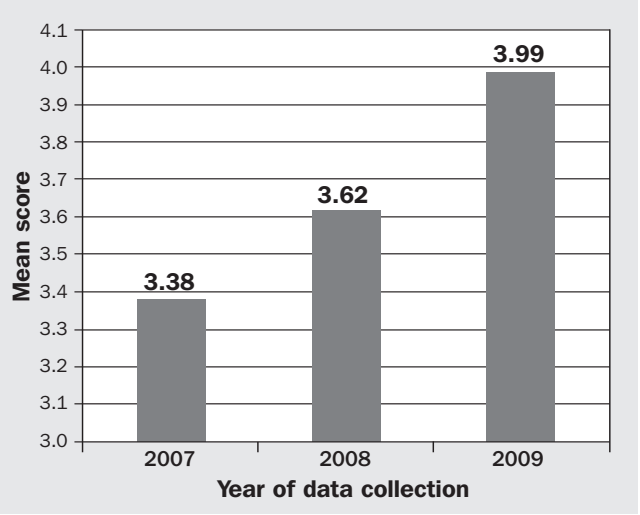

Fig. 1. Comparison of overall mean scores for training officers.

To test whether or not the type of placement had any effect on TOs' perceptions, responses collected for all three years of the study were used. These were then grouped according to placement type and mean scores were compared. As Table 3 indicates, a statistically significant difference between scores for scales A and C was observed, with TOs involved with a sandwich type of placement rating these perceptions most favourably.

Discussion

This study has shown that the biomedical scientists directly involved with laboratory placements, as part of ABMS programmes, are generally satisfied with the scientific ability and professional development of the students and are committed to delivering the required training. These results from TOs add weight to the finding that pathology laboratory managers are keen to employ ABMS graduates,[9] and contribute to the evidence that this form of pre-registration training is suitable for the biomedical scientist profession.

Table 2. Comparison of mean scores for scales A–D over three years.

	2007	2008	2009	
	Mean (SD)	Mean (SD)	Mean (SD)	Mann Whitney U test (z*)
A. Students fitting in to laboratory team	3.62 (0.67)	3.76 (0.65)	4.27 (0.52)	–3.82†
B Students' professional and scientific development	3.58 (0.54)	3.74 (0.52)	4.08 (0.47)	–3.50†
C Impact of 'integrated' degree on service delivery	2.87 (0.60)	3.32 (0.68)	3.55 (0.62)	–3.80†
D Commitment to integrated degree training	3.34 (0.50)	3.54 (0.60)	3.90 (0.52)	–4.03†

*Comparison of means obtained in 2007 and 2009
†P<0.01.

Training officers who participated in this study were broadly representative. The age and gender distribution was similar to that reported for a previous questionnaire survey of IBMS members.[13] Respondents came from across all main pathology disciplines and had a broad range of experience both in terms of time in role and the number students they had supported. Despite the apparently low absolute numbers of questionnaires received, the perceptions of a clearly targeted group of TOs were sought and the response rate was acceptable for this form of research. For example, the survey to evaluate physiotherapy clinical educators and students' perspectives on placements collected questionnaire data from a total of 34 members of staff across 12 NHS trusts,[19] and in a postal questionnaire survey of job satisfaction among IBMS members, the response rate was 10%.[13]

Placement evaluation studies for allied health professionals (AHP) tend to use interviews as the main method of data collection. This usually involves a relatively small number of participants, but the information is still considered valid. Martin and colleagues[8,9] surveyed nine occupational therapy and nine physiotherapy placement trainers in this way and made general conclusions which were useful for organising training of students in these professional groups. The much lower number of replies received in 2009 for the present study is likely to be because the questionnaire was the same each year. Individuals could have been unwilling to respond a second or in some cases a third time. This is suggested by the fall in response rate among the groups of TOs associated with courses from which questionnaires were returned in all three years (Fig. 2). However, the absolute number of 20 questionnaires and the response rate of 12% is comparable to participation rates for the studies cited above. This indicates that the results obtained in third year of the study are credible.

The majority of respondents were IBMS members, which shows clear commitment to the professional body among TOs. This should encourage their trainees to join and become active members, as well as to develop their careers by taking Institute qualifications.[2]

Overall the responses to the questionnaire items changed significantly, to indicate more positive perceptions, during the course of the study (Fig. 1). The data collection was timed to gauge perceptions as the first three cohorts of students taking the new-style ABMS degrees finished. Thus, the results suggest that as TOs are becoming more familiar with the capabilities of the students and the type of training that they require, they are increasing in confidence in the programmes. The university programmes with which the questionnaire respondents were associated varied each year, so it could be suggested that the increases in scores could be due to differences in degree programmes or placement arrangements. However, the separate analysis of the results from the groups of TOs from the three universities where data was available across all three years clearly shows the same positive trend (Fig. 2), which suggests that it is genuine.

The results presented here indicate that from an encouraging start, TOs' perceptions of how well students had fitted into the laboratory team (scale A) improved during each year of the study (Table 2). They clearly viewed the students as 'biomedical scientists in training'. Similarly, TOs' assessment of the calibre of the students improved over

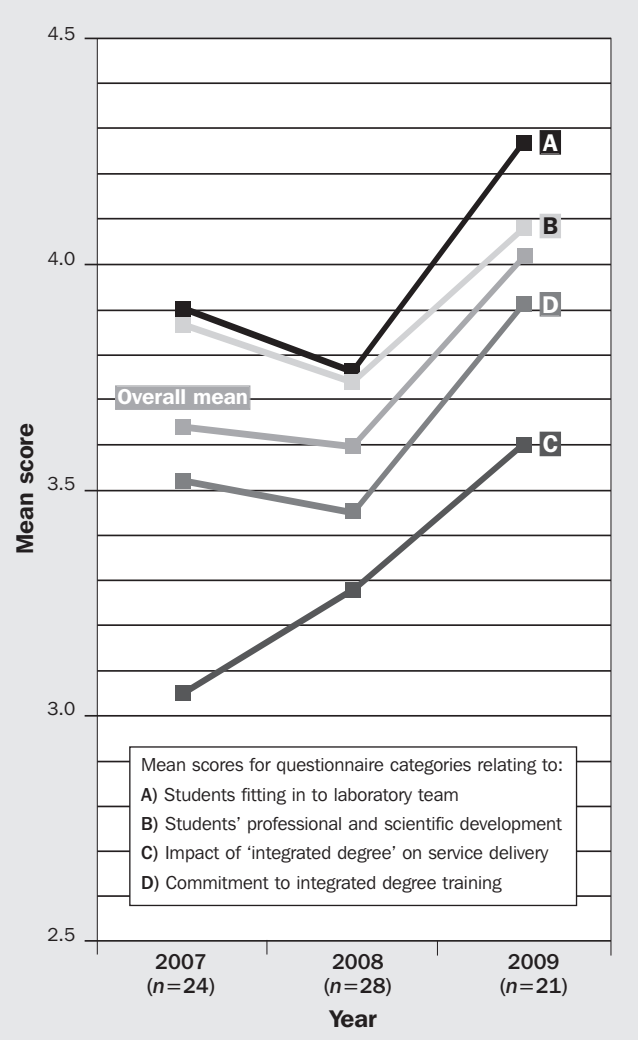

Fig. 2. Mean scores for training officers, by year, for programmes where responses were received for all three years of the study.

time (Table 2). This implies that once they adjusted to the idea of taking on undergraduate students as trainees, TOs saw that their skills and attitudes were developing well. This is in line with the perceptions of how students should develop on placement that has been reported for other professional groups.

The changes to medical training was partly due to a feeling within the profession that students should have contact with patients and work with qualified staff in the clinical situation as early as possible so that they start understanding how doctors think and behave.[12] Allied health professional students work with clients and discuss cases as part of their placement experience and are clearly expected to develop their clinical and professional skills, rather than simply observe others.[8–11]

The introduction of the pre-registration portfolio[5] in 2003 and its subsequent inclusion into undergraduate degree programmes required TOs to adjust their approach to training. The results obtained here indicate that while this necessary adjustment was perceived initially to have a negative impact on service delivery, in subsequent years this was less marked (Table 2, scale C). The recent changes to the placement model for AHPs brought similar anxieties to clinical placement educators, even though it was clear that a

Table 3. Comparison of mean scores by placement type for TOs for all three years.

	Concurrent (n=54)	Sandwich (n=41)	Multiblock (n=12)	Short block (n= 8)	
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Kruskall-Wallis test (χ^2)
Overall	3.49 (0.52)	3.63 (0.49)	3.56 (0.46)	3.27 (0.48)	3.70
A Students fitting in to laboratory team	3.65 (0.69)	3.93 (0.55)	3.97 (0.45)	2.98 (0.83)	13.82*
B Student's scientific and professional development	3.75 (0.58)	3.60 (0.52)	3.86 (0.48)	3.69 (0.37)	3.95
C Impact of 'integrated degree' on service delivery	3.01 (0.68)	3.36 (0.68)	2.90 (0.62)	2.88 (0.52)	7.97†
D Commitment to integrated degree training	3.38 (0.62)	3.65 (0.46)	3.38 (0.60)	3.43 (0.55)	5.25

*P<0.01, †P<0.05.

change was inevitable and would be beneficial in the long term. For example, trainers reported spending time adapting their training programmes and approaches to teaching so that they are suitable for groups of students, which required extra work. Also, they still felt that they need to interact differently with each individual student and that this was tiring and stressful.[8,9,19] However, as for the TOs in the present study, the reason for the change was accepted and supported by the AHP trainers.

Despite these issues, TOs reported a clear commitment to delivering the required training in 2007, and this increased during the study (Table 2, scale D). This is not unexpected, as universities worked very closely with laboratory practitioners to design the placement element of ABMS courses and to ensure that the training is relevant and of a suitable standard.[16] This relationship between the university and the clinical staff is key to the successful delivery of placement training. For example, the number of students on the occupational therapy and physiotherapy placements evaluated by Martin and colleagues[8,9] varied from one per trainer to three, according to local negotiation. Professional staff involved in training tend to be very committed to their role, but what they are asked to offer for students has to be realistic and can depend on the pressures within their working environment.

The integrated degree is designed to give students a multidisciplinary experience and this commitment to the programme has encouraged biomedical scientists to work more closely with colleagues from other departments within pathology and across the hospital. This effect of greater cooperation between tutors and understanding of other practitioners' roles has been noted by others as the effect of changing to interprofessional teaching for AHP students.[11]

Although there are education and placement standards that ABMS courses must meet for IBMS accreditation[21] and HPC approval,[22] there is flexibility in the length and structure of the placement training. Each university is expected to work with their local laboratories to design a package that will suit students and staff. The data collected here make it possible to compare TOs' attitudes according to the type of placement they are delivering. As Table 3 shows, there was no difference in perception of the scientific and professional development of the students or the commitment to training them among respondents in this study (Table 3, scales B and D). However, it appears that involvement in ABMS programmes was seen to have a greater impact on service delivery where the students were on a concurrent, multiblock or short-block placement compared to the sandwich model (Table 3, scale C). This is likely to be partly because the ABMS courses using a sandwich placement were adapted from existing sandwich programmes rather than being a completely new part of the degree. Thus, TOs would have been used to supporting and training undergraduate students.

In contrast, many laboratories involved in the other three placement models had previously taken graduate trainees who would be expected to have better background understanding and practical laboratory skills than first- or second-year undergraduates. Taking all the scores from the three years together for this comparison appears to have exaggerated this effect, as overall the negative impact lessened over time (Table 2 and Fig. 2, scale C). There does also appear to be a difference in the way students are perceived to fit in the laboratory during short-block placements compared with the other two models (Table 3, scale A). However, there was no suggestion that this affected the perceived calibre of the students (Table 3, scale B) or TOs' commitment to delivering the training (Table 3, scale D).

A systematic review of physiotherapy placement education comparing courses from around the world similarly found some perceived strengths and some weaknesses in different models, but it could find no evidence for the superiority of any particular programme.[20] It therefore appears to be best to design a training programme that allows the professional and statutory body requirements to be met and which can be delivered successfully in the local context.

Conclusions

Although participants in this survey were not selected randomly, the targeted sending of the questionnaire via a third party was the most suitable way of reaching the appropriate people and it produced credible results. The TOs in this survey appear to perceive the ABMS programmes as a good way of delivering pre-registration training for biomedical scientists. The move to an integrated degree which includes substantial amounts of clinical placement training aligns biomedical scientists with other HPC-registered professions and has been well received. Training officers are happy to commit their time and effort to

designing teaching sessions and supporting the students, even though there is a noticeable impact on staff time and thus pathology service delivery overall. It is also important to evaluate the experiences of the students involved in these programmes, which is the next stage of this work. □

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