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Effects of Chronic Diabetes and Attentional Focus on Performance and Learning of a Novel Stabilometer Balance Task

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EFFECTS OF CHRONIC DIABETES AND ATTENTIONAL FOCUS
ON PERFORMANCE AND LEARNING OF A NOVEL
STABILOMETER BALANCE TASK

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A doctoral project submitted in partial fulfillment
of the requirements for the

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Novel Stabilometer Balance Task

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Abstract

Background and Purpose: Chronic diabetes is a prevalent systemic disease that impairs physical functioning and often leads to increased risk of falls. Adopting an external focus of attention during motor skill practice has been shown to improve learning outcomes, however, it has not been examined in this population. We examined how attentional focus instructions (internal vs. external) affect balance performance and learning in older adults with and without diabetes.

Methods: Fifty-three older adults (27 with diabetes, 63.7 ± 7.0 years) participated in the randomized, pre-post intervention study. The balance training involved 50 practice trials of a stabilometer task that was novel to all participants. Participants were randomized to receive either internal or external focus task instruction. Task performances were assessed at baseline, during training, and during a retention test. Primary outcomes were changes in balance task performance before and after training. The study protocol was approved by the UNLV Biomedical IRB, and participants gave written consent prior to data collection.

Results: Participants who received external focus instruction showed significantly greater increase in balance performance than individuals who received internal focus instruction (95% CI=[0.02; 4.05], $p=0.048$). While participants with diabetes exhibited poorer baseline task performance ($p=0.02$), both groups improved their relative task performance after training (95% CI=[5.25; 18.14], $p<0.0001$).

Discussion and Conclusions: Adopting an external focus of attention benefits performance during short-term training of a novel balance task in older adults with and without diabetes. Participants with diabetes were capable of improving task performance with practice at a relative rate similar to those without diabetes. This information may be useful for designing interventional strategies to improve physical function and mitigate fall risks in older adults with diabetes.

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Conflict of interest

The authors have no conflicts of interest to declare.

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Section 1: Background

Diabetes is a chronic condition that affects multiple body systems.¹⁻³ The consequences of chronic diabetes on patient's quality of life, and risks of morbidity and mortality make it one of the most urgent health crises.⁴ The prevalence of type 2 diabetes is rising worldwide.⁵ The International Diabetes Federation predicts that by 2030 almost 643 million people worldwide will be living with diabetes.^{5,6} Within the diabetic population a significant source of disability comes from their elevated fall risks.^{7,8} According to a systematic review by Yang et al., the risk of falls in older adults with diabetes is 64% greater than those of comparable age without diabetes.⁴

The increased risk of falls for individuals with diabetes has been attributed to a number of disease-related functional deficits such as sensory impairments and the resulting diminished postural control.⁹ Individuals with diabetes can experience increased risk in the following sensory neuropathic impairments: retinopathy (affecting vision), peripheral neuropathy (affecting proprioceptive sensation), and vestibular dysfunction (affecting inner ear-associated postural control).^{3,10,11} These impairments can lead to increased postural sway, contributing to an increased risk of shifting the body's center of mass outside of the limit of stability, which is a common cause of falls in the older adult population.¹² To address this issue, the current body of clinical evidence shows that reduced balance performance in the diabetic population is a multifactorial construct that can be effectively improved through targeted exercise training and therapy.^{13,14}

Attentional focus manipulation is a line of research aimed to optimize motor performance and learning.¹⁵ An external focus of attention (i.e. on the movement outcome), in comparison to an internal focus (i.e. on the body movements themselves), has been shown to improve motor control and frequency of on-line adjustments during motor tasks. The enhanced motor control is associated with improved physical performance.^{16,17} Furthermore, adopting an external focus of attention may alter the utilization of sub-conscious and reflexive control processes, which can

accelerate the control and learning processes towards one of greater fluidity and automaticity.¹⁷ Previous research has provided evidence of performance benefits when the performer uses an external focus of attention.¹⁸⁻²² For example, Chiviacowsky and colleagues showed that external focus instructions can lead to better balance performance and more effective learning in older adults practicing an unfamiliar balance task.²³ However, the attention focus benefits in older adults with chronic diabetes has not been investigated. Given that task-oriented exercise training has been shown to improve physical function in the diabetic population,²⁴ the logical next step is to understand how to optimize parameters of exercise training in order to elicit maximum efficacy and efficiency when treating this clinical group.

Therefore, the purpose of this study was to examine how attentional focus instructions (internal vs. external) affect balance performance and learning in older adults with and without diabetes. We hypothesized that participants with diabetes would exhibit poorer balance performance, when compared to age-matched controls (hypothesis 1). We further hypothesized that external focus instructions will enhance learning across the training and retention phases in both groups, when compared to internal focus instructions (hypothesis 2).

Section 2: Methods

Participants

To estimate the required sample size, an *a priori* power analysis was conducted using parameters estimated from 4 previous studies that investigated balance performance in older adults with diabetes and neuropathy, and the effects of attentional focus on balance performance.^{9,25,26} Based on the power analysis, we aimed to recruit 48 participants (12 per group) with flyers posted in internal medicine, physical therapy and podiatric clinics, as well as internet advertisements and personal communication within the Southern Nevada region. Inclusion criteria were: 1) age >50 years, 2) able to walk at least 50 meters without walking aids, 3) able to stand for at least 5 minutes without an assistive device and excessive fatigue, and 4) willing to travel to the study site 3 times over a period of up to 2 weeks for training and testing.^{27,28} Experimental group participants were required to have a current medical diagnosis of diabetes.²⁹ Age-similar older adults without diabetes served as controls. The exclusion criteria for both groups were: 1) other concurrent diseases that influenced motor function and balance, 2) leg/foot ulcer or other conditions that caused pain during weight-bearing, and 3) cardiovascular, respiratory, or other health conditions that precluded moderate physical activity. The study protocol was approved by the UNLV Biomedical IRB, and participants gave written consent prior to data collection.

Procedures

Each participant participated in 3 days of data collection at the Clinical Locomotor Neuromechanics Laboratory at the University of Nevada, Las Vegas. The experimental design encompassed four groups: diabetic internal focus (ID), diabetic external focus (XD), control internal focus (IC), and control external focus (XC). We randomly assigned participants to the attentional focus groups, followed by quasi-random allocation to ensure the final groups were

similar in age and gender composition. Day 1 was focused on collecting data on each participant's current level of physical capability and other characteristics through clinical outcome measures (Table 1). Specifically, following consent, participants completed the Activities-specific Balance Confidence (ABC) Scale³⁰, Fear of Falling Avoidance-Behavior Questionnaire (FFABQ)³¹, and International Physical Activity Questionnaire (IPAQ).³² A brief medical history was also obtained. Finally, the Timed Up and Go (TUG) test was conducted.^{33,34} Day 2 was focused on stabilometer task training (parameters detailed below). A performance retention test and debriefing was conducted on Day 3, at least 24 hours after Day 2 to allow learning consolidation.³⁵

Assessment of balance performance and learning was conducted using a stabilometer (Figure 2; Model 16130, Lafayette Instrument, IN, USA). A stabilometer is a balance assessment/training tool that moves from side to side with the participant controlling its movement by weight-shifting. Every participant underwent a total of 50 30-second balance task trials (10 on day 1, 30 on day 2, and 10 for retention test on day 3; Table 1). After each trial, the participant was allowed one minute of rest or until he/she felt ready to continue. During training, after each practice block (five trials), mean performance as time spent "in balance" was provided to the participant as feedback. In this study, we operationally defined a participant's performance to maintain balance as time spent within ± 5 degrees from platform horizontal during each trial.²³ In other words, the longer a participant can keep the platform near horizontal, the better the task performance.

To examine the effect of attentional focus, participants in the two attentional focus groups received different standardized instructions. For the internal focus group, participant was instructed to "*focus on keeping your two feet horizontal for as long as possible*". For the externally focused group, they were instructed to "*focus on keeping the two markers on the platform*".

horizontal for as long as possible". Two colored markers were placed on the stabilometer platform near where the participant would place their feet for the purpose of external focus cueing (Figure 1). At the end of the last block for the day, the participant was asked further questions to verify their focus (Table 1). This question was a self-reflection on where their focus was directed during the balance task, how difficult it was to maintain focus, and how often their focus would drift from the instructed focus targets. At the end of the experiment, participants were asked to rate from 1 (not helpful at all) to 10 (extremely helpful) regarding the question: *"How helpful and useful is the balance training on your everyday walking and other activities?"*



Figure 1: Stabilometer for Balance Training and Testing (the two orange color markers in the front corners of the platform were used for the external focus condition)

Table 1: Summary of Procedures in Each Testing Sessions

	Day 1 (baseline)	Day 2 (training)	Day 3 (retention test)
Clinical outcome Measures	Informed consent TUG test ABC survey FFABQ survey IPAQ survey		ABC survey
Balance practice	10 trials of stabilometer task (with focus-specific instructions)	30 trials of stabilometer task (with focus-specific instructions)	10 trials of stabilometer (retention test without instructions)
Practice-related feedback and checks	Feedback on participant's task performance (provided after each practice block of 5 trials) Focus check questions (at the end of the day)	Feedback on participant's task performance (provided after each practice block of 5 trials) Focus check questions (at the end of the day)	Question on helpfulness and usefulness of the training on everyday activities

Statistical Analysis

To evaluate the participants' demographic and anthropometric characteristics, one-way ANOVA or Chi-square tests were conducted to compare age, gender, ethnicity, BMI, and physical activity levels across the four groups.

A linear mixed effects model was used to examine the effects of focus condition (external versus internal), group (with versus without diabetes) and day (Day 2 versus Day 3) on the primary outcome measure of time in balance. All interactions between our primary independent variables (focus, group, and day) were also included in the model. Co-variables of age in years, gender, trial number during practice, baseline balance task performance during Day 1 were also included in the model. Random slopes for trial and random intercepts for participant were included. We also

included an autoregressive correlation structure in the model to account for autocorrelation between trials across days.

As an exploratory subgroup analysis, a linear mixed effects model on individuals with diabetes was used to examine the possible interaction of variables including mobility (i.e. TUG performance) and focus of attention on time in balance across days 2 and 3. For co-variables, we included age, gender, baseline task performance, trial, and day as fixed effects with trial and subject as random effects. The aim of this analysis was to investigate how focus of attention may differentially impact variation in balance performance in this group.

Separate general linear models were used to examine how group and focus affected changes in ABC scores before and after training. A group by focus interaction was included in the model to determine if changes in either measure were dependent on focus of attention between groups. Co-variables of age and gender were included in each model. Differences in perceived difficulty to follow the instruction, attentional drift, and helpfulness of the training were examined using ordinal regression given that each measure was recorded on a 10-point scale and were skewed.

Section 3: Results

Group Demographics, Anthropometrics, and Physical Function Comparisons

Of the 53 participants recruited for the study, 5 dropped out of the training (3 with diabetes and 2 without; 3 from the internal focus group and 2 from the external focus group). Two dropped out due to apprehension and lack of confidence to complete the study procedure. Three others had personal reasons not related to the training protocol. Participant characteristics are presented in Table 2. Overall, participants in the 4 groups were comparable in age, gender and ethnic compositions, BMI, and physical activity level (MET-minutes per week and sitting minutes). As expected, participants with diabetes exhibited significantly lower ABC scores and baseline balance performance (Table 2).

Table 2: Participant Characteristics

	Participants with Diabetes		Participants without Diabetes		p-value
	XD (n=12)	ID (n=12)	XC (n=12)	IC (n=12)	
Outcome variables					
Age (years)	64.4±8.3	63.0±5.8	61.7±9.7	63.6±8.8	0.724
Gender	10M, 2F	6M, 5F, 1NC	6M, 6F	6M, 6F	0.472
Ethnicity	6 white, 2 Hispanic, 1 black, 3 Asian/Pacific Islander	7 white, 3 Hispanic, 2 Asian/Pacific Islander	11 white, 1 Asian/Pacific Islander	8 white, 1 Hispanic, 2 Asian/Pacific Islander	0.188
BMI (kg/m ²)	31.4±7.3	26.9±3.3	25.7±4.7	33.6±15.4	0.143
IPAQ (MET-minutes)	2497±2797	3368±2820	3724±6266	2223±2478	0.984
IPAQ sitting time (minutes)	2540±1462	3308±2294	1733±1402	2076±1259	0.131
ABC on Day 1	84.7±3.9	67.5±27.9	96.9±2.9	92.8±7.0	<0.001
Baseline time in balance (seconds)	8.5±3.7	7.90±2.0	11.4±3.9	10.1±4.3	0.02

Effect of Attentional Focus, Group, and Day on Time in Balance

Results of the linear mixed effects model demonstrated significant main effects of day ($p < 0.0001$) and focus ($p = 0.048$) but no main effect of group ($p = 0.49$). Overall, participants experienced a 1.9 second increase in time in balance ($\beta = 1.91$, 95% CI=[1.3; 2.5], $p < 0.0001$). Given the estimated model intercept of 11.7 (95% CI=[5.25; 18.14], $p < 0.0001$) this represents a 16% relative improvement in performance from the baseline. For the effect of focus, individuals who received external focus of attention instructions were observed to have an average increase of time in balance of 2.0 seconds greater than individuals who received internal focus of attention instructions (95% CI=[0.02; 4.05], $p = 0.048$).

The lack of a group effect or group by day interaction ($p = 0.36$) indicated that there was no observed mean difference between participants with and without diabetes. One explanation for this is that the primary group difference occurred during the baseline phase, as we observed in an analysis that examined average baseline task performance (mean difference=2.2 seconds, 95% CI=[0.13; 4.3], $p = 0.038$) while controlling for age, gender and focus of instruction. Namely, participants without diabetes had an average time in balance 2.2 seconds longer than people with diabetes before training. Our primary analysis aimed to observe if differences in task performance between groups changed while controlling for the known baseline performance difference. With baseline performance included as a covariate in the analysis of group differences across days 2 and 3, there was no group effect which suggests that group differences occurred during the baseline phase and neither increased or decreased during training or retention test. Data across all days is presented in Figure 2.

A significant interaction of focus by day ($p = 0.008$) was observed. Comparisons of the estimated marginal means of each focus condition between days demonstrated that each condition

improved significantly over time (internal [day 3 – day 2]=1.71, 95% CI=[1.29; 2.14], $p<0.0001$; external [day 3 – day 2]=1.15, 95% CI=[0.75; 1.56], $p<0.0001$). No other interactions were statistically significant. To better understand if the main effect of focus, found in the primary analysis, applied to both groups equally, we performed two separate sub-group analyses that were identical to the primary model but separately for the 2 groups. Results of the analysis on participants without diabetes demonstrated significant effects of focus ($\beta_{\text{external}}=2.26$, 95% CI=[0.18; 4.34], $p=0.02$) and focus by day interaction ($p=0.016$), with external focus having a performance advantage over internal focus. Specifically, contrasts of the estimated marginal means between conditions across each day demonstrated that participants who received external focus outperformed those receiving internal focus during training (mean difference=3.08, 95% CI=[0.99; 3.08], $p=0.035$), but not during the retention test (mean difference=1.12, 95% CI = [-0.81; 3.04], $p=0.24$).

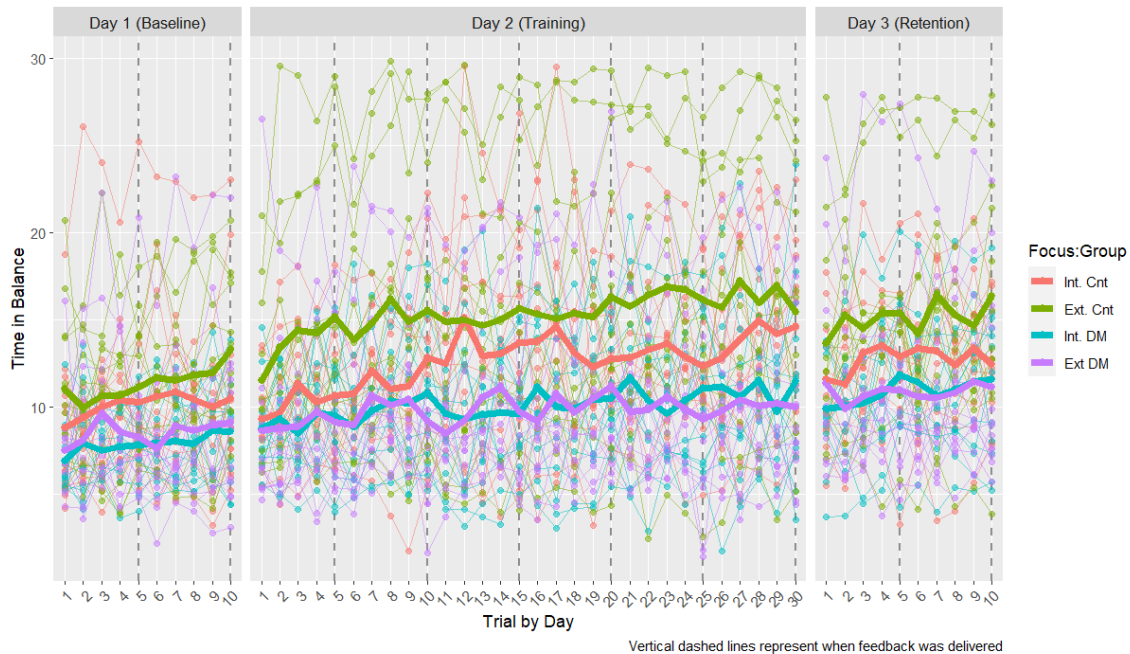


Figure 2: Effects of Attentional Focus, Group and Day on Changes in Balance Performance

Interactions between Physical Function and Focus on Time in Balance among People with Diabetes

Results of the linear mixed effects model that examined the interaction between mobility function and attentional focus among participants with diabetes demonstrated a significant interaction between mobility and focus ($\beta_{\text{TUG:Focus}} = -1.97$, 95% CI = [-3.55; -0.38], $p = 0.009$). This result indicates that the focus of attention used by an individual modified their performance on the stabilometer task as a function of their mobility function. Specifically, the interaction effect between TUG and focus was greater for individuals who received external focus instruction compared to individuals who received internal focus instruction. Individuals with shorter TUG times who received external focus performed better than individuals with similarly fast TUG times who received internal focus. The point of interaction crossover occurs at TUG time = 11.9 seconds. Visualization of this interaction is presented in Figure 3.

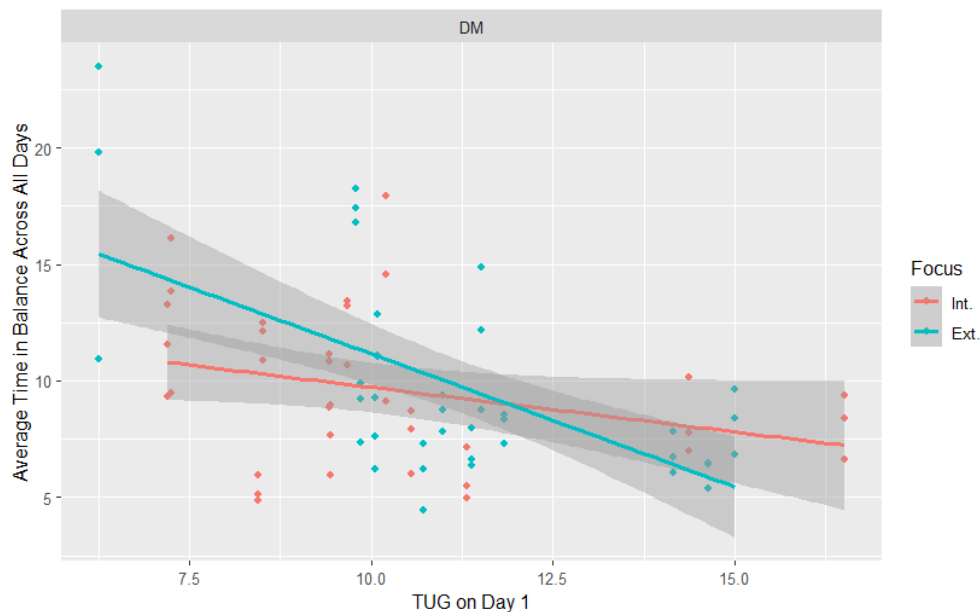


Figure 3. Interaction Between Physical Function and Focus of Attention on Time in Balance

Effect of Focus on Balance Confidence Between Groups

The results of the general linear model which examined the effect of focus on ABC scores between groups and across time demonstrated a main effect of group ($\beta_{DM}=-352$, 95% CI=-487; -217], $p<0.0001$). This result indicates that individuals with diabetes reported an average ABC of 352 points lower than that of individuals without diabetes. Visualization of group and individual data points before and after training were presented in Figure 4.

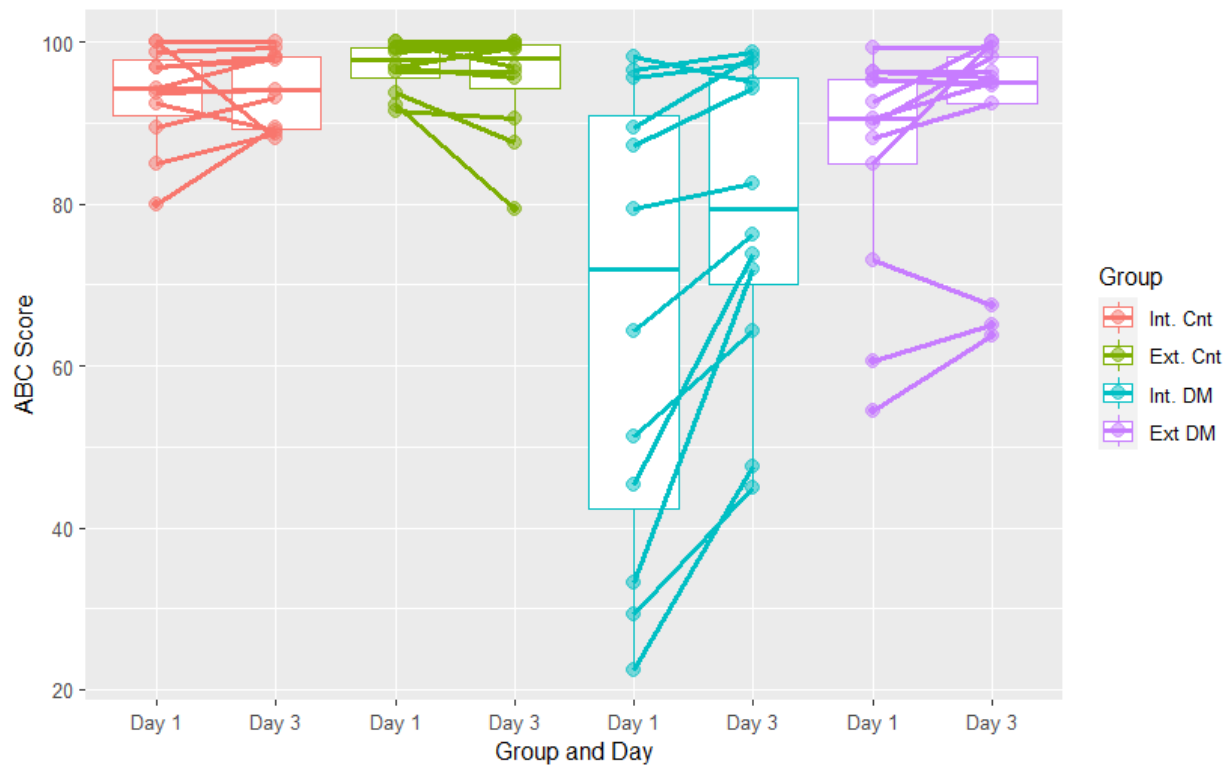


Figure 4: Changes in ABC Score Between Day 1 and Day 3 for Each Group.

Effects of Focus and Group on Difficulty to Follow Focus Instructions, Attentional Drift, and Helpfulness of the Training

Results from the ordinal regression on difficulty to follow focus instructions showed no significant effects in group ($p=0.8$), focus ($p=0.13$), or day ($p=0.06$). Results from the ordinal regression on attentional drift demonstrated a significant effect of group ($p=0.03$) that participants with diabetes experienced less drift than individuals without diabetes. There was no effect of focus ($p=0.43$) or day ($p=0.99$) on attentional drift. Results of the ordinal regression on instructional helpfulness revealed that there was no difference between group ($p=0.78$) or focus ($p=0.91$).

Section 4: Discussion

To our knowledge, this study is the first to examine the influence of chronic diabetes and attentional focus on performance and learning of a novel balance task in older adults in a training setting. The results confirmed our hypothesis that individuals with diabetes exhibited poorer baseline balance performance and balance confidence than control participants who were similar in age, BMI, and physical activity level. The stabilometer training, while novel and challenging to both groups, was effective in improving balance performance in our cohort of older adult participants. Despite their lower baseline performance and diminished physical function, participants with diabetes were still able to improve their task performance at the same rate as compared to those without diabetes. Furthermore, external focus instruction was shown to be more effective in enhancing performance and learning of the balance task during training.

Our result agrees with the findings reported by Chiviacowsky and colleagues²³ when they gave non-disabled older adults instructions that were similar but distinct in the direction of focus (i.e. focus on maintaining the feet vs. markers on the platform in a horizontal orientation for as long as possible) during a task similar to what was used in this study. They found that during only 10 practice trials, older adults who received the external focus instruction significantly outperformed their counterparts who received internal focus instruction. Our findings support the premise that adopting an external focus of attention regarding the task goal is advantageous in improving performance of the balance task and may be beneficial to building balance confidence.

Research on attentional focus over the last twenty years supports the idea that directed attentional focus through carefully worded but simple instructions can significantly influence intended motor performance and learning.¹⁵⁻¹⁷ One prevailing theory of attentional focus posits that instructions that bias the performer's attention internally on body motions or muscle

contractions may interfere with the natural (intrinsic) goal-directed motor control processes.³⁶ In contrast, instructions that direct performer's attention externally to movement outcomes allow them to adopt a more intuitive and perhaps implicit form of control that benefits performance and learning.³⁷⁻³⁹ For example, Wulf and colleagues showed that performance of postural control tasks can be improved when an external attentional focus was adopted.^{16,17,38} The application of this motor learning theory to benefit individuals with disability in need of effective interventions is obvious and of importance for rehabilitation.

Since 2009, rehabilitation researchers have advocated through narratives, reviews, or small-scale observational studies for the application of attentional focus theory and practice perspectives to improve motor skill training (i.e., balance, gait, postural control, and motor functioning in neurorehabilitation).⁴⁰⁻⁴⁵ Given that diabetes is often a pre-cursor to further medical complications that require rehabilitative interventions^{46,47}, results from this study are relevant for translation to clinical practice. A common barrier regarding the adoption of external focus instructions in clinical practice is that it is harder to precisely describe the intended movements that a therapist wants their patients to perform without using anatomical terms that are inherently internal.⁴¹ This explains why most observational studies on direction of attentional focus used in various clinical settings have shown that clinicians often provide instructions and feedback using language that is predominantly internally-focused.^{41-43,45} Our findings that simple external focus instructions were not more difficult to follow, did not cause more drifting of focus, and were perceived to be just as helpful as the traditional internal focus instructions provides evidence to dispel the prevailing assumption that explicit language about specific body movements is necessary to obtain the desired motor learning effects. Future research and development are needed to examine how external focus instructions can be integrated into rehabilitation interventions of

functional tasks that incorporate complex motor skills, and how movement instructions may need to be tailored to individuals with varying levels of physical function.⁴¹

Diminished physical functioning, particularly mobility, has been well-documented in older adults with diabetes.⁴⁸⁻⁵⁰ It is reasonable to speculate that diabetes-related functional impairments may impede performance and learning of balance, gait and postural tasks. This premise was partially confirmed by our findings that participants with diabetes exhibited significantly diminished baseline balance confidence and performance when compared to participants without diabetes. However, our analysis also revealed that when the baseline performance difference was accounted for, participants with diabetes were just as capable of improving performance during a novel task as those without diabetes. Furthermore, they experienced less drift of attention during training when compared to controls. These findings are important as previous studies on motor skill acquisition in older adults have postulated that cognitive abilities such as memory, processing speed⁵¹, physiological decline in the neurological and musculoskeletal functions⁵², as well as psychological factors concerning risk-taking when encountering unfamiliar tasks, may hamper the capacity for older adults to acquire new skills.⁵³ The negative impact of these factors were theorized to be exacerbated in the diabetic population, given the systematic nature of the disease that affects multiple systems and can lead to behavioral changes that further deter learning and performance of new or challenging motor tasks.⁵⁴⁻⁵⁷ This training study provides promising evidence of improved motor function and task confidence in individuals with diabetes when exposed to a short-term intervention. Integration of instructions pertaining to focus of attention during task practice should be added to clinicians' tool box and applied to the rehabilitation of physical function in older adults with diabetes.

Section 5: Conclusion

Adopting an external focus of attention benefits performance during short-term training of a novel balance task in older adults with and without diabetes. While participants with diabetes exhibited diminished physical capacity, importantly, they were capable of improving balance performance with practice at a relative rate similar to those without diabetes. This information may be useful for designing interventional strategies to improve physical function and mitigate fall risks in older adults with diabetes.

Section 6: Limitations

While the current lab-based training study achieved adequate statistical power, the sample of convenience was still relatively small and may be subject to selection bias and high intra/inter-group variability. Generalizability of the beneficial effects observed as a consequence of short-term training to activities of daily living was unclear and should be examined in future studies with larger samples and longer training protocols.

REFERENCES

1. Dixon CJ, Knight T, Binns E, Ihaka B, O'Brien D. Clinical measures of balance in people with type two diabetes: A systematic literature review. *Gait Posture*. 2017;58:325-332.
2. Bonnet C, Carello C, Turvey MT. Diabetes and postural stability: review and hypotheses. *Journal of motor behavior*. 2009;41(2):172-190.
3. D'Silva LJ, Lin J, Staecker H, Whitney SL, Kluding PM. Impact of Diabetic Complications on Balance and Falls: Contribution of the Vestibular System. *Physical therapy*. 2016;96(3):400-409.
4. Yang Y, Hu X, Zhang Q, Zou R. Diabetes mellitus and risk of falls in older adults: a systematic review and meta-analysis. *Age Ageing*. 2016;45(6):761-767.
5. Saeedi P, Salpea P, Karuranga S, et al. Mortality attributable to diabetes in 20-79 years old adults, 2019 estimates: Results from the International Diabetes Federation Diabetes Atlas, 9(th) edition. *Diabetes Res Clin Pract*. 2020;162:108086.
6. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. *Diabetes care*. 2004;27(5):1047-1053.
7. Roman de Mettelinge T, Cambier D, Calders P, Van Den Noortgate N, Delbaere K. Understanding the relationship between type 2 diabetes mellitus and falls in older adults: a prospective cohort study. *PloS one*. 2013;8(6):e67055.
8. Crews RT, Yalla SV, Fleischer AE, Wu SC. A growing troubling triad: diabetes, aging, and falls. *J Aging Res*. 2013;2013:342650.
9. Morrison S, Colberg SR, Mariano M, Parson HK, Vinik AI. Balance training reduces falls risk in older individuals with type 2 diabetes. *Diabetes care*. 2010;33(4):748-750.
10. Wang TY, Chen SC, Peng CW, et al. Relevance of nerve conduction velocity in the assessment of balance performance in older adults with diabetes mellitus. *Disabil Rehabil*. 2017;39(5):419-427.
11. Timar B, Timar R, Gaita L, Oancea C, Levai C, Lungeanu D. The Impact of Diabetic Neuropathy on Balance and on the Risk of Falls in Patients with Type 2 Diabetes Mellitus: A Cross-Sectional Study. *PloS one*. 2016;11(4):e0154654.
12. Crenshaw JR, Bernhardt KA, Atkinson EJ, Khosla S, Kaufman KR, Amin S. The relationships between compensatory stepping thresholds and measures of gait, standing postural control, strength, and balance confidence in older women. *Gait Posture*. 2018;65:74-80.
13. Qin J, Zhao K, Chen Y, et al. The Effects of Exercise Interventions on Balance Capacity in Patients with Type 2 Diabetes Mellitus: A Systematic Review and Meta-Analysis. *Inquiry*. 2021;58:469580211018284.
14. Mohamed AA, Jan YK. Effect of Adding Proprioceptive Exercise to Balance Training in Older Adults with Diabetes: A Systematic Review. *Curr Diabetes Rev*. 2020;16(4):327-339.
15. Wulf G, Lewthwaite R. Optimizing performance through intrinsic motivation and attention for learning: The OPTIMAL theory of motor learning. *Psychon Bull Rev*. 2016;23(5):1382-1414.
16. Chua LK, Jimenez-Diaz J, Lewthwaite R, Kim T, Wulf G. Superiority of External Attentional Focus for Motor Performance and Learning: Systematic Reviews and Meta-Analyses. *Psychological Bulletin*. 2021;147(6):618-645.

17. Wulf G. Attentional focus and motor learning: a review of 15 years. *Int Rev Sport Exer P.* 2013;6(1):77-104.
18. Parr JVV, Gallicchio G, Canales-Johnson A, Uiga L, Wood G. Cortical, muscular, and kinetic activity underpinning attentional focus strategies during visuomotor control. *Psychophysiology.* 2023;60(6):e14249.
19. Wiseman S, Alizadeh S, Halperin I, et al. Neuromuscular Mechanisms Underlying Changes in Force Production during an Attentional Focus Task. *Brain Sci.* 2020;10(1).
20. Lohse KR, Sherwood DE. Thinking about muscles: the neuromuscular effects of attentional focus on accuracy and fatigue. *Acta Psychol (Amst).* 2012;140(3):236-245.
21. Marchant DC, Greig M. Attentional focusing instructions influence quadriceps activity characteristics but not force production during isokinetic knee extensions. *Human movement science.* 2017;52:67-73.
22. Halperin I, Williams KJ, Martin DT, Chapman DW. The Effects of Attentional Focusing Instructions on Force Production During the Isometric Midthigh Pull. *Journal of strength and conditioning research / National Strength & Conditioning Association.* 2016;30(4):919-923.
23. Chiviawosky S, Wulf G, Wally R. An external focus of attention enhances balance learning in older adults. *Gait Posture.* 2010;32(4):572-575.
24. Salsabili H, Bahrpeyma F, Esteki A. The effects of Task-Oriented Motor Training on gait characteristics of patients with type 2 diabetes neuropathy. *J Diabetes Metab Disord.* 2015;15:14.
25. Salsabili H, Bahrpeyma F, Forogh B, Rajabali S. Dynamic stability training improves standing balance control in neuropathic patients with type 2 diabetes. *Journal of rehabilitation research and development.* 2011;48(7):775-786.
26. Porter JM, Nolan RP, Ostrowski EJ, Wulf G. Directing attention externally enhances agility performance: a qualitative and quantitative analysis of the efficacy of using verbal instructions to focus attention. *Front Psychol.* 2010;1:216.
27. Salbach NM, O'Brien K, Brooks D, et al. Speed and distance requirements for community ambulation: a systematic review. *Archives of physical medicine and rehabilitation.* 2014;95(1):117-128 e111.
28. Brown CJ, Bradberry C, Howze SG, Hickman L, Ray H, Peel C. Defining community ambulation from the perspective of the older adult. *Journal of geriatric physical therapy.* 2010;33(2):56-63.
29. ElSayed NA, Aleppo G, Aroda VR, et al. 4. Comprehensive Medical Evaluation and Assessment of Comorbidities: Standards of Care in Diabetes-2023. *Diabetes care.* 2023;46(Suppl 1):S49-S67.
30. Powell LE, Myers AM. The Activities-specific Balance Confidence (ABC) Scale. *The journals of gerontology Series A, Biological sciences and medical sciences.* 1995;50A(1):M28-34.
31. Landers MR, Durand C, Powell DS, Dibble LE, Young DL. Development of a scale to assess avoidance behavior due to a fear of falling: the Fear of Falling Avoidance Behavior Questionnaire. *Physical therapy.* 2011;91(8):1253-1265.
32. Craig CL, Marshall AL, Sjostrom M, et al. International physical activity questionnaire: 12-country reliability and validity. *Medicine and science in sports and exercise.* 2003;35(8):1381-1395.

33. Lee SP, Dufek J, Hickman R, Schuerman S. Influence of Procedural Factors on the Reliability and Performance of the Timed Up-and-go Test in Older Adults. *Int J Gerontol*. 2016;10(1):37-42.
34. Podsiadlo D, Richardson S. The timed up and go - a test of basic functional mobility for frail elderly persons. *Journal of the American Geriatrics Society*. 1991;39(2):142-148.
35. Song S. Consciousness and the consolidation of motor learning. *Behav Brain Res*. 2009;196(2):180-186.
36. Wulf G, Lewthwaite R. Advances in attentional focus research: The search for mechanisms underlying the external focus advantage. External focus of attention: Findings, fallacies, and future directions. *J Sport Exercise Psy*. 2012;34:S59-S59.
37. Richer N, Saunders D, Polskaia N, Lajoie Y. The effects of attentional focus and cognitive tasks on postural sway may be the result of automaticity. *Gait Posture*. 2017;54:45-49.
38. Wulf G, McNevin N, Shea CH. The automaticity of complex motor skill learning as a function of attentional focus. *The Quarterly journal of experimental psychology A, Human experimental psychology*. 2001;54(4):1143-1154.
39. Poolton JM, Maxwell JP, Masters RS, Raab M. Benefits of an external focus of attention: common coding or conscious processing? *Journal of sports sciences*. 2006;24(1):89-99.
40. Sawers A, Hahn ME, Kelly VE, Czerniecki JM, Kartin D. Beyond componentry: How principles of motor learning can enhance locomotor rehabilitation of individuals with lower limb loss--a review. *Journal of rehabilitation research and development*. 2012;49(10):1431-1442.
41. Lee SP, Bonczyk A, Dimapilis MK, et al. Direction of attentional focus in prosthetic training: Current practice and potential for improving motor learning in individuals with lower limb loss. *PloS one*. 2022;17(7):e0262977.
42. Kal E, van den Brink H, Houdijk H, et al. How physical therapists instruct patients with stroke: an observational study on attentional focus during gait rehabilitation after stroke. *Disabil Rehabil*. 2018;40(10):1154-1165.
43. Johnson L, Burridge JH, Demain SH. Internal and external focus of attention during gait re-education: an observational study of physical therapist practice in stroke rehabilitation. *Physical therapy*. 2013;93(7):957-966.
44. Yamada M, Higgins LQ, Raisbeck L. How external and internal focus are used in the field: A review. *Int J Sports Sci Coa*. 2022;17(3):647-654.
45. Durham K, Van Vliet PM, Badger F, Sackley C. Use of information feedback and attentional focus of feedback in treating the person with a hemiplegic arm. *Physiotherapy research international : the journal for researchers and clinicians in physical therapy*. 2009;14(2):77-90.
46. Niermeyer MA. Cognitive and gait decrements among non-demented older adults with Type 2 diabetes or hypertension: a systematic review. *Clin Neuropsychol*. 2018;32(7):1256-1281.
47. Moreira Bde S, Sampaio RF, Furtado SR, Dias RC, Kirkwood RN. The Relationship Between Diabetes Mellitus, Geriatric Syndromes, Physical Function, and Gait: A Review of the Literature. *Curr Diabetes Rev*. 2016;12(3):240-251.
48. Tsai YH, Chuang LL, Lee YJ, Chiu CJ. How Does Diabetes Accelerate Normal Aging? An Examination of ADL, IADL, and Mobility Disability in Middle-aged and Older Adults With and Without Diabetes. *Diabetes Res Clin Pract*. 2021;182:109114.

49. van Sloten TT, Savelberg HH, Duimel-Peeters IG, et al. Peripheral neuropathy, decreased muscle strength and obesity are strongly associated with walking in persons with type 2 diabetes without manifest mobility limitations. *Diabetes Res Clin Pract.* 2011;91(1):32-39.
50. Bruce DG, Davis WA, Davis TM. Longitudinal predictors of reduced mobility and physical disability in patients with type 2 diabetes: the Fremantle Diabetes Study. *Diabetes care.* 2005;28(10):2441-2447.
51. Brigman S, Cherry KE. Age and skilled performance: contributions of working memory and processing speed. *Brain Cogn.* 2002;50(2):242-256.
52. Welford AT. Between bodily changes and performance: some possible reasons for slowing with age. *Exp Aging Res.* 1984;10(2):73-88.
53. Strayer DL, Kramer AF. Aging and skill acquisition: learning-performance distinctions. *Psychol Aging.* 1994;9(4):589-605.
54. Kraiwong R, Vongsirinavarat M, Rueankam M, Sumalrot T. Effects of physical-cognitive training on physical and psychological functions among older adults with type 2 diabetes and balance impairment: a randomized controlled trial. *J Exerc Rehabil.* 2021;17(2):120-130.
55. Vongsirinavarat M, Mathiyakom W, Kraiwong R, Hiengkaew V. Fear of Falling, Lower Extremity Strength, and Physical and Balance Performance in Older Adults with Diabetes Mellitus. *J Diabetes Res.* 2020;2020:8573817.
56. Ferris JK, Inglis JT, Madden KM, Boyd LA. Brain and Body: A Review of Central Nervous System Contributions to Movement Impairments in Diabetes. *Diabetes.* 2020;69(1):3-11.
57. Hewston P, Deshpande N. Fear of Falling and Balance Confidence in Older Adults With Type 2 Diabetes Mellitus: A Scoping Review. *Can J Diabetes.* 2018;42(6):664-670.

Curriculum Vitae

Rebeca Armagnac, PT, DPT

Santa Barbara, CA
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EDUCATION

- **University of Nevada, Las Vegas** – Las Vegas, NV
 - Doctor of Physical Therapy (DPT), May 10th 2024
- **University of Hawaii at Manoa** - Honolulu, HI
 - B.S. in Kinesiology and Rehabilitation, 2019 (Magna cum laude)

RESEARCH

- **Student Investigator**
 - **Armagnac, R.C.**, Lee, Y.H., Letkiewicz, A.M., Mamauag, M.N., Wu, F.L., Lee, S.P (2024). *Effects of chronic diabetes and attentional focus on performance and learning of a novel stabilometer task. In review*
- **Presentations**
 - Poster presentation: APTA Combined Sections Meeting, Boston, MA, February 2024.
- **Research participant**
 - “Covid Effects on mental health, tobacco use among young adults” University of Hawaii Cancer center.

PROFESSIONAL EXPERIENCE

- **Student worker - UNLVPT** (July 2022 - July 2023)
 - Communicated with students to arrange department events and conference travel.
 - Assist with Continue Education events, office inventory and department tasks.
 - Assist with screening of PTCAS applications for incoming UNLVPT cohort.
- **Wellness Trainer - Arcadia Assisted Living Facility** (June 2020 - May 2021)
 - Led and organized aquatic and dry-land classes and activities.
 - Provided necessary coaching to reduce or eliminate fall-risk behaviors in older adults.
 - Helped and instructed residents on a one-on-one basis with their physical and occupational therapy HEP
 - Educated residents in the correct use of all exercise equipment, provided safe transfer techniques to reduce fall risk when getting on and off equipment, and in and out of the facility pool.
- **Supervisor - SoHa Living** (August 2015 – March 2020)
 - Increased efficiency and team productivity by promoting adherence to operational best practices and company policies.
 - Assigned and prioritized work for personnel based on previous training and personal strengths.

- Maintained shift's focus during peak customer hours and delegated tasks as required, keeping business running smoothly.
- Provided direct assistance to customers, assessed their needs, and maintained current knowledge of consumer preferences.

ASSOCIATED EXPERIENCE – CLINICAL EXPERIENCES

- **EQUILIBRIUM Physical Therapy** – Ventura, CA (January 2024 - March 2024)
 - Implemented exercise-based approach to provide vestibular and neurological rehabilitation therapy to patients with a variety of diagnoses: BPPV, Ménière's Disease, MS, PD, and CVA.
 - Educated and trained patients in compensatory strategies to recover function and decrease fall risk.
 - Developed comprehensive treatment plans for patients to address signs and symptoms of vertigo, dizziness, and unsteadiness.
- **Lompoc Valley Medical Center** – Lompoc, CA (September 2023 - December 2023)
 - Delivered therapeutic treatment interventions to help patients reduce pain and discomfort to facilitate return to prior level of function prior to discharge.
 - Educated patients on appropriate assistive device usage and safety risks while simultaneously promoting functional independence to decrease length of stay.
 - Collaborated with staff and patients' family members to determine the level of care required upon patient discharge.
- **Ocean View Post-Acute** – Escondido, CA (July 2023 - September 2023)
 - In charge of conducting initial evaluations, treatment interventions, progress notes and discharge plans in patients with cognitive impairments, musculoskeletal, neurological, or cardiovascular conditions.
 - Implemented evidence-based practice interventions to enhance functional mobility, improve strength, decrease fall risk, and facilitate discharge, including maintenance therapy for long-term residents.
 - Collaborated with OTs, SLPs and nursing staff to ensure care was compassionate, appropriate, and effective to improve patient outcomes.
- **Elam Sports Oahu** – Honolulu, HI (June 2022 - July 2022)
 - Performed evaluations to determine impairments and activity limitations in patients with various orthopedic conditions.
 - Created POC for patients with musculoskeletal injuries based on prior level of function, patient goals, and tissue healing phases.
 - Provided Pain Neuroscience Education in patients with chronic low back pain to eliminate fear avoidance behaviors and promote an active lifestyle.
- **Rehabilitation Hospital of the Pacific iCARE program** – Honolulu, HI (December 2018- July 2019)
 - Provided personalized training sessions (3x/week for 12 weeks) that were compassionate, appropriate, and effective for the treatment of health problems and the promotion of health and fitness for cancer survivors.
 - Conducted fitness tests and measurements (vitals, body composition, pulmonary and cardiorespiratory function) during initial and exit assessments.

CERTIFICATIONS

- **OTAGO Exercise program:** Fall Prevention Training Certification (October 2022)
- **CITI Program:** Biomechanical IRB course (October 2021)
- **Basic Life Support (BLS):** CPR and other basic cardiovascular life support skills (April 2022)

CONTINUING EDUCATION

- 2024 Combined Sections Meeting of the APTA (February 2024) – 18 credit hours.
- Dave Christensen, PT, DPT, SCCE. Rural Health and What Employers are Looking for in Today's Physical Therapist.
- Julia Goodwin, PT, DPT, NCS. "Clinical management of ALS." (April 28th, 2023)
- Tyretel Sprianu, PT, DPT. "Best PT Practices for Patients with Dementia and Psych Diagnoses." (March 31st, 2023)
- Mike Studer, PT, DPT. "Behavioral Economics Part 2." (March 3rd, 2023)
- Mike Studer, PT, DPT. "Behavioral Economics Part 1." (February 2nd, 2023)
- 2023 Combined Sections Meeting of the APTA (February 2023) – 18 credit hours.
- Professionalism Module 1: Introduction to Professionalism (October 2022) – APTA Learning Center
- Professionalism Module 2: History of Professionalism in Physical Therapy (October 2022) – APTA Learning Center
- Professionalism Module 3: Ethical Compass (October 2022) – APTA Learning Center
STEADI: Stopping Elderly Accidents, Deaths & Injuries (September 2022)
 - Screening, assessment, and interventions to reduce older adults' risk for falls.
- Nicole Piemonte, PhD. "Cultivating the Habits at the Heart of Patient Care: Compassion, Vulnerability, and Imagination. (March 3rd, 2022)
- 2022 Combined Sections Meeting of the APTA (February 2022) – 18 credit hours.
- Charlene Portee, PT, PhD. Lynda D. Woodruff Lecture "The Road to Success: Are We Ready to Change Direction?" (October 6th, 2021)

VOLUNTEER WORK

- **Professional**
 - Balance and Memory screening – Henderson Downtown Senior Center, Sun City Summerlin (September 2022); 10 hours.
 - Conducted fall screening tests, educated on fall prevention strategies, and provided resources to senior citizens regarding community programs to reduce fall risk.
 - Rock Steady Boxing (September 2022); 3 hours.
 - Ensured participants' safety during exercises, provided words of encouragement, and helped with equipment set up and take down.
- **Community**
 - Friends of Parkinson's Fundraiser Event – Funny Bunny Race (April 2023); 4 hours.
 - Helped set up for event, assisted people with Parkinson's in activities and games, assisted on event break down.
 - Gigi's Fit Acceptance Challenge Walk (March 2023); 5 hours.

- Checked in participants, helped with set up, cheered participants during the walk/race, helped clean up.
- Wheelchair Rugby Tournament (November 2022); 4 hours.
 - Helped with set/clean up event venue, served as a sub for the timekeeper.
- Nevada Senior Games (October 2022); 4 hours
 - Event set up, encouraged patients during competition, event break down.
- Las Vegas Amputee Support Group Meeting (September 2022); 1 hour.
 - Supported participants by listening to their stories and exchanging personal experiences.
- Political action – CMS: 2023 Physician Fee schedule, Add Physical therapists to NHSC, SMART Act to support PTA's and protect access to care.
 - I informed myself on the legislations and understand the impact my advocacy has in patient outcomes, particularly for those in underserved and rural areas.
- **Rehabilitation Hospital of the Pacific** – Honolulu, HI (December 2018 - March 2020)
 - Assisted physical and occupational therapists in the delivery of therapeutic interventions to patients with a variety of orthopedics, neurologic and cardiovascular disorders.
- **Sprouts Therapy** – Honolulu, HI (January 2018 - May 2018)
 - Assisted physical therapists in delivering play-based therapy for pediatric patients to promote active participation at home and school environments.

PROFESSIONAL ORGANIZATION MEMBERSHIPS

- Member American Physical Therapy Association (2021 - present) Member #: 971619
- Member Academy of Geriatrics of the American Physical Therapy Association (2022-present)
- Member Academy of Hands & Upper Extremity of the American Physical Therapy Association (2022-present)

Yinny Lee, PT, DPT
Las Vegas, NV
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Education

DPT	University of Nevada- Las Vegas	2021-2024	Physical Therapy
BS	University of Nevada- Reno	2016-2020	Community Health Sciences- Kinesiology (Magna Cum Laude)

Certifications and Training

- Tai Ji Quan: Moving for Better Balance Instructor (October 2022)
- CITI Program for Human Research, Biomedical IRB Course (October 2021)
- Bloodborne Pathogens Training- UNLV Risk Management and Safety (July 2021)
- HIPPA Training- UNLV Risk Management and Safety (July 2021)
- Basic Life Support (CPR and AED) from the American Heart Association (March 2021, renewed February 2023)
- NASM-CPT (June 2020)

Professional Experience

Aug 2020 – Apr 2023	PRN Therapy Aide – Dignity Health Rehabilitation Hospital, 2930 Siena Heights Dr, Henderson, NV 89052 Working under the direct supervision of licensed Physical Therapists/ Occupational Therapists. Assisting therapy staff with patient related treatment activities. Assisting therapy staff with transfer activities to/from mats, treatment and tilt tables, wheelchairs, and hospital beds.
July 2020 – Apr 2021	Physical Therapy Technician – Desert Orthopaedic Physical Therapy, 2800 E Desert Inn Rd, Las Vegas, NV 89121 Worked under the direct supervision of licensed Physical Therapists. Assisted patients in performing prescribed therapy exercises and documenting patient responses to treatment. Prepared equipment and treatment areas for patient use.
Sep 2018 – June 2020	Personal Care Assistant – Right at Home, 10635 Double R Blvd #100, Reno, NV 89521 Provided nonmedical in-home and facility care for clients with dementia. Daily services included ambulation/transfers, feeding, brief changes, dressing, bathing, transportation, etc.

Clinical Experiences

Jan 2024 – Mar 2024	Inpatient Rehabilitation – PAM Health Rehabilitation Hospital of Centennial Hills, 6166 N Durango Dr, Las Vegas, NV 89149
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	<p>Worked with inpatient rehabilitation patients in an underserved setting. Patient population's main conditions included amputation, stroke, spinal cord injury, brain injury, respiratory failure, Parkinson's disease, neurological disorders, and cardiopulmonary conditions. Compiled patient info sheets on hip precautions and home exercises as in-service.</p>
Sept 2023 – Dec 2024	<p>Inpatient Acute – Carl T. Hayden Veteran's Administration Medical Center, 650 E Indian School Rd, Phoenix, AZ 85012</p> <p>Worked specifically with the veteran population in an underserved setting. Patient population's main conditions included amputation, wound care, polytrauma, stroke recovery, spinal cord injury, and neurological disorders. Presented an in-service presentation on discharge dispositions.</p>
July 2023 – Sept 2023	<p>Outpatient Orthopedic – Origin Physical Therapy, 6480 S Tenaya Way Ste 100, Las Vegas, NV 89113</p> <p>Received experience practicing in a private practice setting. Patient population's main focus included sports performance training, dance rehabilitation, balance and vestibular, and worker's compensation. Presented an in-service presentation on running mechanics and analysis.</p>
June 2022 – July 2022	<p>Outpatient Orthopedic – Spine and Sport Physical Therapy- Poway, 12648 Poway Rd, Poway, CA 92064</p> <p>Utilized MDT techniques in evaluations and treatment. Patient population's main focus included chronic neck/back pain, post-surgical rehabilitation, sports performance training, worker's compensation, and aquatic therapy. Presented an in-service presentation on Pain Neuroscience Education for chronic pain patients.</p>

Research

- Investigator
 - o Armagnac RC, **Lee YH**, Letkiewicz AM, Mamauag MN, Wu FL, Lee SP. *Effects of Chronic Diabetes and Attentional Focus on Performance and Learning of a Novel Stabilometer Balance Task*
- Participant
 - o Malek EM, Navalta JW, McGinnis GR. *Time of Day and Chronotype-Dependent Synchrony Effects Exercise-Induced Reduction in Migraine Load: Pilot Cross-Over Randomized Trial*

Membership in Scientific/Professional Organizations

- American Physical Therapy Association (APTA) (2021 to present)
 - o Academy of Geriatrics (2022 to present)
 - o Nevada Physical Therapy Association (2021 to present)

Community Service

- Fall Prevention Awareness Week 2022
 - Nevada Goes Fall Free Coalition (NGFFC) Events
 - Provided balance and memory screening community events for older adults at the following locations:
 - Osher Lifelong Learning Institute (OLLI), September 14, 2022, 4 hours
 - Sun City Summerlin Desert Vista Community Center, September 20, 2022, 5 hours
 - Encompass Health Rehabilitation Hospital of Henderson, September 21, 2022, 3 hours
- Shelby Estocado Annual Charity Golf Tournament at Los Prados Golf Course
 - Spotter for greenies and chippies, October 30, 2022, 6 hours

Continuing Education

- American Physical Therapy Association Combined Sections Meeting, San Diego, CA, February 22-25, 2023 – 24 hours
- The Otago Exercise Program: Falls Prevention Training, October 9, 2022 – 3 hours
- STEADI: Empower Healthcare Providers to Reduce Fall Risk, September 11, 2022 – 1 hour

Honors

- UNLVPT Scholars Award Recipient at University of Nevada, Las Vegas (2021-2023)
- Phi Kappa Phi Honor Society Member (2018-2020)
- Presidential Scholarship Recipient at University of Nevada, Reno (2016-2020)
- Dean's List at University of Nevada, Reno (2016-2020)
- Millennium Scholarship Recipient (2016-2020)

Alicia Letkiewicz, PT, DPT
She/Her
Las Vegas, NV
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Education

Employment and Clinical Experience

June 2020 –	Doctorate of Physical Therapy, DPT
May 2024	University of Las Vegas Nevada – Las Vegas, NV
August 2016 –	Bachelor of Science: Kinesiology
May 2020	University of Las Vegas Nevada – Las Vegas, NV
August 2014 –	No Degree: Non-degree Seeking
May 2016	College of Southern Nevada – Las Vegas, NV
January 2024 –	Student Physical Therapist
March 2024	Fyzical Balance and Rehabilitation, Las Vegas Nevada Outpatient Neuro/Outpatient Orthopedic
	<ul style="list-style-type: none">• Aided patients with balance and neurological impairments in achieving their mobility and functional goals• Worked as a team with other physical therapists to give the highest quality care for a wide variety of patients with orthopedic and/or neurologic diagnoses• Researched, created a plan of care for, and provided individualized treatment for patients with CVA, vestibular dysfunction, PD, dementia, TBI, visual impairments, MS, anxiety disorder, and other neurological diagnoses
September 2023 –	Student Physical Therapist
November 2023	Carson Valley Medical Center, Gardnerville, Nevada Acute Care/Outpatient Orthopedic
	<ul style="list-style-type: none">• Trouble shot unique patient cases and worked with a team of health care professionals to develop optimal care• Learned about the unique needs of a rural hospital and its patients• Worked with post-op patients on return to function• Constructed plans of care that focused on each individuals' specific impairments and goals
July 2023 –	Student Physical Therapist
September 2023	St Luke's Health System - Magic Valley Regional Medical Center, Idaho Falls, ID Acute Care
	<ul style="list-style-type: none">• Worked with an interdisciplinary team to help return patients to a safer level of function via exercises, mobility, education, and functional activities• Created an encouraging and motivational atmosphere for all ages of patients to improve mental and physical health outcomes• Participated in occasional inpatient rehab sessions• Participated in finding the most optimal discharge plan for a patient's unique needs.
June 2022 –	Student Physical Therapist
July 2022	Edge Physical Therapy, Frisco, TX

Outpatient Orthopedic

- Developed position specific rehabilitation programs for soccer, football, basketball, and golf players
- Performed appropriate manual therapy techniques on all musculoskeletal patients
- Created an in-service presentation on joint contractures to aid the physical therapists in continuing education

June 2019 – March 2020 **Physical Therapy Technician**
Synergy Physical Therapy, Las Vegas, NV
Outpatient Orthopedic

- Collaborated with physical therapists to create and administer routine exercises, modalities, and treatment for a variety of patients
- Increased physical therapist and patient satisfaction by recognizing and acting to meet their needs
- Created a welcoming and positive atmosphere for all patients

Additional Work History

May 2016 – May 2020 **Math Tutor**
University of Las Vegas Nevada, Las Vegas, NV

- Used problem solving skills to find and resolve individual student's problems
- Conducted group tutoring sessions to help students engage in active learning and develop their critical thinking skills
- Stressed importance of good study habits by encouraging students to create personalized study plans and engage in study groups

Honors and Awards

- Dean's List, University of Las Vegas Nevada (2016 – 2020)
- Excellence Scholarship, University of Las Vegas Nevada (2016 – 2020)

Volunteer Work

February 2023 **Academy of Neurologic Physical Therapy, CSM**
Volunteered at the Academy of Neurologic Physical Therapy (ANPT) booth at CSM 2023. Facilitated conversations between members and prospective members, answered questions, and provided information on the benefits of joining and goal of the ANPT.

November 2022 **UNLV Physical Therapy Interview Day**
Worked as a lab Coordinator and Student Mingler on two consecutive interview days. Created and facilitated a biomechanics lab experience for prospective physical therapy students. Welcomed students and worked to answer their questions and calm their nerves before their interviews.

October 2022 **Nevada Senior Games**

Participated as an equipment shagger and retrieved equipment during practice and official events. Cheered on the participants and worked to maintain the professionalism of the event.

September 2022 **Fall and Balance Screening**

Welcomed and guided participants through initial paperwork prior to completing the screenings. Answered questions and provided reading assistance for participants.

November 2021 **UNLV Physical Therapy Interview Day**

Worked as a lab coordinator by developing and facilitating a biomechanics lab experience for prospective physical therapy students.

October 2021 **UNLV PT Day of Service**

Wrote letters to older adults in isolation and created signs for AMBUCS.

January 2020 - **Veteran's Affairs Hospital, Physical Therapy Clinic**

March 2020 Volunteered in the role of a physical therapy technician on weekends.

Professional Memberships

- Member of American Physical Therapy Association (2020 – present)
- Member of Nevada Chapter of American Physical Therapy Association (2020 – present)
- Member of Neurology Section of American Physical Therapy Association (2022 – present)
- Member of Sports Section of American Physical Therapy Association (2022 – present)
- Member of Geriatrics Section of American Physical Therapy Association (2022 – present)
- Member of Acute Care Section of American Physical Therapy Association (2023 – Present)
- Member of Cardiovascular & Pulmonary Section of American Physical Therapy Association (2023 – Present)
- Member of Research Section of American Physical Therapy Association (2023 – Present)

Continuing Education

- STEADI Training (September 2022)
- Professionalism Module 3: Ethical Compass (October 2022)
- Professionalism Module 2: History of Professionalism in Physical Therapy (October 2022)
- Professionalism Module 1: Introduction to Professionalism (October 2022)
- Defensible Documentation: A Framework for Physical Therapy Documentation (September 2021)

Certifications

- BLS Certification (April 2024)
- Otago Training (October 2022)
- UNLV HIPPA Awareness Certification (February 2022)
- UNLV Blood Borne Pathogen Awareness Certification (February 2022)

Mieko Mamauag, PT, DPT
Las Vegas, NV
Email: mieko.mamauag@gmail.com

Education

Jun 2021-Present	DPT	University of Nevada, Las Vegas	Physical Therapy
May 2008-Dec 2017	B.S.	University of Nevada, Las Vegas	Kinesiology (Cum Laude)

Employment

Associated Experience

Jan 2024-Mar 2024	Student Physical Therapist - Valley Health System, Centennial Hills Hospital Medical Center, Las Vegas, NV 89149 Fulfilled an expected full-time caseload in the underserved acute care hospital; performing the functional and wound care assessment/treatment, post-operative management, and determining plan of care and safe discharge recommendations.
Sep 2023-Dec 2023	Student Physical Therapist - Advanced Health Care of Henderson, Las Vegas, NV 89183 Fulfilled an expected full-time caseload in the Skilled Nursing Facility, demonstrated teamwork and timely communication with occupational therapists to maximize restoration of the functional deficits, to optimize treatment efficiency, and to determine the barrier to discharge.
Jul 2023-Sep 2023	Student Physical Therapist - Dignity Health Physical Therapy, South Durango, Las Vegas, NV 89113 Completed 10 weeks in the orthopedic outpatient clinic. Mainly treated patients with musculoskeletal injuries, vestibular problems, concussion, and neurological deficits. I obtained the skills of individualized patient centered treatment.
Jun 2022-Jul 2022	Student Physical Therapist - Leavitt Physical Therapy, Henderson, NV 89052 Completed 5 weeks in the orthopedic outpatient clinic. Evaluated a wide variety of pathology, demographics, and provided manual therapies.
Sep 2020-Jun 2021	Operations Support Specialist - ATI Physical Therapy, Henderson, NV 89052 Facilitated front-end patient transition into treatment plan via documentation verification, insurance benefits plans/limitations, and scheduling/triage, and aiding office operations such as ordering clinic supplies. The position also encompasses the duties and responsibilities of a Rehab Technician (below).
May 2018-Sep 2020	Rehab Technician - ATI Physical Therapy, Henderson, NV 89052 Supported therapists and patients by organizing documentation, cleaning and maintaining equipment, clinic sanitation, English-Japanese translator, and navigating patients under the licensed physical therapist's direct supervision.

Research

Investigator

Aug 2021-May 2024 Effects of chronic diabetes and attentional focus on performance and learning of a novel stabilometer task in older adults

Aug 2016-May 2017 Graduate College Rebel Research and Mentorship Program

Presentation

Mamauag, M.N., Armagnac, R.C., Lee, Y.H., Letkiewicz, A.M., Wu, F.L., Lee, S.P (2024). Effects of chronic diabetes and attentional focus on performance and learning of a novel stabilometer task. Poster presentation, Combined Sections Meeting, Boston, MA, February 2024

Eggleston, J. D., Flores, L.A., **Mamauag, M.**, Lidstone, D.E., Harry, J.R., Dufek, J.S. (2017). Influence of a weighted backpack and weighted vest on gait kinematics in children with autism spectrum disorder. Poster Presentation, UNLV Office of Undergraduate Research, Research Week Gala, University of Nevada, Las Vegas, Las Vegas, NV, October 2017.

Mamauag, M., Eggleston, J., Flores, L.A., Lidstone, D.E., Dufek, J.S. (2017). Examining the influence of backpack weight on stride kinematics among children with autism spectrum disorder. Poster Presentation, Northwest Biomechanics Symposium, Eugene, OR, May 2017.

Eggleston, J. D., Flores, L.A., **Mamauag, M.**, Lidstone, D.E., Harry, J.R., Dufek, J.S. (2017). Influence of a weighted backpack and weighted vest on gait kinematics in children with autism spectrum disorder. Poster Presentation, Northwest Biomechanics Symposium, Eugene, OR, May 2017.

Flores, L.A., Eggleston, J.D., **Mamauag, M.**, Lidstone, D.E., Dufek, J.S. (2017) Effects of load carriage on lower extremity joint patterns in children with autism spectrum disorder. Podium Presentation, Northwest Biomechanism Symposium, Eugene, OR May 2017.

Mamauag, M., Eggleston, J., Flores, L.A., Lidstone, D.E., Dufek, J.S. (2017). Examining the influence of backpack weight on stride kinematics among children with autism spectrum disorder. Poster Presentation, Undergraduate Research Forum, University of Nevada, Las Vegas, Las Vegas, NV, April 2017.

Flores, L.A., Eggleston, J.D., **Mamauag, M.**, Lidstone, D.E., Dufek, J.S. (2017) Effects of load carriage on lower extremity joint patterns in children with autism spectrum disorder. Poster Presentation, Undergraduate Research Forum, University of Nevada, Las Vegas, Las Vegas, NV, April 2017.

Membership in Scientific/Professional Organizations

Sep 2021-Present **American Physical Therapy Association (APTA)**

- Academy of Geriatrics (Sep 2022-Present)
- Nevada Physical Therapy Association (Sep 2021-Present)

Aug 2021-Present **The Sports Medicine Club**

Certifications

Apr 2023	Stop the Bleed
Oct 2022	OTAGO Exercise Program: Falls Prevention Training - Certified by Center of Disease Control
Apr 2022	Basic CPR by American Heart Association
Oct 2021	CITI Program for Human Research, Biomedical IRB course
Jun 2021	Bloodborne Pathogens Training
Jun 2021	HIPPA training

Professional/Community Services

Mar 2023	President Joe Biden's Speech at UNLV Attended a Presidential speech "Prescription drug costs" as a member of professional health care providers.
Mar 2023	Movement Fair at University of Nevada, Las Vegas The fair was organized by Parkinson's Place of Las Vegas. I supported in setting and cleaning up during the event, and assisted participants.
Mar 2023	GiGi's Fit Acceptance Challenge Walk, Henderson, NV Volunteered to support fundraising for GiGi's Playhouse, a national chain of Down Syndrome Achievement Centers, to open one in Las Vegas.
Dec 2022	APTA Legislative Action Center Took advocacy action by sending a personal letter to NV Representatives regarding the "Preserving Access to Home Health Act" and "Cosponsor H.R.8181 and Raise Awareness of the Importance of Postpartum Care"
Nov 2022	UNLV PT Interview Day Advocation of UNLV PT program and answering questions by mingling with interviewees. Assisted with cleaning.
Sep-November 2022	Rock Steady Boxing, Henderson, NV Helped with setting up equipment, protecting participants from a fall, Encouraging exercises, and helped with the event for The Michael J. Fox Foundation for Parkinson's Research.
Oct 2022	Nevada Senior Games, Las Vegas, NV Helped with field setup, a ball shagger, and assisting players with a disability.
Sep 2022	Balance & Memory Screenings Event, Las Vegas, NV PT and OT students from UNLV provided free screening services for Senior residents in Summerlin and downtown Henderson. I performed STEADI, discussed the results with participants and provided some suggestions if applicable. I also helped with set-up/clean-up, check-ins, and advocacy for the event at the senior center.
Jan 2022	UNLVPT Interview Day Advocation of UNLV PT program and answering questions by mingling with interviewees. Assisted with cleaning.
Oct 2021	Shelby Estocado Charity Golf Tournament A Fundraising event to support Shelby Estocado who suffered a spinal cord injury. Promoted raffle tickets sales to the participants and

organizing/directing golfers.

Continuing Education

Feb 2024	APTA Combined Sections Meeting in Boston, MA
Oct 2023	APTA NV SSIG <ul style="list-style-type: none"> Danielle and Ron Garcia, PT, DPT “Learn How to Pay Off over 300K in Debt in Under 3 Years”
Sep 2023	APTA Nevada Annual Program <ul style="list-style-type: none"> Szu-Ping Lee, PT, PhD “Rehabilitation After Lower Limb Amputation
Apr 2023	Pain Neuroscience Education <ul style="list-style-type: none"> Adriaan Louw, PT, PhD “Teaching People About Pain”
Feb 2023	Interprofessional Education Workshop Recognizing the important roles of other healthcare disciplines, advocating the roles of physical therapy in the healthcare system, and learning effective and professional communication among peers.
Oct 2022	APTA webinars <ul style="list-style-type: none"> Professionalism Module 1: Introduction to Professionalism Professionalism Module 2: History of Professionalism in Physical Therapy Professionalism Module 3: Ethical Compass
Oct 2022	OTAGO Exercise Program: Falls Prevention Training
Oct 2022	UNLVPT Distinguished Lecture Series <ul style="list-style-type: none"> Ellen Hillegass, PT, EdD, CCS, FAPTA “Tales of the Heart: Inspiration to Motivate Change in Clinical Practice and Education”
Sep 2022	STEADI module
Sep 2022	APTA NV SSIG virtual meeting <ul style="list-style-type: none"> Divyan Raghavan, PT, DPT, OCS “Corporate Physical Therapy: Do you want to be part of this new revolution?”
Aug 2022	APTA Core Values Self-Assessment
Feb 2022	APTA Combined Sections Meeting in San Antonio, TX
Nov 2021	UNLVPT Distinguished Lecture Series <ul style="list-style-type: none"> Julie M Fritz, PT, PhD, FAPTA “Pain Management in a Time of Dueling Pandemics” and “Evidence-Based Physical Therapy for Patients with Low Back Pain: Past, Present, and Future”
Aug 2021	Recognizing and Reporting Child Abuse and Neglect Training by Clark County Department of Family Services
2021-Present	UNLVPT Brown Bag lectures <ul style="list-style-type: none"> 2/10/23: Mike Studer, PT, DPT, MHS, NCS, CEEAA, CWT, CSST, FAPTA “Behavioral Economics Part 1 – Recognizing patient’s personality and providing the best patient-centered care.” 9/10/21: Danille Parker, PT, DPT, GCS, CEEAA “iPT: There’s an App for that? Enhancing your practice and learning through mHealth technology.” 6/18/21: Joseph Reinke “Financial Literacy for Physical Therapists”

2021-Present**UNLV Sports Medicine Club**

- 04/19/2023: “Stop the Bleed”-Learning how to intervene and deliver trauma care in case of an emergency.
- 02/07/2023: “Strengthening/conditioning/progression with regards to running – presented by Juan Maldonado, PT, DPT (Strength Coach with the Sox)
- 09/30/2022: Attended virtual discussion regarding critically appraising research, critical thinking, and decision making. – featured by Erik Meira, PT, DPT, SCS, CSCS
- 9/20/21: Jennifer Bennet “Sports-Related Concussion and Cognitive-Communication Therapy”
- 8/30/21: Glenn Barnes, DO CAQSM “Sideline Emergencies”

Honors and Awards

Mar 2023	UNLVPT Recognition of Achievement Award
Mar 2023	UNLVPT CSM Travel Scholarship
Jan 2023	UNLVPT Department Scholarship
Jan 2022	UNLVPT Department Scholarship
Mar 2017	Honor Society of Phi Kappa Phi
Jan 2017	Dean’s Honor Roll awarded by the School of Allied Health Sciences
Oct 2016	National Society of Leadership and Success