



# Exploring balance challenge in fall prevention community exercise programs for older adults across Canada: A cross-sectional electronic survey of instructor perceptions

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## ABSTRACT

**Background:** Exercise that challenges balance helps reduce falls in older people. Evaluating the intensity of balance challenge is difficult and no validated measures exist for group settings.

**Objective:** To examine how instructors determine and perceive balance challenge at the program level, and explore relationships between estimates of program-level balance challenge.

**Design:** Cross-sectional self-report study

**Setting:** Electronic survey questionnaire approach.

**Participants:** Instructors of Canadian group exercise programs targeting community-dwelling older adults.

**Measurements:** Instructors perceived program-level balance challenge and estimates of program-level balance challenge.

**Results:** Most instructors ( $n = 108$ , 77%) perceived that their programs fully challenged balance among participants. However, no programs were identified as highly challenging. Most of the observed non-verbal balance challenge behaviours observed ( $n = 4$ , 80%) had no relationship to perception of balance challenge.

**Conclusions:** Findings suggest a misalignment between instructor perception and estimates of balance challenge at the program level. Further investigations of methods to assess balance challenge are warranted.

## 1. Background

Globally, falls are a major public health problem with 37.3 million reported yearly requiring medical attention. Exercise programs that focus on improving balance can reduce falls, particularly in community-dwelling older people [1]. Evidence-based practice recommendations to guide fall prevention programming indicate that exercise programs should aim to: 1) provide a high balance challenge, i.e. the degree of challenge to the balance control system relative to the capacity of the individual [2]; 2) be conducted for at least three hours per week; 3) be offered on an ongoing basis [1]. However, the most effective way to assess, prescribe and progress balance exercise has not been established [3,4]. Although new measures of the intensity of balance challenge have recently been developed for patient self-reporting [5–8] and therapist assessment in rehabilitation practice [6,8], no validated measures exist for a group setting, such as a community exercise program [3,5,6,9].

In 2019, a national survey of instructors of Canadian fall prevention and balance training community exercise programs for older adults was conducted. The study reported on the design characteristics at the level of the program, and explored whether programs included the three evidence-based recommendations for effective fall prevention exercise [10]. Most instructors reported that exercises became more challenging over time and that options were provided to make exercises more or less challenging [10]. Our study objectives were to further examine survey data to: 1) report how respondents determined participant-level balance challenge and their perception of program-level balance challenge; 2) estimate program-level balance challenge based on (a) average program balance challenge score [11] calculated by coding exercises reported by respondents and (b) non-verbal indicators of balance challenge [2] reported by respondents; and, 3) explore associations between instructor perceptions of program balance challenge and the two program-level estimates of balance challenge.

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## 2. Methods

As previously published, following institutional ethics approval, a self-report electronic questionnaire was sent to instructors of fall prevention community exercise programs for community-dwelling older adults ( $\geq 50$  years and living outside of government-funded institutions) across Canada following a modified Dillman recruitment approach in 2019 [10,12]. Group-delivered programs, conducted within a community setting, independently living older adult ( $\geq 50$  years) participants and a primary goal of fall prevention and/or improving balance were criteria for inclusion. The questionnaire was piloted through an iterative process and included open- and closed-ended questions that explored program characteristics, exercise content, target population and program and instructor demographic information.

Variables of focus for this study explored the primary way in which exercise challenge was determined (i.e., “What is the primary way in which you determine how challenging the balance exercises are for the participants?”), and instructors’ perceptions of how challenged their exercisers are while performing balance exercises. This study further examined questionnaire data related to estimating program-level balance challenge based on: (a) average program balance challenge score [11] calculated by coding the exercises that were included as reported by respondents and (b) non-verbal indicators of balance challenge [2] reported by respondents. We averaged the balance challenge score of each of the individual exercises in a program to calculate an overall program-level balance score (0–5). The program-level balance challenge score was used to assign programs into low (score of less than 2), moderate (score between 2 and 3.9), or high (score of 4 or greater) balance challenge categories, according to the previously established coding scheme [10,11]. For each of the non-verbal balance challenge indicators (postural sway, postural reactions as evidenced by ankle or hip or stepping/reaching strategies, or bracing) [2], the questionnaire asked instructors to indicate whether, in a typical balance exercise section of the program, they saw the non-verbal behaviour in the majority ( $\geq 50$  %) of their participants, in the minority ( $< 50$  %) of their participants, or whether they did not observe the behaviour.

Incomplete questionnaire responses (i.e., missing more than one full section) were not included in the analysis. We summarized data using descriptive statistics in Microsoft Excel (Office 2021). The Chi-square statistic ( $X^2$ ), calculated in SPSS (SPSS Inc.; Chicago, IL), was used to explore the relationship between perceived balance challenge reported by instructor and the estimates of program-level balance challenge nominal variables [13]. The likelihood ratio was used if an assumption was violated (i.e., if 20 % or more of the cells had an expected count less than 5) [13]. A p-value  $< 0.05$  was considered significant. Standardized residuals were used to determine which category contributed most to the  $X^2$  value [14]. A correlation coefficient (phi ( $\phi$ )) for  $2 \times 2$  tables and Cramer’s V (V) for  $2 \times 3$  tables) was used to determine the strength of the association between variables with 0.10, 0.30 and 0.50 representing a small, medium, and large effect size [14].

## 3. Results

As previously reported, 171 (73 %) of the 232 invited instructors responded. After excluding 21 ineligible and 10 incomplete surveys, 140 were included for data analysis [10]. Balance challenge program characteristics and perceptions reported by respondents are reported in Table 1. Most respondents ( $n = 108$ , 77 %) estimated that the majority of their participants ( $> 50$  %) were being fully challenged by the exercises.

Estimates of program-level balance assessments of balance challenge and statistical results are reported in Table 2. No programs were identified as having a high balance challenge score, the majority of programs were categorized as moderate balance challenge ( $n = 122$ , 88 %). There was a significant but weak association between instructor-perceived balance challenge and program-level balance challenge score,  $X^2(1, N(138))=4.1$ ,  $p=.04$ ,  $\phi=0.19$ ). The most commonly observed balance

**Table 1**

Balance challenge characteristics reported by instructors ( $N = 140$ ).

Variable	Number (n)	Percent (%)
Primary way in which participant-level balance challenge is determined		
Client’s successful performance of previously completed balance exercises	58	41 %
Client’s own decision	32	23 %
As weeks progress, challenge increases	32	23 %
Combination of factors	12	9 %
Other	6	4 %
Perceived program-level balance challenge		
Fully challenge balance (exercise performed near the limits of postural stability) in a majority ( $> 50$ %) of exercises	108	77 %
Do not fully challenge balance or challenge balance only in a minority ( $< 50$ %) of exercises	32	23 %
Never challenge balance	0	0 %

challenge behaviours were a step/reach postural strategy ( $n = 87$ , 65 %), sway ( $n = 66$ , 49 %), and ankle postural strategy ( $n = 60$ , 45 %). The only significant relationship was between perceived balance challenge and the ankle strategy behaviour,  $X^2(2, N = 134)=8.5$ ,  $p=.01$ ,  $V = 0.25$ ).

## 4. Discussion

To our knowledge, this is the first study to examine the relationship between instructor perception and estimates of balance challenge in fall prevention community exercise programs for older adults. Instructors were able to recognise when balance challenge was low based on the program-level balance coding scheme. However, the majority of instructors perceived that their programs were fully challenging balance while no programs were identified as highly challenging balance based on the program-level balance coding scheme. Additionally, perception of balance challenge had no relationship to four of the five observed non-verbal behaviours.

Our results support the notion that balance challenge assessment should incorporate both the difficulty of the exercise and the balancing ability of the individual person [5,6]. Discrepancies between observed and actual balance challenge levels have been reported [8]. When creating the Balance Intensity Scale for rehabilitation therapists (BIS-T) Farlie et al. noted that, even though therapists acknowledged challenging exercises are recommended and that they perceived they were prescribing exercises at this level, they were actually reluctant to push exercisers to high levels of balance challenge for several tasks [8]. Further research is needed to investigate the validity and reliability of the observer and participants ability to report a perceived balance challenge level in community exercise programs for older adults.

While low program-level balance challenge scores differentiated programs perceived as fully or not fully challenging balance, most programs were identified as moderately challenging. The coding scheme developed by Sibley may be insufficient to distinguish 3-levels (low, moderate and high) of program-level balance challenge accurately. The inclusion of participant self-reporting to this coding method could be a beneficial component to more comprehensively evaluate the level of challenge for participants. The rating of perceived stability (RPS) is a new tool, published after this questionnaire was administered, to quantify the level of challenge posed to an individual by a balance task [5]. It has been found to be independent from physical activity intensity (the level of effort or the energy expended by a person to complete the exercise) [5] and is able to distinguish between high and low levels of balance intensity (2-level scale) [6]. Future studies should consider modifying the program-level balance score coding to 2-levels (high versus low) and explore the inclusion of a client perception of balance challenge via a self-rating scale of balance intensity scale. The observed

**Table 2**  
Summary of program-level assessments of balance challenge (n, %). Boldface indicates significance.

Balance Challenge Score (0–5) (n = 138) <sup>†</sup>			Program Fully Challenges Balance (n = 107)	Program Does Not Fully Challenge Balance (n = 31)	X <sup>2</sup>	p Value
Low (<2.0)		Obs. (n, %)	9 (8.4 %)	7 (22.6 %)	<b>4.1</b>	<b>.04</b>
		Exp. (n, %)	12.4 (12 %)	3.6 (12 %)		
		Std. Res.	–1.0	1.8		
Moderate (2.0–3.9)		Obs. (n, %)	98 (91.6 %)	24 (77.4 %)		
		Exp. (n, %)	94.6 (88 %)	27.4 (88 %)		
		Std. Res.	.4	–0.7		
Observed Non-verbal Behaviours (n = 134) <sup>‡</sup>			Program Fully Challenges Balance (n = 103)	Program Does Not Fully Challenge Balance (n = 31)	X <sup>2</sup>	p Value
Ankle Strategy	Not Seen	Obs. (n, %)	11 (11 %)	10 (32 %)	<b>8.5</b>	<b>.01</b>
		Exp. (n, %)	16.1 (16 %)	4.9 (16 %)		
		Std. Res.	–1.3	2.3		
	Seen in Minority	Obs. (n, %)	44 (43 %)	9 (29 %)		
		Exp. (n, %)	40.7 (39 %)	12.3 (39 %)		
		Std. Res.	.5	–0.9		
	Seen in Majority	Obs. (n, %)	48 (47 %)	12 (39 %)		
		Exp. (n, %)	46.1 (45 %)	13.9 (45 %)		
		Std. Res.	.3	–0.5		
Brace	Not Seen	Obs. (n, %)	38 (37 %)	11 (35 %)	3.9	.14
		Exp. (n, %)	37.7 (37 %)	11.3 (37 %)		
		Std. Res.	.1	–0.1		
	Seen in Minority	Obs. (n, %)	45 (44 %)	9 (29 %)		
		Exp. (n, %)	41.5 (40 %)	12.5 (40 %)		
		Std. Res.	.5	–1.0		
	Seen in Majority	Obs. (n, %)	20 (19 %)	11 (35 %)		
		Exp. (n, %)	23.8 (23 %)	7.2 (23 %)		
		Std. Res.	–0.8	1.4		
Hip Strategy	Not Seen	Obs. (n, %)	12 (12 %)	5 (16 %)	1.4	.50
		Exp. (n, %)	13.1 (13 %)	3.9 (13 %)		
		Std. Res.	–0.3	.5		
	Seen in Minority	Obs. (n, %)	46 (45 %)	16 (52 %)		
		Exp. (n, %)	47.7 (46 %)	14.3 (46 %)		
		Std. Res.	–0.2	.4		
	Seen in Majority	Obs. (n, %)	45 (44 %)	10 (32 %)		
		Exp. (n, %)	42.3 (41 %)	12.7 (41 %)		
		Std. Res.	.4	–0.8		
Step/Reach*	Not Seen	Obs. (n, %)	1 (1 %)	0 (0 %)	1.9	.38
		Exp. (n, %)	.8 (1 %)	.2 (1 %)		
		Std. Res.	.3	–0.5		
	Seen in Minority	Obs. (n, %)	38 (37 %)	8 (26 %)		
		Exp. (n, %)	35.4 (34 %)	10.6 (34 %)		
		Std. Res.	.4	–0.8		
	Seen in Majority	Obs. (n, %)	64 (62 %)	23 (74 %)		
		Exp. (n, %)	66.9 (65 %)	20.1 (65 %)		
		Std. Res.	–0.4	.6		
Sway	Not Seen	Obs. (n, %)	10 (10 %)	6 (19 %)	2.9	.23
		Exp. (n, %)	12.3 (12 %)	3.7 (12 %)		
		Std. Res.	–0.7	1.2		
	Seen in Minority	Obs. (n, %)	43 (42 %)	9 (29 %)		
		Exp. (n, %)	40 (39 %)	12 (39 %)		
		Std. Res.	.5	–0.9		
	Seen in Majority	Obs. (n, %)	50 (49 %)	16 (52 %)		
		Exp. (n, %)	50.7 (49 %)	15.3 (49 %)		
		Std. Res.	–0.1	.2		

\* Abbreviations: Obs. = Observed; Exp. = Expected; Std. Res. = Standardized Residuals.

† Note: Two responses were excluded for the balance challenge score analysis due to incompleteness (skipping more than 50 %) of the survey section; proportions calculated based on total respondents that completed this section.

‡ Note: Six responses were excluded for the non-verbal behaviour analysis due to incomplete data; proportions calculated based on total respondents that completed this section.

non-verbal behaviour assessment method included in our survey was adapted from Farlie et al.'s more comprehensive BIS-T, which also included verbal markers [2,8]. The BIS-T has been validated for a therapist to immediately rate an individual exerciser's physical performance after completing a balance task [2,8]. The inability of the isolated reporting of non-verbal behaviours to distinguish between perceived balance challenge groups may be due to the prolonged time between observation and reporting, in addition to the need for them to remain as

a component of the more comprehensive BIS-T [8]. Our study complements new measures (e.g., BIS-T, RPS) by expanding the study of balance challenge from a clinical context to a community and group setting, however further work is needed to apply and validate these measures in these settings.

We acknowledge the limitations of non-random, self-selected sampling and self-report nature of survey methodology that may introduce bias and limit generalizability [15,16]. However, this approach enabled

the collection of a large dataset on various aspects of fall prevention community exercise programs, including balance challenge. It should also be noted that the observed associations between the estimates of program-level balance challenge and instructor-perceived balance challenge do not imply directionality or causation.

## 5. Conclusions

This study provides insight into instructor perceived ratings of balance challenge and methods of balance challenge assessment of fall prevention community exercise programs in Canada. The majority of respondents in the current study perceived that they are meeting the recommendation to include high balance challenge programming; however, none of the programs were identified as having a high balance challenge. While these results provide some insight, further research is needed to validate methods of accurately determining balance challenge in group settings and evaluate the integration of client self-report ratings of balance challenge in community programs.

## Ethics approval and consent to participate

Ethics approval was obtained from the University of Manitoba health research ethics board (HS22364). The first page of the questionnaire consisted of the consent disclosure form. Informed consent was assumed for all individual participants who returned the electronic questionnaire.

## Data sharing statement

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

## Generative AI and AI-assisted technologies

The authors declare that no generative AI and AI-assisted technologies were used in the preparation of this manuscript or the creation of the figures, images and artwork.

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Not applicable.

## CRediT authorship contribution statement

**Alison M Bulow:** Writing – review & editing, Writing – original draft, Formal analysis, Data curation. **Alexie J Touchette:** Writing – review & editing, Visualization, Validation, Project administration, Methodology, Investigation, Data curation, Conceptualization. **Alison R Oates:** Writing – review & editing, Methodology, Conceptualization. **Kathryn M Sibley:** Writing – review & editing, Visualization, Validation, Supervision, Software, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

## Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: Kathryn Sibley reports financial support was provided by Canadian Research Chairs. If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## References

- [1] Sherrington C, Michaleff ZA, Fairhall N, Paul SS, Tiedemann A, Whitney J, et al. Exercise to prevent falls in older adults: an updated systematic review and meta-analysis. *Br J Sports Med* 2017;51(24):1750–8. Dec.
- [2] Farlie MK, Molloy E, Keating JL, Haines TP. Clinical markers of the intensity of balance challenge: observational study of older adult responses to balance tasks. *Phys Ther* 2016;96(3):313–24. Mar 1.
- [3] Farlie MK, Robins L, Haas R, Keating JL, Molloy E, Haines TP. Programme frequency, type, time and duration do not explain the effects of balance exercise in older adults: a systematic review with a meta-regression analysis. *Br J Sports Med* 2019;53(16):996–1002. Aug.
- [4] Chodzko-Zajko WJ, Proctor DN, Fiatarone Singh MA, Minson CT, Nigg CR, Salem GJ, et al. Exercise and physical activity for older adults. *Med Sci Sports Exerc* 2009;41(7):1510. July.
- [5] Espy D, Reinthal A, Meisel S. Intensity of balance task intensity, as measured by the rate of perceived stability, is independent of physical exertion as measured by heart rate. *J Nov Physiother* [Internet] 2017;7(S4) [cited 2024 July 16] Available from, <https://www.omicsgroup.org/journals/intensity-of-balance-task-intensity-as-measured-by-the-rate-of-perceivedstability-is-independent-of-physical-exertion-as-measured-2165-7025-1000343.php?aid=89228>.
- [6] Ferris J, Zwier J, Carender WJ, Sienko KH. Differences between physical therapist ratings, self-ratings, and posturographic measures when assessing static balance exercise intensity. *Front Rehabil Sci* 2023;4:1096171. May 11.
- [7] Alsubaie SF, Whitney SL, Furman JM, Marchetti GF, Sienko KH, Klatt BN, et al. Reliability and validity of ratings of perceived difficulty during performance of static standing balance exercises. *Phys Ther* 2019;99(10):1381–93. Oct.
- [8] Farlie MK, Keating JL, Molloy E, Bowles KA, Neave B, Yamin J, et al. The balance intensity scales for therapists and exercisers measure balance exercise intensity in older adults: initial validation using rasch analysis. *Phys Ther* 2019;99(10):1394–404. Oct 28.
- [9] Farlie MK, Robins L, Keating JL, Molloy E, Haines TP. Intensity of challenge to the balance system is not reported in the prescription of balance exercises in randomised trials: a systematic review. *J Physiother* 2013;59(4):227–35. Dec.
- [10] Touchette AJ, Oates AR, Menec VH, Sibley KM. Design characteristics and inclusion of evidence-based exercise recommendation in fall prevention community exercise programs for older adults in Canada: a national descriptive self-report study. *BMC Geriatr* 2021;21(1):33. Dec.
- [11] Sibley KM, Touchette AJ, Singer JC, Dubberley KMA, Oates AR. To what extent do older adult community exercise programs in Winnipeg, Canada address balance and include effective fall prevention exercise? A descriptive self-report study. *BMC Geriatr* 2019;19(1):201. Dec.
- [12] Dillman DA. Mail and internet surveys : the tailored design method. 2007 update with new internet, visual, and mixed-mode guide. 2nd ed. Hoboken, N.J.: Wiley; 2007.
- [13] McHugh ML. The Chi-square test of independence. *Biochem Medica* 2013:143–9.
- [14] Portney L. Foundations in clinical research, 4e: applications to evidence-based practice [Internet]. 4th edition. Philadelphia, PA: F.A. Davis; 2020 Available from, <http://uml.idm.oclc.org/login?url=https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=2344953&site=ehost-live>.
- [15] Kelley K. Good practice in the conduct and reporting of survey research. *Int J Qual Health Care* 2003;15(3):261–6. May 1.
- [16] Liamputtong P. Research methods in health [Internet]. Melbourne, AUSTRALIA: Oxford University Press Australia & New Zealand; 2017 [cited 2022 Nov 14]. Available from, <http://ebookcentral.proquest.com/lib/umanitoba/detail.action?docID=6512693>.