RESEARCH ARTICLE

Embedding Evidence-based Practice Education into a Post-graduate Physiotherapy Program: Eight Years of pre-Post Course Evaluations

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Abstract

Background and Purpose. Little has been published about the effectiveness of training postgraduate physiotherapy coursework students in research methods and evidence-based practice (EBP) theory. Graduate qualities in most universities include lifelong learning. Inclusion of EBP in post-graduate coursework students' training is one way for students to develop the knowledge and skills needed to implement current best evidence in their clinical practice after graduation, thereby facilitating lifelong learning. This paper reports on change in confidence and anxiety in knowledge of statistical terminology and concepts related to research design and EBP in eight consecutive years of post-graduate physiotherapy students at one Australian university. Methods. Pre-survey/post-survey instruments were administered to students in an intensive 3-week post-graduate course, which taught health research methods, biostatistics and EBP. This course was embedded into a post-graduate physiotherapy programme from 2007 to 2014. The organization and delivery of the course was based on best pedagogical evidence for effectively teaching adult physiotherapists. The course was first delivered each year in the programme, and no other course was delivered concurrently. Results. There were significant improvements in confidence, significantly decreased anxiety and improvements in knowledge of statistical terminology and concepts related to research design and EBP, at course completion. Age, gender and country of origin were not confounders on learning outcomes, although there was a (non-significant) trend that years of practice negatively impacted on learning outcomes (p = 0.09). There was a greater improvement in confidence in statistical terminology than in concepts related to research design and EBP. Conclusion. An intensive teaching programme in health research methods and biostatistics and EBP, based on best practice adult physiotherapy learning principles, is effective immediately post-course, in decreasing anxiety and increasing confidence in the terminology used in research methods and EBP. Copyright © 2016 John Wiley & Sons, Ltd.

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Keywords

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Background

Physiotherapy education has changed significantly over the past century. Initially taught using an apprentice-trade skill model in colleges and hospitals, physiotherapy studies were predominantly skill-based and clinically focused. Physiotherapy became a recognized university bachelor degree in the 1970s–1980s in many Western countries (particularly those in the UK, or with British colonial history), and teaching adopted a clinical science framework (Warren and Pierson, 1994; Hunt et al., 1998). Graduate physiotherapists are now equipped with a broad range of knowledge and skills, and when they move into the workplace, they are expected to maintain their clinical skills and stay abreast of current research (Hunt et al., 1998). It has been reported that health professions evolve in response to research, market forces and society needs (Warren and Pierson, 1994). For physiotherapists, this means demonstrating ongoing accountability for their practice (Stathopoulos and Harrison, 2003; Jull and O’Sullivan, 2006; Jones et al., 2008). Demonstrating a commitment to evidence-based practice (EBP) is an increasingly important requirement for physiotherapy graduates (Stathopoulos and Harrison, 2003; Jull and O’Sullivan, 2006; Jones et al., 2008).

Evidence-based practice is defined as ‘the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients’ (Sackett, 1997). It involves integrating individual clinical expertise with the best available clinical evidence sourced from systematic research. Since the late 1990s, physiotherapy professional associations internationally have identified adoption of EBP as a priority (Warren and Pierson, 1994; Hunt et al., 1998; Jull and O’Sullivan, 2006). Influential researchers and clinicians have argued that physiotherapists have a moral and professional obligation to base their practice on research findings and move away from techniques based on anecdotal testimonies or opinion (Bozzolan et al., 2014). Consequently, education in the theoretical and practical aspects of EBP is now embedded within most entry-level physiotherapy degree programmes (Bozzolan et al., 2014). There is an increasing body of research concerning how to best provide education in EBP at undergraduate level in order to provide knowledge and skills to graduate physiotherapists (McEvoy et al., 2010; Wong et al., 2013; Bozzolan et al., 2014).

Moreover, over the last 20 years, clinical postgraduate coursework programmes have played an important role in developing expert clinical skills within the physiotherapy profession. The intent of postgraduate coursework in physiotherapy is threefold: to increase knowledge, improve clinical reasoning skills and assist students to become educated consumers of research (Sran and Murphy, 2009; Petty et al., 2011).

To achieve the latter requires targeted training in EBP that is relevant to adult learners, and which supports lifelong learning regarding integrating EBP principles, current research evidence, clinical knowledge and patient values. The literature suggests that most physiotherapists have positive attitudes towards EBP; specifically, they are motivated to access current research evidence to update their knowledge and skills (Iles and Davidson, 2006; Jansen et al., 2012; Bozzolan et al., 2014). However, to date, little has been published on how to effectively improve physiotherapists’ knowledge, skills and intentions post-degree completion at the post-graduate level. As a first step in addressing this gap in the literature, this paper describes short-term self-reported learning outcomes from 8 years of pre-course/post-course evaluations (2007–2014 inclusive), in a diverse group of national and international post-graduate physiotherapy students.

Methods

Course development

An intensive 3-week EBP course, which aimed to make students educated consumers of research and lifelong learners in terms of applying research evidence into future clinical practice, was embedded into an existing post-graduate physiotherapy programme. The course content was based on a review of the best-available literature in 2007, on effective adult learning strategies in health sciences (Garrison and Kanuka, 2004; Reasons et al., 2005; Sullivan et al., 2005; Taradi et al., 2005; Ruiz et al., 2006; Hadley et al., 2007). This literature review identified several barriers to adopting evidence in clinical practice, including lack of time, limited access to literature, low confidence in the skills needed to identify and appraise research and poor support from colleagues and employers (Sran and Murphy, 2009; Wong et al., 2013; Bozzolan et al., 2014). The course attempted to provide post-graduate students with strategies to overcome these barriers upon their return to the workforce and enablers to improve their use of
research evidence in clinical practice (Garrison and Kanuka, 2004; Wong et al., 2013; Bozzolan et al., 2014). These enablers included knowledge of the methods used to conduct primary and secondary research, skills in finding, locating, critically appraising, summarizing and reporting research literature and becoming champions of disseminating EBP knowledge and skills amongst colleagues, patients and third parties.

Over the years, the content and delivery of the course was continually refined based on student evaluation, feedback from previous years and new research on the best ways to educate mature-aged allied health professionals — identified by ongoing reviews of the literature (Brown et al., 2008; Milanese et al., 2013; Milanese et al., 2014). From inception, the course used a hybrid model of teaching and learning strategies (Kumar et al., 2010) and was specifically targeted to physiotherapy learning styles, that is, both practical and theoretical components. It included a combination of face-to-face, didactic lectures (the number of lectures varied over the years depending on class size and need), practical exercises undertaken in class in small groups, small group presentations and group assignments. Concurrent workshops with university librarians were conducted to provide students with practical methods for finding and accessing research evidence. A daily-monitored online discussion board was used to encourage students to reflect on real EBP problems that they encountered in their reading or from reflection on previous clinical practice experiences.

**Study measures**

Pre-course data were captured from all students on day 1 of the course, prior to course commencement using a survey. Students completed the survey in class. The survey was repeated on the final day of the course, in class, after all formal learning activities were completed. Student responses were paired for the pre-course and post-course survey, and differences were calculated. Students did not view their pre-course responses when completing the post-course questions. The complete pre-course/post-course survey instrument is available on request from the authors. Yearly collection of pre-course/post-course data was an approved quality improvement activity for internal course evaluation purposes. Ethical approval was provided by the University’s Human Research Ethics Committee (Application ID: 0000033559), and the research was conducted in accordance with the Declaration of Helsinki (Eva, 2009).

The survey sought information on learning outcomes relating to confidence and anxiety in knowledge of statistical terminology and concepts related to research design and EBP. We deliberately used the terms confidence and anxiety as ‘proxies’ for potential knowledge and skill acquisition. There was no final written exam to test knowledge and skill, and because students could have had a range of research experiences since their undergraduate training, it was assumed that they may also have different levels of understanding of research and EBP terminology when they entered the course. Without a pre-course demonstration of knowledge and skills (which was neither practical nor feasible given the nature and timing of the course), it was impossible to directly assess knowledge and skill change, hence, our use of the terms ‘confidence’ and ‘anxiety’. The survey questions were linked to course objectives, the curriculum and the expected qualities of graduates.

**Pre-course/post-course changes in confidence and anxiety**

Differences in four pre-course/post-course questions are reported in this paper. The first question enquired about student confidence regarding 15 terms related to health research methods (methodology and statistics): mean, standard deviation (SD), standard error, median, confidence limits, odds ratio, percentage, Chi-square test, student t-test, ANOVA, normal distribution, null hypothesis, Pearson’s r, error distribution and sensitivity. The second question enquired about student confidence for 17 concepts related to EBP: experiment, randomization, epidemiology, blinding, control group, allocation, drop out, loss to follow up, prevalence, sub-set analysis, adjusting for confounders, stratification, study quality, case study, clinical guideline, meta-analysis and ABA study design. Both questions had three response categories (no confidence, some confidence, totally confident) for each item. The final two questions asked students about their level of anxiety about statistics and EBP, using visual analogue scales (VAS) (0 = no anxiety, 10 = extreme anxiety). In addition, students were asked in the post-course evaluation what they liked and did not like about the course. This was recorded as free text.
Data management and analysis

Data were amalgamated for the 8 years of the intensive programme (2007–2014 inclusive). The three response categories for the questions on confidence in methods and EBP terms were scored for analysis as 0 (no confidence), 1 (some confidence) and 2 (totally confident). The difference in pre-confidence/post-confidence scores was considered per item and was also summed for 1) statistical terminology and 2) concepts related to research design and EBP, to give an overall change in the items in each question. Mean change and SD in each item and the total score for each question were calculated. The items with the largest amounts of change in confidence were identified, using a threshold of change of 1 point (moving from ‘no confidence’ to ‘some confidence’ or from ‘some confidence’ to ‘total confidence’). The total confidence change scores were also interpreted as percentage change, using the pre-course total score as the denominator. The VAS scales for level of anxiety about statistics and EBP were analysed in their raw form (0–10 numeric scores).

Considering the non-parametric nature of the data for the two questions on confidence, significance of differences was tested using Kruskal–Wallis tests. Pre-scores/post-scores were compared graphically for each item. For the VAS scales for level of anxiety about statistics and EBP, ANOVA models were applied as the data were normally distributed. The effect of potential confounders on confidence and anxiety scores were analysed using univariate Kruskal–Wallis tests. Potential confounders were age (grouped in 5-year categories), gender, nationality (Australian, international) and previous years of physiotherapy experience (categories of 2, 2–5, 6-10, 10+ years). Significance was set at p < 0.05. Analyses were undertaken using MSExcel (Microsoft Corporation, Redmond, WA, USA) and SAS version 9.1 (SAS Institute, Cary, NC, USA).

Results

Sample

Over the 8 years, 236 students completed the course (225 of these being physiotherapists, ranging from 20 to 30 students per year). The remainder were nurses, occupational therapists and pharmacists. Their data has not been included in this analysis. Overall, 27% of physiotherapy students were Australian born, and the remainder were international students. A range of countries was represented in the class each year. Between 2007 and 2010, European countries predominated; however, there was a swing in the last 5 years towards Asian countries. The majority (207 students; 92%) had more than 2 years’ clinical practice experience before enrolling in the post-graduate programme, with most having between 5 and 10 years of experience. There were relatively equal numbers of men and women each year, and the age of students ranged from 22 to 51 years (median 31).

Confidence and anxiety change

Nine students did not provide data for either the pre-course or post-course evaluation, and their scores were excluded. In every case, this was because they were absent from class at time of testing. Level of anxiety with statistics and EBP concepts decreased significantly (p < 0.05) at post-course, with an average decrease in scores of 3.6 (±1.8) and 3.7 (±2.1) points, respectively. The majority (185 students; 82%) rated themselves pre-course as 7+ on both questions (very anxious), and for post-course, the majority (180 students; 80%) rated themselves as 3 or less (not very anxious).

Considering confidence with statistical terminology, mean pre-course scores were generally poor, with most students rating themselves as having no confidence on most items. The total pre-course score was 10.6 (±6.2), which reflected 35% of the possible total score of 30 (15 questions each scoring a maximum of 2 points). For post-course, there was significant improvement in scores for all items (Figure 1, Table 1), with an average of approximately 300% improvement in scores overall. The mean post-course total score of 25.2 (±6.2) also highlights the large effect in terms of knowledge acquisition (reflecting approximately 84% of the possible total score).

Considering confidence with concepts related to research design and EBP, mean pre-course confidence
was again generally poor, with most students rating themselves as having no confidence on most terms. The total pre-course score for this question was 15.8 (SD 6.2), which reflected approximately 44% of the possible total score of 36 (17 questions each scored a maximum of 2 points). For post-course, there was significant improvement in scores for all items (Figure 2, Table 2), with an average of approximately 188% improvement in scores overall. The mean post-course total score (24.6, SD 6.1) also highlights the large improvement at the end of the course in EBP confidence (reflecting approximately 68% of the possible total score). There were, however, fewer items that showed an average improvement of one point or more compared with the questions relating to statistical terminology. The items showing an improvement of one point or more were sub-set analysis, adjusting for confounding, stratification, quality, meta-analysis and ABA study design.

Confounding:
There was no influence of age, gender or country of origin on learning outcomes, although there was a trend ($p = 0.09$) for the effect of years of experience and confidence with statistical terminology; that is, students with more years of physiotherapy experience tended to be less confident at the end of the course about statistical terminology, perhaps reflecting the absence of statistical training in their undergraduate education, and their lack of exposure to research and EBP training since graduation.

What students liked and did not like about the course
Overall there were 1022 responses to the ‘like’ question, and 793 responses to the ‘dislike’ question. The findings are outlined in Table 3. Several themes occurred simultaneously in both ‘like’ and ‘dislike’ questions. While there was an age trend in the common theme of the intense nature of the course (i.e., more positive responses from students who were greater than the
median age of 31 years compared with students aged < 31 years), there was no age trend in the theme of summative assessments during the course.

**Discussion**

This paper adds to the scant body of knowledge regarding student perspectives on, and short-term effectiveness of, EBP training programmes at the post-graduate level.

**Table 2.** Average change from baseline for items and total score confidence with concepts related to research design and evidence-based practice

<table>
<thead>
<tr>
<th>Item</th>
<th>Mean</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experiment</td>
<td>0.6</td>
<td>0.7</td>
</tr>
<tr>
<td>Randomization</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>Epidemiology</td>
<td>0.8</td>
<td>0.7</td>
</tr>
<tr>
<td>Blinding</td>
<td>0.8</td>
<td>1.5</td>
</tr>
<tr>
<td>Control group</td>
<td>0.5</td>
<td>0.6</td>
</tr>
<tr>
<td>Allocation</td>
<td>0.9</td>
<td>0.8</td>
</tr>
<tr>
<td>Drop out</td>
<td>0.8</td>
<td>0.7</td>
</tr>
<tr>
<td>Loss to follow up</td>
<td>0.9</td>
<td>0.8</td>
</tr>
<tr>
<td>Prevalence</td>
<td>0.9</td>
<td>0.7</td>
</tr>
<tr>
<td>Sub-set analysis</td>
<td>1.2</td>
<td>0.7</td>
</tr>
<tr>
<td>Adjusting for confounders</td>
<td>1.2</td>
<td>0.7</td>
</tr>
<tr>
<td>Stratification</td>
<td>1.1</td>
<td>0.7</td>
</tr>
<tr>
<td>Quality</td>
<td>1.0</td>
<td>0.7</td>
</tr>
<tr>
<td>Case study</td>
<td>0.6</td>
<td>0.7</td>
</tr>
<tr>
<td>Clinical guideline</td>
<td>0.8</td>
<td>0.7</td>
</tr>
<tr>
<td>Meta-analysis</td>
<td>1.2</td>
<td>0.8</td>
</tr>
<tr>
<td>ABA study design</td>
<td>1.2</td>
<td>0.7</td>
</tr>
<tr>
<td>Total change in scores</td>
<td>14.7</td>
<td>7.2</td>
</tr>
<tr>
<td>% change from baseline total</td>
<td>188.4</td>
<td>388.3</td>
</tr>
</tbody>
</table>

SD, standard deviation.

The form and timing of the EBP course reported in this paper was determined by the programme timetable, and while its intensity was noted positively and negatively by students, it provided an ideal opportunity to teach incoming students for an uninterrupted period, without the requirement of attending other courses. The objectives and learning outcomes of this course also provided an opportunity to use a range of evidence-based teaching strategies suitable for adult learners (Garrison and Kanuka, 2004; Reasons et al., 2005; Sullivan et al., 2005; Taradi et al., 2005; Ruiz et al., 2006; Hadley et al., 2007). Collectively, the intensive teaching period, and the use of multiple adult teaching and learning strategies, may have contributed to the significant improvements in learning outcomes over the period of the course.

The significant improvements in confidence and decreased anxiety in a range of statistical terms and EBP concepts suggests that the course was an effective way of teaching adult learners about difficult issues of application of research into clinical practice. The only items in which there was less than one point or more improvement (on average) in terms of confidence with statistical terminology were mean, median and percentage. These are perhaps the most common statistical terms in clinical language, and many students may have already been familiar with them. Students reported improved confidence and decreased anxiety for a number of EBP concepts (sub-set analysis, adjusting for confounding, stratification, quality, meta-analysis and ABA study design), a finding which may reflect that students experienced greater difficulty in acquiring...
confidence in an area with which many of them would have been unfamiliar at the beginning of the course. These outcomes are reflective only of short-term learning outcomes; however, they provide a foundation for assessing the effectiveness of long-term knowledge retention and EBP behaviour. Further research is required to determine whether what was learnt during the course continued after the course and influenced evidence uptake into practice.

The theme of intensive learning, which occurred in both the ‘like’ and ‘dislike’ questions in the post-course survey, indicated the different learning needs of younger and older physiotherapists. The students who indicated that they liked the intensive learning opportunity were generally older. They noted that the intensive nature made the course value for money, gave them a lot of information in a short time, allowed them to focus on one type of learning and provided them with day-to-day access to lecturing staff. Students who disliked the intensive nature of the course were generally younger, and mostly, their comments reflected difficulties in maintaining concentration over consecutive days and having to learn and work intensely from the first day of the course.

Another common theme was the completion of summative assessments during the course. The summative assessments were intended to encourage adult learning and act as an incentive to students to assure their grades before the course finished, encourage greater access to lecturers and reduce the stress that is normally associated with exams. While this opportunity was valued by many students, for some, this posed a challenge, possibly because of time management, the composition of their small group, their language and/or their understanding of the course material.

**Conclusion**

Educating physiotherapists in a clinical post-graduate course about research methods and EBP provides a way of ensuring that the profession will continue to advance, by providing physiotherapists with lifelong learning skills and empowering them to be educated consumers of research. While there is no ideal way to do this from students’ perspectives, we have demonstrated that a short and intensive EBP course, which is based on best-practice adult learning principles and is not run in conjunction with any other coursework training, is effective immediately post-course in improving students’ confidence and lowering their anxiety in the use of research terminology.

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