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Original paper

Exercise for falls prevention in older people: Assessing the knowledge of exercise science students

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Abstract

Participation in appropriate exercise can help reduce the risk of falls and falls injury in older people. Delivery of population-level exercise interventions requires an expert workforce with skills in development and delivery of group exercise programs and prescription of individually targeted exercise. This study assessed the current knowledge of university exercise science students (as future exercise professionals) across different levels of study. A structured survey designed to assess knowledge in relation to falls in older people and exercise prescription for falls prevention was administered during second, third and fourth year lectures in seven Australian universities. Students' knowledge was assessed as the percent of correct responses. Overall, 566 students completed the survey and knowledge levels increased significantly with study year. Mean knowledge levels were significantly <70%, indicating limited knowledge. They were lowest for falls risk factor questions and highest for issue/cost related questions in second and third year students. Fourth year students had best knowledge about falls interventions and this was the only group and topic with a mean score >70%. In conclusion, knowledge about falls and exercise prescription for falls prevention in current students does not meet a desired competency level of 70% and is therefore insufficient to ensure an adequately equipped future workforce in this area. There is a clear need for the development and widespread delivery of an evidence-based "exercise for falls prevention" curriculum module for exercise professionals.

Keywords: Exercise; Accidental falls; Aged; Injury prevention; Exercise prescription; Capacity building; Curriculum development; Undergraduate education; Workforce; Training

1. Introduction

Falls present one of the most serious and costly problems associated with older adulthood. One in three community-dwelling people aged >65 years experience at least one fall each year[1] and more than 30% of fallers sustain injuries severe enough to require medical attention.[1,2] Falls are the leading cause of injury-related hospitalisation in older people and often mark the beginning of a decline in function and independence. In economic terms, the direct and indirect costs associated with falls are great and are predicted to contribute a considerable burden on the health care system in future years.[3]

There is evidence that falls are not an inevitable part of ageing and are in fact preventable. Exercise plays a major role in modifying falls injury risk factors and preventing falls in older people,[4,5] with clinically significant reductions in falls rates following exercise interventions demonstrated in randomised controlled trials and recent meta analyses.[6–8]

There are increasing health agency policy directives and clinical recommendations promoting exercise as a key strategy for falls and injury prevention.[9–11] Historically, particular health professionals, such as physiotherapists, have been largely responsible for the prescription and delivery of exercise for older people in Australia. However, workforce

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capacity needs indicate that the reliance on these professionals as the only deliverers of exercise interventions for falls prevention is unsustainable and a non-generalisable approach. There is a clear role for trained exercise professionals to deliver these necessary exercise interventions to prevent falls in older people.[12]

This paper presents the surveyed knowledge levels of a future exercise professional workforce in relation to falls prevention. In particular, the extent to which current Australian undergraduate human movement and exercise/sport science students and postgraduate exercise rehabilitation students have the pre-requisite knowledge to prescribe exercise for falls prevention in older people was assessed. The survey focussed on students' knowledge about falls risk, falls injury prevention and exercise prescription for older adults. As there is a lack of specific courses dedicated to the issue of falls in older people and exercise for falls prevention, it was hypothesised that students would have limited knowledge levels. Due to the integration of some topics related to ageing in existing courses, it was also hypothesised that there would be greater knowledge with increasing year of study.

2. Methods

The sampling units were classes of students, identified according to university and year of study. Seven universities across the Australian states of Victoria (three urban, one regional) and New South Wales (two urban, one regional) were invited to participate. Universities were chosen because they had well-recognised exercise science/human movement training programs and together offered a maximum of 1041 second, third and fourth year student places. Sampling ensured a broadly representative and large enough sample to give a reasonably precise (i.e. ±5%) estimate of the proportion of correct responses to the survey.

Initial telephone contact with relevant university staff was followed up by a formal letter of invitation that was accepted by all seven universities. The department head or year level coordinator nominated classes across three years of study. One university did not nominate a second year class and another did not nominate a fourth year class.

During September–October 2007, a researcher visited each university to administer the survey. During nominated lecture times, students were given brief information about the survey and completion of the survey was taken as implied consent to participate. In all but two classes, all students attending the nominated lecture agreed to participate. The survey was completed during lecture times, usually within 10–15 min and collected immediately.

The survey examined knowledge in relation to falls in older people and exercise prescription for falls prevention. Preliminary questions categorised each student's university, degree, year of study, age and gender. The knowledge component consisted of 41 items, including multi-choice (Part A), true/false (Part B) and ranking (Part C) questions, chosen in the interest of time efficiency and objective scoring. Although the survey was not formally validated, it drew heavily on similar assessment questions previously used by the researchers and underwent extensive expert validation and pilot testing. The knowledge survey is presented in Supplemental File 1.

The 31 questions in Part A required students to choose one of four stated alternatives. Each correct answer scored one mark, with a maximum Part A score of 31. Items were further categorised according to topic area: burden and cost of falls (ten questions); risk factors and assessment (five questions); physiology and biomechanics of balance and gait (nine questions); falls prevention interventions (seven questions). The percentage of correct items overall and in each topic was calculated.

Seven Part B questions required students to indicate a yes/no response to given statements. Up to seven statements were given per question. Correctly answered statements were allocated one mark. The final score was the percent correct (from a maximum of 52).

Three Part C questions required students to rank a list of specified exercises as would be appropriately progressed. Each correct sequence was awarded one mark; a half mark was given where only one mistake existed in the ranking order. The final score was the percent correct (from a maximum of 3).

To provide exercise services to older people, exercise professionals should have a high level of knowledge about falls injury risk and exercise for reducing this risk. For this reason, the survey results were assessed against a desired baseline benchmark level of 70% correct, corresponding to university standards of what is regarded as enhanced knowledge in students.[13] The survey was designed, so that the difficulty of questions reflected the requisite level of knowledge that would be commensurate with someone responsible for developing exercise programs and prescribing exercise in this area.

The study was approved by the University of Ballarat Human Research Ethics Committee. Survey scoring and analysis was undertaken using SPSS 15.0 for Windows (SPSS Inc., Chicago, USA). Results are presented separately for each of Parts A, B and C.

To account for the sampling frame, whereby students were sampled through group classes at a given year level within a specific university, adjustment for clustering effects was made.[14] Differences between universities/states/regions were not of interest and therefore not assessed; however, potential university effects were accounted for in the analysis. Hierarchical Generalised Linear Modelling (GLM)[15] was used to calculate estimated marginal mean (EM) scores overall, and across survey sub-components. The Hierarchical GLM-EM model tested differences across year levels for all survey parts, and across topics within Part A, against the 70% null hypothesis level by the Wald Chi-square statistic.

Table 1
Numbers of students surveyed and comparison of GLM estimated marginal mean scores on the three parts of the survey across year levels.

State	University	Year level	*n*	Mean percentage score on Part A (range)	Part A >70% (*n*)	Mean percentage score on Part B (range)	Part B >70% (*n*)	Mean percentage score on Part C (range)	Part C >70% (*n*)
Victoria	1	2	32	52.4 (38.7–64.5)	1	60.7 (53.8–75.0)	18	58.8 (0.0–100)	7
		3	47	59.6 (32.3–74.2)	3	62.8 (36.5–73.1)	6	71.7 (0.0–100)	5
		4	9	63.0 (61.3–80.6)	0	65.3 (57.7–75.0)	0	77.2 (33.3–100)	1
		Total	88		4		24		13
	2	2	36	50.5 (19.4–61.3)	2	58.6 (40.4–69.2)	27	44.9 (0.0–100)	7
		3	39	57.7 (29.0–74.2)	2	60.6 (48.1–73.1)	9	57.9 (0.0–100)	3
		4	17	61.0 (54.8–77.4)	4	63.2 (59.6–75.0)	26	63.3 (0.0–83.3)	11
		Total	92		8		62		21
	3	2	25	55.0 (38.7–71.0)	0	62.2 (53.9–75.0)	21	56.9 (0.0–100)	12
		3	12	62.2 (48.4–77.4)	6	64.2 (48.1–75.0)	31	69.9 (0.0–100)	18
		4	0						
		Total	37		6		52		30
	4	2	58	49.9 (25.8–71.0)	0	58.3 (38.5–73.1)	8	47.3 (0.0–100)	2
		3	20	57.1 (35.5–77.4)	5	60.4 (53.9–69.2)	23	60.3 (0.0–100)	12
		4	41	60.4 (32.3–83.9)	7	62.9 (44.2–73.1)	16	65.7 (0.0–100)	8
		Total	119		12		47		22
New South Wales	5	2	34	56.2 (32.2–74.2)	5	59.9 (46.2–73.1)	21	46.5 (0.0–100)	6
		3	32	63.4 (35.5–87.1)	8	62.0 (44.2–73.1)	19	59.4 (0.0–100)	3
		4	23	66.8 (45.2–83.9)	14	64.5 (44.2–73.1)	25	64.9 (0.0–100)	15
		Total	89		27		65		24
	6	2	49	57.2 (32.2–74.5)	3	60.2 (42.3–75.0)	17	45.0 (0.0–100)	4
		3	24	64.3 (41.9–90.3)	11	62.3 (42.3–76.9)	21	58.0 (0.0–100)	10
		4	31	67.7 (51.6–83.9)	8	64.8 (51.9–76.9)	17	63.4 (0.0–100)	7
		Total	104		22		55		21
	7	2	0						
		3	22	65.7 (45.2–93.5)	8	65.5 (50.0–75.0)	17	71.3 (33.3–100)	9
		4	15	69.1 (58.1–83.9)	10	68.0 (57.7–78.9)	14	76.8 (33.3–100)	6
		Total	37		18		31		15
Total		2	234	54.2 (19.4–74.5)	11	60.5 (38.5–75.0)	112	51.1 (0.0–100)	38
		3	196	61.5 (29.0–93.5)	43	62.5 (36.5–76.9)	126	64.1 (0.0–100)	60
		4	136	64.6 (32.3–83.9)	43	65.1 (44.2–78.9)	98	69.5 (0.0–100)	48
		Total	566	60.1 (19.4–93.5)	97	62.7 (36.5–78.9)	336	61.6 (0.0–100)	146
GLM comparisons		Overall		$\chi^2_{(2,\, n=566)} = 113.41$, $p < 0.001$		$\chi^2_{(2,\, n=566)} = 44.53$, $p < 0.001$		$\chi^2_{(2,\, n=532)} = 37.58$, $p < 0.001$	
Mean difference (*p* value)		2 versus 3		−7.17%, $p < 0.001$		−2.06%, $p = 0.001$		−12.94%, $p < 0.001$	
		2 versus 4		−10.54%, $p < 0.001$		−4.60%, $p < 0.001$		−18.40%, $p < 0.001$	
		3 versus 4		−3.37%, $p = 0.003$		−2.54%, $p < 0.001$		3.47%, $p = 0.345$	

3. Results

Overall, 566 students participated in the survey, with 532 completing all survey components, equating to approximately 60% of second, third and fourth year students taking exercise science courses at the participating universities. The average student age was 21.7 (range 19–50) years; 41.7% of respondents were second year students, 33.8% third year and 24.5% fourth year. The number of respondents by state, university and study year is presented in Table 1. Of the 566 surveys, 436 were from students from urban universities. Victorian university students comprised 59.4% of the sample.

In terms of mean knowledge scores across all survey parts, third year students performed better than second year students and fourth year students performed better than both second and third year students (Table 1).

Table 1 presents overall Part A results, averaged by year of study, across universities and states. The mean knowledge score on this part of the survey was 58.6% (EM mean 60.1%), significantly less than 70% ($t_{565} = -23.90$, $p < 0.001$), with some variability across year levels and universities. Mean knowledge scores were significantly <70% both overall and across year levels.

Mean scores according to study year for each topic within Part A are given in Fig. 1. Mean scores were generally lowest for risk factor questions. Excepting fourth year students, knowledge about the issue/cost associated with falls was highest. Fourth year students appeared to know most about exercise interventions. For this topic, knowledge scores were

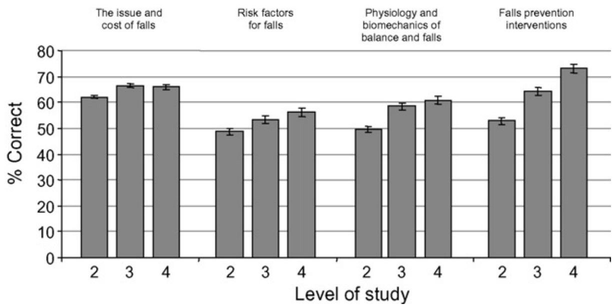

Fig. 1. Comparison of student's knowledge across year levels in relation to sub-components of knowledge assessed (estimated marginal mean ± SEM).

significantly <70% overall. Whilst the second and third year scores were significantly <70%, the fourth year knowledge scores regarding interventions did not significantly differ from 70%.

Year of study comparisons by Part A topic areas are in Supplemental File 2. In all cases, second year students had significantly poorer knowledge than both third and fourth year students. Despite lower knowledge levels than fourth year students for each topic, third year students only had significantly reduced knowledge about interventions.

The mean knowledge score for Part B (Table 1) was 61.8% (EM 62.7%) and significantly <70% ($t_{566} = -28.25$, $p < 0.001$). Knowledge scores were significantly <70% in all students, irrespective of year of study.

The mean knowledge score on Part C (Table 1) was 58.6% (EM mean 61.6%) and significantly <70% ($t_{565} = -8.68$, $p < 0.001$). Second year students had knowledge scores that were significantly <70%, but third and fourth year knowledge scores were not significantly different to 70%.

4. Discussion

Population-wide delivery of exercise prescription for falls prevention in older people requires an adequately trained and expert workforce. This study has assessed the knowledge standards of current exercise science students, as future exercise professionals, from a cross-section of Australian universities. The survey was conducted towards the end of the calendar year so the reported knowledge can be taken as a fair representation of that attained by the second, third and fourth (graduating) years. Average level of knowledge was found to be significantly less than 70%. This criterion, although somewhat arbitrary, reflects the cut-point for a distinction grade at universities and was considered to be the minimum standard necessary for exercise prescription experts. The findings suggest that exercise science students do not graduate with sufficient knowledge regarding falls and the prescription of exercise for falls prevention.

Students with more years of study had significantly higher scores indicating that knowledge regarding falls and exercise for falls prevention improves with the length of university tuition. Despite this, fourth year students still only scored an average of 65% in Parts A and B. No courses dedicated to the issue of falls in older people or exercise needs for falls prevention were offered at the participating universities at the time of this survey. However, it seems that some information regarding physiological ageing and prescription of exercise for older people are integrated into courses covering broader topics, such as *Growth and Development* and *Exercise Rehabilitation*. Our study results indicate a need for curriculum development, across all undergraduate years, to improve the knowledge base regarding falls in older people so that upon graduation, exercise science students are well-placed to provide specialised exercise services for falls prevention in older adults.

There was some variation in test performances across topics, but all were significantly below the desired 70% benchmark. Students performed worst in questions related to risk factors for falls. A systematic review concluded that the prevention of falls in older adults could be maximised by interventions that target multiple risk factors in individuals.[7] In this context, exercise professionals need to appreciate the many intrinsic and extrinsic factors that increase the risk of falls in older people,[16] which risk factors are amenable to exercise intervention and how to tailor exercise accordingly.[17–19] Our findings suggest the need for a curriculum with special focus on topics including medical, sensory, neuromuscular, psychosocial, behavioural, environmental and demographic factors that increase the likelihood of a fall.

Knowledge about the physiology and biomechanics of balance and falls was also relatively low. It is widely accepted that poor balance is a significant contributor to falls in older people[20] and that balance training can help prevent falls.[8] It is important that exercise professionals working with older populations understand how age manifests in sensorimotor performance before prescribing exercise.[21] Furthermore, an understanding of the various mechanical factors that challenge balance and influence balance recovery (for example, the required joint torques necessary for effective trip recovery) is necessary for the identification of appropriate exercise.[22] Average scores on items relating to the progression of exercises were also significantly below the 70% benchmark. Prescribing appropriately graduated balance exercise, in particular, is crucial to the success of exercise interventions for falls prevention.[8]

There were several limitations of this study. The survey assessed students' knowledge about falls prevention and not specific skills in prescribing exercise. Future assessments should consider practical skills development as well as knowledge levels. Similarly, scores on surveys such as this can reflect both knowledge levels and the difficulty of the questions. We aimed to develop a survey that was not too difficult and reflected required knowledge levels corresponding to an expert with responsibility for prescribing exercise for older people.

Some of the survey questions may have been unintentionally leading or led students to anticipate some answers. We were unable to asses the extent, if any, of these biases. However, the fact that mean knowledge scores were below the 70% benchmark suggests that this is not a major bias.

We aimed to recruit a representative sample of students in second, third and fourth years of exercise science degrees, in urban and regional universities across two Australian states. Given that the sampled universities were the major institutes offering exercise science degrees in the two states, we have assumed that these findings are representative of all exercise science students in Australia. Whilst it was not the purpose of this study to compare universities, a difference of only 8% separated the mean scores for the poorest (mean 56% correct) and best performing universities (mean 64% correct) for Part A. We did not assess the curriculum content at the participating universities but anecdotal evidence suggests little focus specifically on falls prevention. Future work should investigate whether knowledge levels found in this study are representative of students of other allied health professions and in other countries.

Not withstanding these limitations, the relatively low observed knowledge levels suggest a need to specifically target the education of future exercise professionals. A focussed approach aimed at systematically educating a whole workforce through the university sector has the potential to be the most effective and sustainable. To ensure that exercise professionals are prepared to take a lead role in providing exercise programs for older adults, university course content must include the latest falls prevention evidence. This may require a shift in teaching direction for many universities from the historical focus of improving elite sport performance or enhancing the health and fitness of predominantly healthy younger populations, but one that reflects an important need in the community.

Future falls prevention at the population level will require a critical mass of clinical champions to develop programs and implement interventions shown to be efficacious.[23] There is a clear role for exercise professionals to contribute to population-level falls prevention initiatives by taking on this role.[12] However, to achieve this they must have minimum requisite knowledge to ensure they are equipped to develop programs and prescribe suitable and effective exercises for falls prevention in older people with varying levels of function and impairment. Future workforce development could be achieved through the provision of new workforce learning, external courses and professional development opportunities, including teaching into undergraduate and post-graduate university courses. Importantly, curricula targeting exercise professionals should extend current physiology, biomechanics and exercise prescription content to focus on the impact of ageing on functional fitness and targeting exercise prescription for reducing falls risk. This training should extend along a continuum of intervention needs appropriate to the level of impairments and function of older individuals. With improved training in this area, these professionals will be well placed to provide evidence-based exercise services for older adults, and importantly, for falls prevention.

In conclusion, this study highlights the need for the development and widespread implementation of an evidence-based "exercise for falls prevention" curriculum for future exercise professionals. Adoption of such a curriculum would improve workforce capacity for falls prevention in a matter of a few years. Increased delivery of appropriately targeted falls-prevention exercise programs to older people will reduce their risk of falling, reduce their risk of fall-related injury and improve their general quality of life by improving functional capabilities. In doing so, exercise professionals will collectively make a significant contribution to improving long-term public health.

Practical implications

- Current training in exercise science in Australia does not produce a workforce with pre-requisite knowledge to deal with the large potential target population of older people at risk of falls and falls injury.
- Failure to equip a key group of exercise professionals with skills to deliver falls prevention programs leaves a significant gap in the exercise prescription workforce.
- Whilst health care policy now recognises and reflects the importance of exercise as a falls injury prevention strategy, there remains a need to reflect this in workforce development plans including university curricula for exercise professionals.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.jsams.2008.11.005.

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