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Title:

Effects of an online education program on physiotherapists' confidence in weight management for people with osteoarthritis: a randomized controlled trial

Running head:

Online weight management training for physiotherapists

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ABSTRACT

Objective: Evaluate effects of an online education program about weight management for osteoarthritis on physiotherapists' self-reported confidence in knowledge and skills in weight management, and attitudes toward obesity.

Method: A two-group randomized controlled trial, 80 physiotherapists (58 female) randomized to education or control groups. The theoretically- and evidence-informed online self-directed training program covered biopsychosocial elements of obesity and weight management. The primary outcome was self-reported confidence in knowledge in weight management using a customised validated tool (scale 14-70, higher scores indicating higher confidence) assessed at baseline and six weeks. Secondary measures included confidence in nutrition care, clinical skills in weight management, and weight stigma. Process measures evaluated participant experience. Differences in change between groups were compared using linear regression models adjusted for baseline scores and stratifying variables (clinical setting; confidence in weight management). Moderation analysis was performed using an interaction approach in a linear regression model and multivariable fractional polynomial interaction approach.

Results: 79 (99%) participants completed outcome measures at six weeks. The education group demonstrated greater improvement in confidence in knowledge than control (adjusted mean-difference (95% confidence intervals) 22.6 units (19.6,25.5). Greater improvement in knowledge was associated with lower baseline values (interaction p-value=0.002). Secondary outcomes showed greater improvements in confidence in skills and nutrition care and in weight stigma domains favouring the education group. Over 90% of participants would recommend the program to peers.

Conclusion: An online education program improves physiotherapists' short-term **confidence in knowledge and skills** in weight management for people with osteoarthritis and reduces weight stigmatized attitudes.

SIGNIFICANCE AND INNOVATION

- Physiotherapists commonly treat people with osteoarthritis and while clinical guidelines recommend weight loss for those with overweight/obesity, most physiotherapists feel they lack the requisite knowledge and skills to provide weight management advice and support.
- An interactive training program (EduWeight-OA) for clinicians based on existing obesity management frameworks and educational pedagogy was developed for physiotherapists to support integration of weight management into their treatment for OA to address this gap in practitioner confidence.
- Results of this randomized controlled trial indicate that the EduWeight-OA program is effective in increasing physiotherapists' self-reported confidence in knowledge in weight management and reducing weight stigma for people with OA.
- EduWeight-OA is a freely available online self-directed training resource for healthcare practitioners around the world

(<https://healthsciences.unimelb.edu.au/departments/physiotherapy/chesm/clinician-resources/eduweight-training>)

INTRODUCTION

The prevalence and burden of obesity is increasing worldwide (1). Obesity is associated with many chronic musculoskeletal conditions, including osteoarthritis (OA), a leading and increasing cause of musculoskeletal pain and disability (2, 3). Having obesity is a significant risk factor for both the development (4) and progression (5) of knee OA. As such, OA clinical practice guidelines consistently identify weight management (for those who have overweight or obesity) as a fundamental treatment alongside exercise (6). However, achieving and sustaining weight loss is extremely difficult (7) and often requires support from healthcare practitioners. Despite the strong evidence-based consensus advocating weight loss for people with OA who have overweight or obesity, significant evidence-to-practice gaps exist in OA care (8, 9). Upskilling healthcare practitioners to help implement high value OA care is a key priority (10).

Physiotherapists are at the frontline of OA management and are responsible for enacting clinical guidelines for OA. Exercise combined with caloric control, and with health behaviour change support, is helpful for weight control (11). With direct relevance for people with knee OA who have overweight or obesity, meta-analysis shows that combined diet and exercise interventions provide moderate pain relief in this population (12). Traditionally, guidance for caloric control has been provided by dieticians in addition to their more complex nutrition care roles (13). However physiotherapists outnumber dieticians in Australia 4:1 (14) and optimizing access to care for people with OA is vital (10). The scope of the profession is evolving (15, 16). Physiotherapists may be well placed to upskill to engage in basic caloric restriction guidance as part of integrated weight management practice for people with OA, given their skills in exercise prescription and health behaviour change and the length of time spent with patients. However, research globally indicates that most physiotherapists lack the knowledge

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and skills to integrate weight management into their treatment paradigm (17-20). Australian physiotherapists describe difficulty managing patients with co-morbid obesity and if they do provide education about weight loss, they predominantly advise about *why* weight loss is important rather than advise about *how* to lose weight (17, 18, 20, 21). Significantly, incorporation of weight management into physiotherapy education and postgraduate training appears to be lacking (22). Of further concern and relevance for treatment outcomes, physiotherapists have been found to exhibit elements of weight stigma (23) which can detrimentally affect patient engagement with healthcare, health behaviours and health outcomes (24). In order to build the necessary workforce capacity to effectively manage weight, physiotherapists require customized training in weight management.

Development of obesity training initiatives for healthcare professionals has been the focus of much research over the past decade (25-27). A growing number of core competency frameworks for obesity management for healthcare professionals have been developed by medical education researchers (28-31) and professional healthcare practitioner bodies internationally (32, 33). Common to all are educational principles covering medical knowledge of obesity and weight regulation, acknowledgement of weight bias, interprofessional collaboration in obesity care and of key importance, the principles of chronic disease management, including person-centred care, shared decision making, and using empathic, ethical, professional communication. These principles align with health competency standards for chronic disease management developed by World Physiotherapy (34) and the core capability framework recently developed for optimization of OA care (35). Thus, they provide a sound basis for the development of a training program to enhance physiotherapists' confidence in their knowledge and skills to integrate weight management into their OA treatment paradigm and to address weight stigma. However, to date, no programs have been

developed to specifically target practicing physiotherapists' knowledge and skills in weight management.

This randomized controlled trial aimed to evaluate the effect of a customized online training program in weight management for OA (*EduWeight-OA: E-learning for physiotherapists in weight management for osteoarthritis*) on physiotherapists' self-reported (1) confidence in knowledge and clinical skills in weight management for OA, and (2) weight stigmatized attitudes.

MATERIALS AND METHODS

Design:

We conducted a two parallel arm, superiority randomized controlled trial. Participants were recruited within Australia and all participants provided informed consent. Ethical approval was granted by the institutional Human Research Ethics Committee, (HREC reference number: 1955069). The trial was prospectively registered (Clinicaltrials.gov, no: NCT04574804).

Sample size:

An a priori sample size calculation was conducted. We expected the training program to have a large effect on confidence outcomes given that weight management is not well covered in entry-to-practice physiotherapy courses. As such, we aimed to detect an effect size of 0.8. This was considered feasible and appropriate based on data from a previous trial evaluating the effects of web-based training on physiotherapists' self-reported confidence in management of rheumatoid arthritis, which reported a large effect size of 1.62 with a drop-out rate of 35% (36). To detect a more conservative effect size of 0.8 with 80% power and two-sided significance

level of 0.05, 26 participants were required per group. Allowing for a 35% drop out rate, the sample size was increased to 40 in each group.

Participants:

Physiotherapists working in Australia were recruited through advertisements in Facebook pages of the Musculoskeletal Physiotherapy Group and the Research Centre through which the study was conducted. Inclusion criteria were: current registration with the Australian Health Practitioner Regulation Agency; access to a computer with internet connection; willingness to complete approximately 8 hours of online education if randomized to the education group; and willingness to refrain from participating in any weight management professional development activity external to the study for the six weeks of the intervention period. There were no exclusion criteria.

Procedures:

After passing online and phone screening, providing informed consent and baseline data, participating physiotherapists were randomized to either the online education or no education control group. The randomisation schedule was prepared by the biostatistician using random permuted blocks of size 4-8, stratified by clinical setting (predominantly private practice or predominantly public (hospital based)) and by self-reported confidence score for “how would you rate your confidence in knowledge about weight management for people with OA?” on an 11-point NRS (0=not at all confident and 10=extremely confident) with scores stratified using “0-5” and “6-10”. Randomization was conducted by a researcher with no other involvement in the study. Blinding of participants (who also served as assessors given the self-reported nature of the outcome measures) was not possible. The biostatistician performing data analysis was blinded to group allocation.

Intervention:

Development

The theoretically- and evidence-informed education material was developed using participatory methodology, which involved a consultative process with 21 stakeholders including: leading endocrinologists and obesity researchers, tertiary education specialists, practicing physiotherapists and dieticians with experience in weight loss interventions for OA and representatives from the Australian Physiotherapy Association. This iterative process involved input and feedback at each stage, from theoretical conception to refinement of learning objectives, learning modules and alignment of the learning objectives to a custom assessment tool (see **Table 1** and **Supplementary Material S1**). The program included six modules: (1) Overweight and obesity and OA; (2) Weight regulation, overweight and obesity; (3) Examining weight stigma and personal beliefs about weight; (4) Communication approaches for addressing weight management; (5) Interventions for weight management and (6) Health Behaviour Change support (**Table 1**). The learning objectives were derived from the features common to existing obesity education frameworks (28-33) and aligned with the World Physiotherapy health competency standards for chronic disease management (34). To link content knowledge with practice, various strategies were incorporated: i) case and video exemplars of clinical interactions; ii) patient feedback from clinical encounters; iii) clinical strategies to make patient's feel more comfortable in a clinical encounter about weight; iv) resources for both therapists and patients. To enhance engagement and learning, blended learning modalities including quizzes, lectures, case studies and expert responses were incorporated in line with adult learning principles (37, 38). An independent group of evaluators, including clinical physiotherapists and educators from external universities, were recruited and given access to the online platform to assess the program's (1) content for clarity and clinical

relevance, and (2) usability and engagement. These assessors provided free text feedback, and where modifications were made, subsequent review of the modified program components.

Delivery

Participants randomized to the intervention group were given access to the “EduWeight-OA” online training program delivered on the University of Melbourne Learning Management System (LMS) (Canvas LMS by Infrastructure, 2019), as self-directed online learning to complete over a 6-week period. Participants were required to work through each module and complete a short ‘check your understanding’ quiz at the end of each module, to help reinforce knowledge and learning, before being granted access to the subsequent module.

(<https://healthsciences.unimelb.edu.au/departments/physiotherapy/chesm/clinician-resources/eduweight-training>)

Outcome measures:

Primary and secondary outcomes were collected via electronic questionnaires at baseline and 6 weeks post randomization. To evaluate the effectiveness of the program, a custom self-report tool (RIVA questionnaire) was developed by the researchers (**Supplementary Material S1**), given the absence of a suitable existing tool. The primary outcome was self-reported confidence in *knowledge* about weight management for patients with OA measured using Part A of the RIVA questionnaire (score range 14-70, higher scores indicating higher confidence) (**Table 1**). Secondary measures include self-reported confidence in *clinical skills* for weight management for patients with OA (measured using part B of the RIVA questionnaire (score range 9-45) (**Table 1**)), self-perceived competence in nutrition care to patients with chronic disease (NUTCOMP) questionnaire (39) (scored 35-175, higher scores indicating higher perceived competence), and weight stigmatized attitudes (Anti-Fat attitudes questionnaire (40),

scored 0-117, subscale scores 'Dislike' 0-63, 'Fear of Fat' 0-27 and 'Willpower' 0-27, higher scores indicating more stigmatized attitudes).

Process measures were collected from the education group including the number of modules completed, time taken to complete each module, and perceived usefulness of each module on a 5-point Likert scale anchored at '1' strongly disagree, to '5' strongly agree with respect to: 1) knowledge being relevant to clinical practice as a physiotherapist, 2) addressing learning needs, 3) being presented in an engaging manner, and 4) likelihood of recommending to other physiotherapists.

Development, reliability and validity of the primary outcome measure:

The development, validity and reliability of the custom RIVA questionnaire is detailed in **Supplementary Material S1**. In brief, Part A of this questionnaire included 14 statements reflecting the course learning objectives, which participants rated their confidence in knowledge, and Part B, 9 statements pertaining to confidence in clinical skills, each rated on a 5-point Likert scale, anchored at 1=Not at all confident, 5=Very confident. The questionnaire structure was developed and adopted based on an existing outcome measure developed by Fary et al., to evaluate a customized training program to enhance physiotherapists' knowledge and skills in rheumatoid arthritis (36).

Statistical analysis:

Analysis was conducted on de-identified data by a blinded biostatistician using Stata v16.0 (StataCorp, TX). No imputation of missing values was needed due to negligible missing data. For both primary and secondary outcomes, the mean (95% confidence interval) difference in change (follow-up minus baseline) between groups was estimated using linear regression

models adjusted for baseline scores and the stratifying variables. Model assumptions were assessed using standard diagnostic plots. Process measures were described in terms of mean (SD)/median (IQ range) or number (frequency).

We also conducted planned exploratory analyses to investigate potential moderators that could influence the effect of the training on the primary outcome. Pre-identified potential moderators included practice location (predominantly private practice vs predominantly public (hospital)), baseline self-rated confidence in weight management, and years of clinical experience. To assess effect moderation by the binary potential moderator (practice location), an interaction term between randomized group and the potential moderator, as well as terms for the randomized group and the potential moderator, were included in the outcome regression model. To assess effect moderation by continuous potential moderators (self-rated confidence in weight management and years of clinical experience), the multivariable fractional polynomial interaction approach was applied. This approach allowed for nonlinear functional forms of the continuous potential moderator to be included in the regression model for outcomes, with the potential for separate nonlinear functional forms in each treatment group.

RESULTS

Eighty participants were recruited between October and November 2020 and randomized (41 into the control group), with 79 (99%) completing primary and secondary outcome measures at week 6 (**Figure 1**). Participants were based across six of the eight states and territories of Australia. Baseline characteristics were similar between groups (**Table 2**). Participants in both groups were predominantly female, worked in private practice, and had little prior training in weight management.

Between group comparisons

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Significant between-group differences were identified for both the primary outcome of self-reported confidence in *knowledge* and secondary outcomes of confidence in *clinical skills* in weight management and competency in nutrition care (**Table 3**). The education group demonstrated a greater mean increase in confidence in *knowledge* of weight management at 6 weeks compared to the control group (adjusted between-group mean difference RIVA-A (95% confidence interval (CI)), 22.6 (19.6, 25.5)). For the secondary outcome measure of confidence in clinical skills, the education group's mean confidence improved at 6 weeks, while the control group demonstrated no change (adjusted between group mean-difference RIVA-B (95%CI), 14.6 (12.7, 16.4)). Self-reported competency in nutrition care as measured by the NUTCOMP questionnaire, showed a greater improvement in the education group compared to the control group (adjusted between group mean-difference (95%CI), 39.9 (34.5, 45.4)).

Weight stigmatized attitudes, as measured by the Anti-Fat attitudes questionnaire total score at 6 weeks, improved in the education group compared to the control group (between group mean difference (95%CI) -6.5 (-11.4, -1.6)) (**Table 3**). When examining the subscales of the Anti-Fat attitudes questionnaire, significantly greater improvements in mean scores over time were seen in the education group, compared to the control group for the subscales of 'dislike' (-3.1 (-5.9, -0.3)) and 'willpower' (-4.2 (-6.0, -2.5)), but not for the 'fear' (0.3 (-1.6, 2.2)) subscale.

Moderation analysis

Baseline self-rated confidence in knowledge was the only factor to moderate the effect of the intervention on the primary outcome (interaction p-value=0.002) (**Table 4, Supplementary Material S2**). For every one-unit increase in baseline NRS self-rated confidence, participants in the education group had less improvement in the primary outcome with a difference between groups of -2.4 (95% CI -3.9, -0.9) (**Table 4, Supplementary Material S2**).

Process measures

Of the 39 physiotherapists randomized to the education group, 38 completed all 6 modules. One participant did not engage with any module and did not complete any process or outcome measures. The mean self-reported time to complete the program was 6.9 ± 2.3 hours (range 1.7 to 11.7 hours). Likert scale responses to the process measure statements are shown in **Figure 2**. The majority (82-97% across modules) agreed (4 on the Likert-scale) or strongly agreed (5 on the Likert scale) the *knowledge gained* in the modules to be useful to their clinical practice, the *modules covered their learning needs* (82-97%), and that they *would recommend the modules to other physiotherapists* (76-89%). The presentation of the material (“*I felt the module was presented in an engaging manner*”) ranked lowest of the process measures, however the majority still agreed or strongly agreed the material was presented in an engaging manner (68-84%).

DISCUSSION

This randomized controlled trial demonstrated that a customized online self-directed education program, EduWeight-OA, increased physiotherapists’ self-reported confidence in knowledge about weight management for OA. Self-reported confidence in clinical skills about weight management for OA and self-perceived nutrition competency also increased following the six-week access to the online learning material, while weight stigmatized attitudes were reduced. Overall, physiotherapists’ perceived the Eduweight program to be valuable for their clinical practice.

Weight management has not traditionally been considered scope of practice for physiotherapists. However, as contemporary healthcare models respond to changing societal needs and evolve with evidence surrounding best person-centered management, physiotherapists and other healthcare practitioners are required to engage in broader health delivery roles (30, 35). While there are calls to extend physiotherapy scope of practice (15, 16), not all physiotherapists see weight management as being part of their role. This may be partly due to the fact that they feel underqualified to engage in this role (17, 18, 21) and they see it as a lower priority in their clinical management of OA (41). Within the core capabilities developed for all healthcare practitioners managing patients with OA, communication, person-centered care, self-management and lifestyle intervention to support weight management are considered required competencies (35). However, discipline-specific investigation into the barriers of provision of evidence-based care for OA by physiotherapists, and other primary care practitioners across Australia, identified personal knowledge and skills, particularly in weight management care delivery, as major barriers to translation of evidence-based care into practice (20). To date, the physiotherapy profession has demonstrated flexibility in adapting to changes in health care models beyond their traditional scope of practice, for example by undergoing supplementary training in psychologically informed care for complex pain (42). Addressing these barriers of knowledge and skills in physiotherapists in weight management was the purpose of the Edu-weight OA study.

Our study provides the first data regarding the development and evaluation of an online weight management training program for physiotherapists. Whilst we cannot infer what magnitude of change represents a clinically important difference on our customized primary outcome, it is of clinical note that the final scores obtained by the physiotherapists on the RIVA-A (57.4 (5.8)) and RIVA-B (36.2 (4.3)) questionnaire in the education group were comparable to the

average score of the 75 dietitians who completed the self-report tool in our validity study (52.7 (8.7)) and 36.2 (5.1) respectively) (**Supplementary Material S1**). Further, our physiotherapists obtained a mean NUTCOMP score at follow up in the education group (132.9) that was significantly higher than data from other non-dietitian healthcare professionals (90.5 (39) and approaching those reported in dietitian cohorts (145.5) (39). Taken together, these data indicate that our online training program enhanced physiotherapists' confidence in knowledge and skills in weight management by a clinically relevant magnitude in the short-term.

Whilst our results clearly show increased confidence in knowledge and in clinical skills about weight management for OA, we did not include an assessment surrogate of clinical practice (e.g. case studies/vignettes in the evaluation). Thus, we cannot determine if the education program improved the physiotherapists' actual clinical competency. Some open text feedback indicated that some participants still felt uncertain as to how to enact their learning within clinical practice. Investigations of previous e-learning interventions for physiotherapists suggest that use of online learning technologies do enhance practical skills and performance in addition to knowledge acquisition and confidence (43). Multiple randomized controlled trials have found that physiotherapists who studied other clinical concepts using websites including online tutorials, or online banks of videos and patient-clinician simulations improved their practical skills (44-46). However, there is also research suggesting that clinical simulations or supervised practical experience is required to supplement online material for physiotherapy students (47) and practitioners (21, 48) to feel confident and prepared to implement new skills in clinical practice. Further, weight is a particularly sensitive and visible issue, and previous qualitative research highlights physiotherapists' perceived discomfort with addressing weight (17, 18). Thus, beyond clinical skills, knowledge may not be implemented if physiotherapists

still experience personal discomfort engaging with the topic, do not have an opportunity to practice or receive feedback, or are uncertain regarding scope of practice indications. Further, as our study only collected data immediately following the program, we are unable to determine the effects in the longer term, although it is likely that gains may reduce over time without follow-up educational resources or opportunities to reflect on or revisit the material. A previous cohort study evaluating an online training program for physiotherapists in rheumatoid arthritis management showed reduction of the initial improved confidence in knowledge and skills at eight weeks follow up (36). This reinforces the notion that stimulated practice following e-learning is important to consolidate learning. Further research would be required to understand longer term gains in confidence and knowledge and whether they can be enhanced by including simulated practice, and to be able to draw conclusions on whether physiotherapists do change their clinical practice as a result of completing the program.

Both groups demonstrated comparable moderate levels of weight stigma at baseline, consistent with previous reports of weight stigmatized attitudes in physiotherapists (23), other healthcare practitioners and the general public (24). Our education group showed greater reduction in weight stigma at 6 weeks, particularly for subscales of 'dislike' and 'willpower'. This supports the idea that online training can reduce weight stigma by increasing knowledge in the complexities of weight and weight management, and how patients who have overweight or obesity may feel in a healthcare setting. The presence of weight stigmatized attitudes can lead to a greater chance of enacted stigma (behaviours which originate from negative attitudes) (49). In healthcare, enacted stigma can reduce the quality of care, quantity of care and can cause the patient to be more likely to avoid seeking care or to adhere with clinician recommendations (24). For these reasons reducing weight stigma in the physiotherapy workforce should be seen as a priority. It is important to acknowledge that physiotherapists in this study still exhibited

weight stigma (particularly regarding ‘fear of fat’) after completing the education modules, albeit to a lesser degree. The pervasiveness of the fear of weight gain in individuals in this study is reflective of the deep rooted societal beliefs and norms surrounding overweight and obesity (24) and is likely to take large societal shifts for change to be seen in this domain in healthcare practitioners undergoing weight stigma training. This area requires further investigation.

The Eduweight-OA training was pragmatically developed as a web-based program for ease of access for working clinicians. Increasingly, e-learning is being used to deliver professional development, education and training to healthcare practitioners and students to address barriers related to access, scalability and affordability (50). Of our sample, all but one physiotherapist in the education group engaged with all six modules, with the average time to complete the program (6.9 hours) deemed acceptable by participants. Flexibility of self-paced learning and ease of access to information are highly valued by undergraduate physiotherapists engaging in e-learning for the management of chronic health conditions (47). Of arguably greater clinical relevance is the efficacy of these online programs to enhance knowledge and clinical skills. A systematic review of research comparing e-learning with non-internet learning for healthcare professionals and doctors found e-learning to be similarly effective for education outcomes (knowledge and skills) as more traditional in-person teaching methods (50). This suggests that education material to upskill physiotherapist’s confidence and knowledge in novel subject areas can be effectively delivered through an asynchronous online training program.

Our study has several further methodological considerations. Whilst the primary outcome measure was a customized self-report scale, we conducted a thorough and robust analysis of its clinometric properties and found it to be valid and reliable. Further, we accounted for

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baseline levels of confidence in knowledge of weight management in our recruitment of physiotherapists and moderation data analysis. Our sample was diverse and came from across Australia including regional and remote settings which aids generalizability of our findings. The randomized controlled trial design enabled us to robustly evaluate the effect of the training program, although participants were unable to be blinded.

In conclusion, this study provides evidence for the effectiveness and acceptability of an e-learning program to increase physiotherapists' confidence in their knowledge and confidence in their clinical skills about weight management for OA, as well as improve weight stigmatized attitudes. Online learning serves as a feasible and effective mode of delivery for such education, with benefits of being affordable, scalable and accessible. Future studies will provide additional insight into whether physiotherapist-delivered weight loss interventions are safe and effective in the management of OA.

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Table 1. Items comprising Part A (n=14 items) and Part B (n=9 items) of the customized self-reported RIVA questionnaire mapped to the corresponding learning objectives of the six-module EduWeight-OA program.

Learning module	Learning Objectives	RIVA-A Confidence in knowledge *	RIVA-B Confidence in clinical skills *
MODULE 1: Overweight, obesity and osteoarthritis	<ol style="list-style-type: none"> 1. Describe what OA is and how to explain OA to patients using appropriate non-threatening language 2. Outline the treatments recommended by OA clinical guidelines 3. Describe the relationship between overweight and obesity and the development, progression and symptoms of OA 4. Explain the potential mechanisms by which overweight and obesity can influence the OA disease process and illness experience 5. Explain the benefits of weight loss for people with knee OA who have overweight or obesity 	<p><u>Subscale[#]: Weight and the osteoarthritis disease process</u></p> <p>How confident do you feel in your knowledge of:</p> <ol style="list-style-type: none"> 1. The mechanisms by which overweight and obesity can influence the knee osteoarthritis process and illness experience 2. The effects of weight loss on symptoms in people with knee osteoarthritis 	<p><u>Subscale[#]: Weight and the osteoarthritis disease process</u></p> <p>How confident do you feel in your ability to:</p> <ol style="list-style-type: none"> 1. Describe the benefits of weight loss to a patient with knee OA who is overweight or obese
MODULE 2: Overview of	<ol style="list-style-type: none"> 1. Define obesity class and 		

weight regulation, overweight and obesity	<p>anthropometric weight classifications and outline their limitations</p> <ol style="list-style-type: none"> 2. Describe obesity staging classification 3. Outline the epidemiology of obesity in Australia and worldwide 4. List the complications of overweight and obesity 5. Describe how body weight is regulated 6. Explain the body's compensatory response to weight loss and why achievement and maintenance of weight loss is difficult 7. Outline factors influencing weight gain 	<p><u>Subscale: Pathophysiology of overweight and obesity</u></p> <p>How confident do you feel in your knowledge of:</p> <ol style="list-style-type: none"> 3. The biological and physiological processes by which body weight is regulated 4. The body's physiological compensatory responses to weight loss 	<p><u>Subscale: Pathophysiology of overweight and obesity</u></p> <p>How confident do you feel in your ability to:</p> <ol style="list-style-type: none"> 2. Explain to a patient why achievement and maintenance of weight loss is difficult.
MODULE 3: Examining weight stigma in physiotherapy and personal beliefs about weight	<ol style="list-style-type: none"> 1. Explain what weight stigma is, its pervasiveness in healthcare, and its causes 2. Describe the impact of weight stigma on individuals 3. Recognise the social and environmental influences that contribute to overweight and obesity 4. Provide examples of how patients who are 	<p><u>Subscale: Weight stigma</u></p> <p>How confident do you feel in your knowledge of:</p> <ol style="list-style-type: none"> 5. The impact of weight stigma experiences on an individual's engagement with healthcare 6. The broad array of extrinsic factors outside 	<p><u>Subscale: Weight stigma</u></p> <p>How confident do you feel in your ability to:</p> <ol style="list-style-type: none"> 3. Provide an environment or safe space to minimize patient discomfort when discussing weight

	<p>overweight or have obesity may feel in a clinical setting</p> <p>5. Identify their personal attitudes and behaviours related to overweight and obesity in clinical practice</p>	<p>an individual's control that can contribute to overweight and obesity</p> <p>7. How clinicians' beliefs about weight influence their discussions and interactions with patients about weight loss</p>	
<p>MODULE 4: Communication approach for addressing weight management</p>	<p>1. Explain the 'Five A steps' approach for addressing overweight or obesity in a clinical setting</p> <p>2. Demonstrate different ways to sensitively raise the topic of weight with a patient</p> <p>3. Explain the important elements of the assessment of overweight or obesity in a physiotherapy setting</p> <p>4. Outline topic areas that may be relevant for discussion with patients when addressing weight management</p> <p>5. Outline potential indications for referral for medical, dietetic and psychological evaluation and</p>	<p><u>Subscale:</u> <u>Communication around weight</u></p> <p>How confident do you feel in your knowledge of:</p> <p>8. The data or information that are important to capture in an assessment exploring overweight or obesity in a physiotherapy setting</p> <p>9. The 5A steps to addressing overweight and obesity</p> <p>10. When referral to a medical practitioner is indicated for evaluation and management of overweight and obesity.</p>	<p><u>Subscale:</u> <u>Communication around weight</u></p> <p>How confident do you feel in your ability to:</p> <p>4. Communicate with patients about weight without compromising rapport or patient engagement with treatment</p> <p>5. Implement the 5A steps to manage overweight or obesity</p>

	support for people with overweight and obesity		
MODULE 5: Interventions for weight management	<ol style="list-style-type: none"> 1. Outline the components of treatment of overweight and obesity 2. Summarise healthy eating recommendations 3. Describe the different types of diets for weight loss and supporting evidence 4. Explain the role of physical activity and exercise in weight management and treatment of knee OA 5. Outline the role of pharmacotherapy and bariatric surgery in the management of obesity 	<p><u>Subscale: Lifestyle interventions for weight loss</u></p> <p>How confident do you feel in your knowledge of:</p> <ol style="list-style-type: none"> 11. The range of available options for of hypocaloric diets 12. The role of aerobic exercise in weight loss and weight maintenance 13. The effects of weight loss on lean muscle mass 	<p><u>Subscale: Lifestyle interventions for weight loss</u></p> <p>How confident do you feel in your ability to:</p> <ol style="list-style-type: none"> 6. Engage in a discussion with patients about dietary intervention and referral options for weight loss
MODULE 6: Health behaviour change support	<ol style="list-style-type: none"> 1. Outline the elements of quality care for chronic musculoskeletal disease management 2. Describe the determinants of behaviour and health behaviour change 3. Outline the role of self-efficacy in behaviour change 4. Identify common barriers and facilitators to 	<p><u>Subscale: Health behaviour change support</u></p> <p>How confident do you feel in your knowledge of:</p> <ol style="list-style-type: none"> 14. The determinants of behaviour and behaviour change 	<p><u>Subscale: Health behaviour change support</u></p> <p>How confident do you feel in your clinical skills to:</p> <ol style="list-style-type: none"> 7. Co-develop appropriate weight loss goals with patients 8. Identify patient specific barriers and facilitators to health behaviours

	engaging with weight management interventions 5. Describe appropriate behaviour change techniques to support weight management 6. Explain the principles of motivational interviewing and how it can be applied to weight management		for weight management 9. Co-develop with patients tailored and appropriate strategies to overcome barriers related to weight management.
TOTAL		[Total Knowledge Statements 14]	[Total Skills Statements 9]

* Participants were asked to rate their confidence on a 5-point Likert style scale where 1 = Not at all confident, 2 = Not very confident, 3 = Somewhat confident, 4 = Confident, 5 = Very confident responding to the knowledge and clinical skills statements.

Subscale headings were not visible to participants and represent the topics developed by the researchers as considered important for physiotherapists treating patients with knee osteoarthritis.

Table 2. Baseline characteristics of participants by group, reported as mean (standard deviation) unless otherwise stated.

	Control (n=41)	Education (n=39)
Female, n (%)	32 (78%)	26 (67%)
Practice location [†]		
Major city	38 (73%)	32 (84%)
Regional/rural	3 (27%)	6 (18%)
Practice location by state [†]		
Victoria	16 (39%)	13 (34%)
New South Wales	9 (22%)	10 (26%)
Western Australia	4 (8%)	3 (8%)
Queensland	7 (17%)	10 (26%)
South Australia	3 (7%)	2 (5%)
Australian Capital Territory	1 (2.4%)	0 (0%)
Employment setting		
Predominantly public	10 (24%)	10 (26%)
Predominantly private	31 (76%)	29 (74%)
Years clinical practice	14.6 (9.4)	11.9 (8.0)
Confidence in knowledge about weight management, NRS (0-10)	4.9 (1.9)	4.7 (1.8)
Physiotherapy Education		
Diploma, n (%)	1 (2%)	0 (0%)
Bachelor, n (%)	21 (51%)	20 (51%)
Masters, n (%)	18 (44%)	17 (44%)

PhD, n (%)	0 (0%)	2 (5%)
Specialisation, physiotherapy, n (%)	1 (2%)	0 (0%)
Previous professional development, hours		
Health behaviour change	10.3 (18.3)	5.8 (7.7)
Weight management	3.2 (15.7)	1.5 (4.0)
Osteoarthritis management	17.5 (23.1)	14.2 (15.0)
Casemix, (patients with chronic musculoskeletal disease), n (%)		
>75%	10 (24%)	15 (38%)
50 -74%	18 (44%)	14 (36%)
25-49%	12 (29%)	7 (18%)
<25 %, n (%)	1 (2%)	3 (8%)
Proportion of patient caseload (with OA and overweight) where weight management is discussed, n (%)		
>75%	15 (37%)	15 (38%)
50 -74%	8 (20%)	6 (15%)
25-49%	8 (20%)	3 (8%)
<25 %	10 (24%)	15 (38%)
Components of weight management care in OA included in practice, n (%)		
Don't address weight	0 (0%)	3 (8%)
Discuss relationship of weight and symptoms	40 (98%)	35 (90%)
Develop weight loss goals	8 (20%)	6 (15%)
Develop physical activity strategies to achieve weight loss goals	29 (71%)	23 (59%)

Develop health behaviour change strategies to achieve weight loss goals	11 (27%)	7 (18%)
Develop dietary plans or strategies to achieve weight loss goals	3 (7%)	3 (8%)
Other	5 (12%)	6 (15%)

OA=osteoarthritis, NRS=numeric rating scale (0-10, higher score indicates higher confidence)

[†]n=1 Location data missing for one participant in the training group

Table 3. Mean (SD) scores on outcome measures across time, by group, change within groups (6 weeks minus baseline), and difference in change between groups (adjusted for baseline value of outcome and stratifying variables)

	Baseline		6 weeks		Mean (SD) change within groups		Adjusted mean difference (95% CI)
	Control (n=41)	Education (n=39)	Control (n=41)	Education (n=38) [†]	Control (n=41)	Education (n=38) [†]	
Primary outcome							
Confidence in knowledge (RIVA-A) ^	32.1 (8.3)	32.3 (6.4)	34.9 (10.1)	57.4 (5.8)	2.8 (6.1)	25.4 (7.6)	22.6 (19.6, 25.5)
Secondary outcomes							
Confidence in clinical skills (RIVA-B) ^	22.0 (5.7)	21.5 (5.5)	22.1 (6.1)	36.2 (4.3)	0.0 (4.3)	14.9 (5.0)	14.6 (12.7, 16.4)
NUTCOMP ^	94.0 (17.3)	93.5 (13.9)	93.7 (19.0)	132.9 (16.3)	-0.4 (9.1)	39.5 (15.4)	39.9 (34.5, 45.4)
Anti-Fat Questionnaire							
¥:							

Total	37.2 (15.9)	36.0 (16.5)	36.6 (18.4)	29.4 (16.4)	-0.6 (9.8)	-6.7 (12.7)	-6.5 (- 11.4, -1.6)
‘Dislike’ subscale	12.8 (10.1)	12.6 (8.7)	13.6 (11.1)	10.4 (8.6)	0.8 (6.4)	-2.3 (6.8)	-3.1 (-5.9, -0.3)
‘Fear’ subscale	13.1 (6.8)	11.7 (7.2)	12.4 (7.0)	11.6 (7.4)	-0.7 (4.0)	-0.1 (5.1)	0.3 (-1.6, 2.2)
‘Willpower’ subscale	11.3 (4.8)	11.7 (5.3)	10.7 (5.2)	6.7 (4.9)	-0.6 (3.6)	-5.0 (4.7)	-4.2 (-6.0, -2.5)

[†]n=1 missing all 6-week data from Education group

CI = confidence intervals; SD = standard deviation; RIVA-A = Self-reported confidence in knowledge about weight management for patients with OA, scored 14-70, higher values indicating higher confidence; RIVA-B = Self-reported confidence in clinical skills about weight management for patients with OA, scored 9-45, higher values indicating higher confidence; NUTCOMP = Nutrition Competency, self-perceived competence in nutrition care to patients with chronic disease, scored from 35-175, higher values higher confidence. Anti-Fat Attitudes: Self-reported weight stigmatized attitudes, total scores range from 0-117, subscale scores ‘Dislike’: 0-63, ‘Fear of Fat’: 0-27, and ‘Willpower’: 0-27, higher scores indicating more stigmatized attitudes. ^ Positive change within group means improvement and positive difference in change between groups favours education group; ¥ Negative change within group means improvement and negative difference in change between groups favours education group.

Table 4: Results of the moderation analysis for both binary and continuous moderators (measured at baseline) on the primary outcome of change in confidence in knowledge (RIVA-A) from baseline (week 6 minus baseline). Results are presented as mean (SD) and mean differences between groups for the binary moderator, and in terms of the effect on the primary outcome of a one-unit increase in the moderators in each of the control and education groups for the continuous moderators.

BINARY MODERATOR (CLINICAL SETTING)				
Moderator	Control mean (SD)	Education mean (SD)	Mean difference, Education minus Control (95%CI)	p-value¹
Predominantly public	2.60 (6.13)	24.40 (9.19)	21.19 (15.38, 27.00)	0.60
Predominantly private	2.90 (6.14)	25.79 (7.05)	23.02 (19.64, 26.40)	
CONTINUOUS MODERATORS				
Moderator	Control moderator coefficient (95%CI)	Education moderator coefficient (95%CI)	Difference in coefficients, Education minus Control (95% CI)	p-value²
Self-rated confidence in weight management (NRS)	-0.02 (-1.35, 1.32)	-2.43 (-3.86, -0.99)	-2.41 (-3.91, -0.91)	0.002
Years of clinical experience	-0.05 (-0.28, 0.18)	0.27 (0.01, 0.54)	0.33 (-0.02, 0.67)	0.067

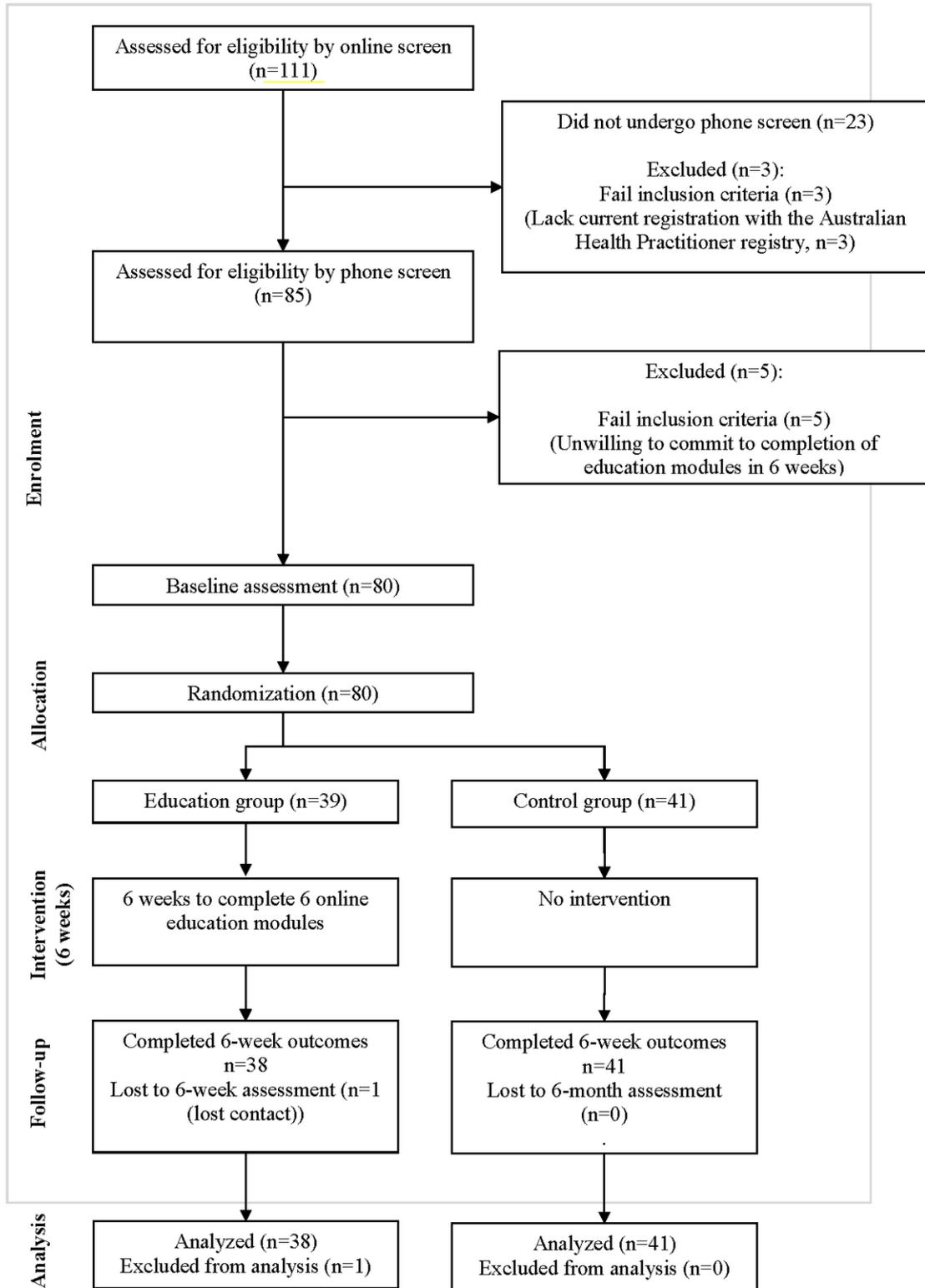
¹P-value for the interaction between moderator and treatment group. This p-value is associated with the null hypothesis that there is no difference in the treatment effect across moderator groups.

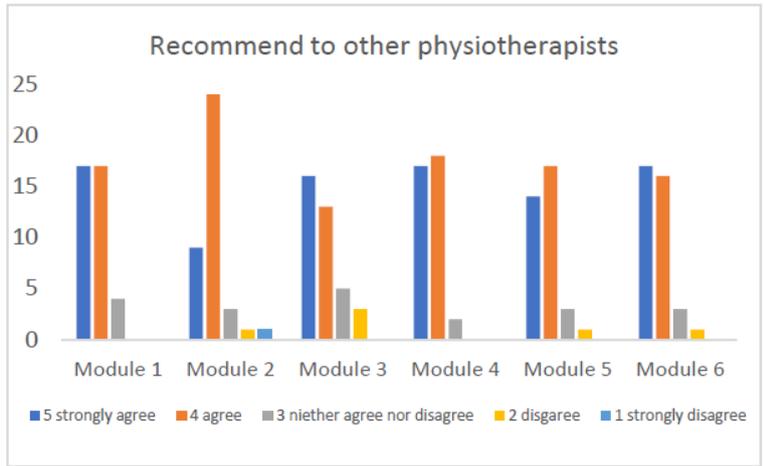
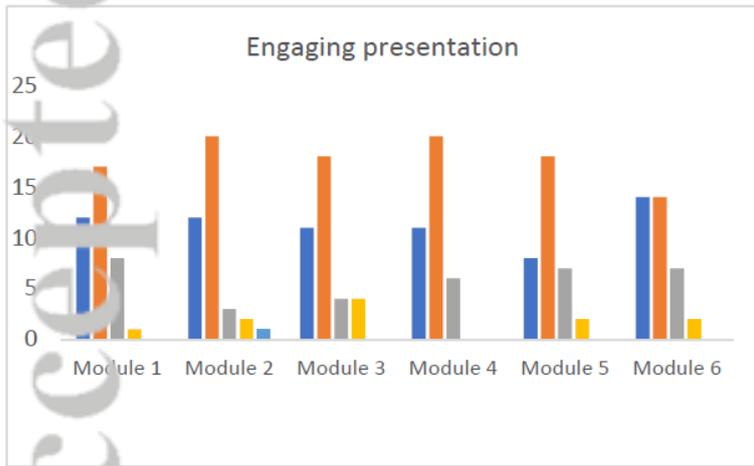
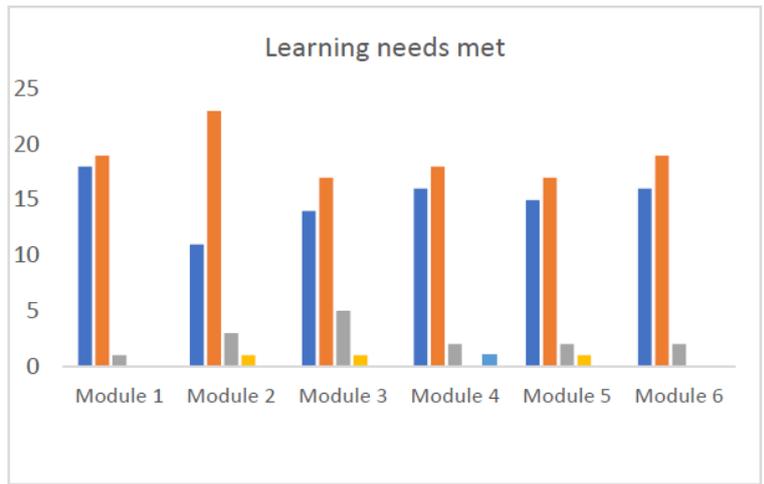
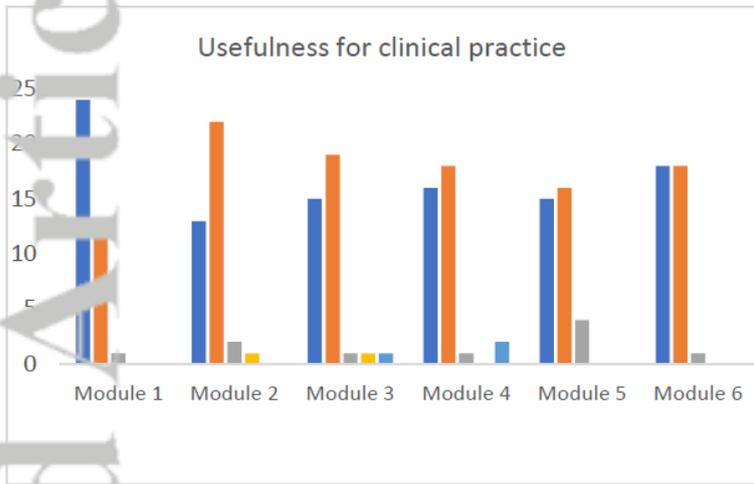
²P-value for the interaction between moderator and treatment group. This p-value is associated with the null hypothesis that there is no difference in the treatment effect across the moderator values.

Figure Legends

Figure 1. Flow of participants through study

Figure 2. 5-point Likert scale responses (5 = strongly agree (blue), 4 = agree (orange), 3 = neither agree nor disagree (grey), 2 = disagree (yellow), 1 = strongly disagree (light blue)) to perceived usefulness of modules with respect to ‘the knowledge I gained was useful for my clinical practice’, ‘I felt my learning needs were met’, ‘the material was presented in an engaging manner’ and ‘I would recommend to other physiotherapists’ for each of the six modules.





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