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Cover Page Footnote

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Changes in Attitudes and Functional Performance After an Educational Intervention and Participation in the DIME in Cadets

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Introduction: Cadets frequently suffer from lower extremity injuries but fail to participate in effective injury prevention programs (IPPs). The purpose of this study was to determine if an intervention focused on benefits and barriers of IPP with participation in an IPP would change attitudes towards participating in IPPs and functional performance. **Methods:** Thirty-four ROTC cadets (Male: n=28, Age: 19.67±1.45 years, Height: 175.57±8.30cm, Mass: 75.38±14.30kg) volunteered to participate in the study. Participants completed the Health Belief Model Scale (HBMS), Theory of Planned Behavior Scale (TPBS), Y-Balance test, Landing Error Scoring System, 2-mile run, push-up test, and sit-up test. During the Army Physical Fitness program, the Dynamic Integrated Movement Enhancement (DIME) program was implemented by cadet student leaders whom also tracked compliance. Every 2 weeks, participants would self-report participation in the DIME and also be exposed to the intervention presented as an infographic on the benefits and barriers of the DIME as well as potential solutions for barriers. All testing was repeated at the end of the fall semester. **Results:** Compliance over the 10-week period was 87.2%. Participants had improvements in individual self-efficacy, Y-Balance test performance, 2-mile run, and sit-up test. However, HBMS perceived consequences, HBMS perceived benefits, HBMS community-led self-efficacy, TPBS perceived benefits, TPBS perceived barriers, TPBS social norms, TPBS social influence, and TPBS intention to participate all worsened. The most common reason for lack of participation in the DIME was time. **Discussion:** Participants were more confident in their ability to participate in IPPs after the intervention and also improved in several aspects of functional performance. However, several subscales worsened after participation. Future research should focus on determining effective strategies to improve attitudes towards IPP participation to enhance compliance. ***Key Words:*** *injury prevention*

INTRODUCTION

Approximately 21% of cadets suffer an injury to the lower extremity during their training.[1] These injuries can have both short and long-term consequences including pain, loss of function, and time loss from participation or missed duty.[2] Additionally, some of the common negative sequelae of lower extremity musculoskeletal injuries are early development of osteoarthritis and limitations related to health-related quality of life.[3] Due to these consequences, there is a shift of importance to preventing these injuries from occurring. Several injury prevention programs (IPPs) have been successful at reducing the risk of lower extremity injuries.[4] However, adoption and adherence to these programs remains low.[5]

Adoption and adherence to IPPs is a multi-faceted problem. One of the major influences of adoption and adherence is the users' attitudes towards participation.[5] Very few previous studies have attempted to change attitudes towards participation in injury prevention using educational interventions.[6,7] One of these investigations focused on prevention of injuries to the anterior cruciate ligament and implemented demonstration of exercises used to improve landing technique. Unfortunately, attitudes towards participation in injury prevention and participation rates did not improve after the intervention in high school athletes.[6] The other investigation structured their intervention for club sport athletes around the Health Belief Model. The intervention led to improvements in self-efficacy or the users'

confidence in their ability to participate.[7] Due to the general dearth of information related to interventions, previous investigations have examined the most influential factors related to intention to participate in an IPP to inform intervention creation. Within a group of Reserve Officers' Training Corps (ROTC) cadets the resulting factors were perceived benefits and barriers, suggesting education in these areas may influence attitudes towards participating in IPPs.[8] This small amount of evidence shows there is a potential that structuring the intervention around social and behavioral theoretical models such as the Health Belief Model could lead to more significant changes in attitudes and participation rates.

Another factor that could play a role in attitudes toward an IPP is previous engagement with prevention. Literature suggests that individuals who have previously participated in an IPP have more positive attitudes towards participating.[9] Specifically, individuals who participated in the IPP found it to be less challenging, more beneficial, and overall more enjoyable than those who had not participated. The results of this study suggest participation in the IPP may influence attitudes towards participation and future participation in IPPs.

There is currently a lack of adoption and adherence to IPPs, including individuals who participate in military activities. It is plausible that an intervention targeting potential benefits and barriers as well as participation in the IPP will influence attitudes towards participation. Therefore, the purpose of this study was to determine if an intervention focused on benefits and barriers that included participation in the IPP would change attitudes towards participating in an IPP and functional performance. A secondary purpose was to assess reasons ROTC cadets did not participate in the IPP. We hypothesized attitudes towards participation in IPPs and functional performance would improve over time.

METHODS

Participants

Thirty-four ROTC cadets (Male: n=28, Age: 19.67±1.45 years, Height: 175.57±8.30cm, Mass: 75.38±14.30kg) volunteered to participate. Participants were included if they were between the ages of 18-35, actively participated in ROTC at the University, and reported participating in a moderate level of physical activity for >90 minutes per week. Participants were excluded if they had a current injury or illness that prevented them from participating in physical activity for an extended period of time.

Procedures

The study design was repeated measures including a pre-measure and post-measure. The study design initially included a follow-up measure to occur at the end of the spring semester in 2020, but due to COVID-19 the follow-up measure was not possible. The study was approved by the institutional review board prior to recruitment. Participants were recruited through ROTC courses at the University and provided informed consent prior to participating in the study. Participants completed a demographic questionnaire which assessed demographics, previous history of musculoskeletal injury, and previous experience with IPPs. Next, they completed the Health Belief Model Scale (HBMS) and Theory of Planned Behavior Scale (TPBS). Additionally, participants completed functional tasks including the Y-Balance test and Landing Error Scoring System (LESS). Participants completed the Army Physical Fitness tests including the 2-mile run, push-up test, and sit-up test throughout the fall semester of 2019. Testing was administered by the ROTC leaders and results of the testing were provided to the researchers. All participants completed the standard Army Physical Fitness Program required by the ROTC where the Dynamic Integrated Movement Enhancement (DIME) program was implemented for injury prevention. The DIME was led by trained ROTC cadet leaders

who also tracked compliance. Participants completed Qualtrics surveys every two weeks that contained infographics on the benefits of participating in the DIME and potential solutions to overcome barriers associated with the DIME. Additionally, the participants self-reported compliance with the DIME and provided reasoning as to why they did not participate if applicable. At the end of the fall semester, the scales, functional tasks, and Army Physical Fitness tests were repeated.

Scales

The HBMS and TPBS were used to assess attitudes towards participation in IPPs.[10] The HBMS contains 39 items and 9 subscales (perceived susceptibility, fear of injury, perceived consequences, perceived benefits, perceived barriers, individual self-efficacy, community led self-efficacy, external health cues, general health cues). The TPBS contains 19 items and 5 subscales (perceived benefits, perceived barriers, social norms, social influence, intention to participate). Both scales have response options ranging along a 7-point Likert scale from strongly agree to strongly disagree. Positive scores are thought to be associated with an increased likelihood to participate in an IPP for all subscales except perceived barriers where a lower score would be more associated with an increased likelihood to participate. The psychometric properties were formally confirmed for both scales.[10] Total scores for the subscales of the HBMS and TPBS were used for analyses.

Functional Testing

The Y-Balance Test was used to assess dynamic postural control and has already been found to be reliable.[11] The participants were instructed to balance on one limb while barefoot and reach into the anterior, posteromedial, and posterolateral directions. Four practice trials were completed immediately followed by three testing trials. Trials were repeated if the following errors occurred: removing the hands from the hips, touching or tapping down with the non-stance limb, losing contact with the box on the stance limb, placing too much pressure on the push box, or slinging the push-box. Reach distances were measured in cm and normalized to leg length measured from the most prominent portion of the ASIS to the medial malleolus (cm). Average scores for each reach direction were used for analyses.

The LESS real time was used to assess landing technique.[12] Participants jumped off of a 30cm box to a distance measured ½ of their height away from the box. Once the participants landed, they were instructed to immediately jump straight back up into the air. Participants completed 2 practice jumps immediately followed by 4 testing jumps. The standardized rating system was used to assess landing technique with a minimum score of 0 and a maximum score of 15.[12] Lower scores are associated with landing technique more consistent with a reduced risk of injury. The total number of errors was used for analyses.

The YBT and LESS were administered by athletic trainers or athletic training students. All researchers were trained on how to administer the tests and standard operating procedures were used to ensure consistent methods were used.

The participants completed the Army Physical Fitness Tests at regularly scheduled intervals. The tests administered were the 2-mile run, push-up, and sit-up test. Testing was administered by ROTC leaders and data was provided to the researchers. The total number of push-ups and sit-ups completed in 2 minutes were used for analyses while the total time measured in seconds for the 2-mile run was used for analyses.

Intervention

The DIME IPP was implemented throughout the fall semester. The DIME is a 10-12 minute warm-up program that is intended to be completed prior to participation in physical activity.[13] The program contains exercises which target strength, flexibility, agility, and plyometric performance. The DIME has previously shown effectiveness at decreasing

the risk of injury and also improving performance on the 2-mile run, push-up, and sit-up tests.[13-15] The "train the trainer" method was used where researchers trained 3 cadet leaders to lead all participants through the DIME twice per week. They were trained to provide necessary feedback to ensure participants were completing the exercises properly. The cadet leaders tracked participant compliance each week for a total of 10 weeks.

A Qualtrics survey was delivered every two weeks via email and/or text message based on participant preference. The survey contained a different infographic each week presenting the benefits of participating in the DIME as well as potential barriers and strategies to overcome those barriers. Additionally, participants self-reported compliance with the DIME and provided reasoning as to why they failed to participate if applicable. The following potential reason choices were provided to the participants: injury/illness, weather, lack of time, lack of knowledge about the DIME, location of the program, didn't want to, slept in, or other. If the participant selected "other", they were prompted to type in the reason.

Data Analysis

Compliance with the DIME was calculated as the number of dates attended divided by the total number of recommended dates of participation which was 20. The independent variable was time (pre-measure/post-measure) and the dependent variables were attitudes towards participation in IPPs (subscales of HBMS and TPBS) and functional tests (Y-Balance test, LESS, push-up test, sit-up test, 2-mile run). Separate Wilcoxon tests were used to compare attitudes at the pre-measure and post-measure. Non-parametric effect sizes were calculated using the following equation ($z/\sqrt{n}$). To determine the most frequent reasons for failure to participate in the DIME, the frequency of each response was calculated. Alpha was set a priori to $P<0.05$.

RESULTS

Compliance over the 10-week period was 87.2%. There were several statistically significant differences in attitudes towards participation in an IPP when comparing the pre-measure to the post-measure (Table 1). From the HBMS, perceived consequences, perceived benefits, and community led self-efficacy worsened following the intervention. However, individual self-efficacy increased in the post-measure when compared to the pre-measure. For the TPBS, perceived benefits, perceived barriers, social norms, social influence, and intention to participate all worsened at the post-measure when compared to the pre-measure. There were several statistically significant differences in functional performance when comparing the pre-measure to the post-measure (Table 2). The anterior, posteromedial, and posterolateral reaches of the YBT all significantly improved after the intervention. Performance on the sit-up and 2-mile run also significantly improved following the intervention. There were no other statistically significant differences between measures ($P>0.05$).

The most frequent reasons for lack of participation were lack of time (35.29%), other training (17.65%), location of the program (15.69%), and slept in (11.76%). Infrequent reasons for failing to participate included injury/illness (7.84%), weather (5.89%), and other (3.92%). Only one response indicated that the user didn't want to participate and none of the individuals indicated a lack of knowledge as a reason for not participating.

Variable	Pre-Participation	Post-Participation	P-Value	Effect Size
HBMS Susceptibility	0.00 (13.50)	-1.00 (10.50)	0.99	-0.002
HBMS Fear of Injury	-3.00 (5.87)	-4.00 (6.00)	0.13	-0.26
HBMS Consequences	-3.00 (7.00)	-5.00 (6.50)	0.03*	-0.38
HBMS Benefits	9.00 (5.00)	4.00 (5.00)	<0.001*	-0.72
HBMS Barriers	-3.00 (8.50)	-4.00 (9.23)	0.35	-0.16
HBMS Individual Self-Efficacy	0.00 (7.50)	3.00 (5.00)	0.001*	-0.60
HBMS Community led Self-Efficacy	6.00 (2.13)	6.00 (3.50)	0.02*	-0.41
HBMS General Health Cues	12.00 (5.50)	12.00 (8.50)	0.08	-0.30
HBMS External Health Cues	0.00 (3.50)	0.00 (5.00)	0.78	-0.05
TPBS Benefits	10.00 (6.00)	8.00 (7.00)	<0.001*	-0.70
TPBS Barriers	-1.00 (4.50)	0.00 (4.50)	0.01*	-0.43
TPBS Social Norms	8.00 (3.50)	8.00 (3.00)	0.01*	-0.45
TPBS Social Influence	7.00 (3.00)	6.00 (4.50)	0.01*	-0.48
TPBS Intention	10.00 (6.00)	8.00 (6.00)	<0.001*	-0.73

Table 1. Differences in Attitudes Pre and Post Intervention (Median, Interquartile Range, [*HBMS: Health Belief Model Scale, TPBS: Theory Planned Behavior Scale; *indicates significance at P<.05])*

Variable	Pre-Measure	Post-Measure	P-Value	Effect Size
YBT ANT (%)	63.42 (13.53)	65.20 (12.14)	0.01*	-0.46
YBT PM (%)	112.72 (14.83)	111.24 (12.97)	0.02*	-0.41
YBY PL (%)	108.59 (18.14)	114.65 (12.72)	0.002*	-0.57
LESS	7.00 (2.75)	6.50 (4.75)	0.546	-0.11
Sit-up	64.00 (27.00)	67.50 (20.75)	0.01*	-0.44
Push-up	56.00 (25.50)	56.50 (28.75)	0.558	-0.10
2 Mile Run (s)	936.00 (200.75)	888.00 (112.00)	>0.001*	-0.75

Table 2. Difference in Functional Performance Pre and Post Intervention (Median, Interquartile Range, [*YBT: Y-Balance Test, LESS: Landing Error Scoring System; *indicates significance at P<.05])*

DISCUSSION

The major findings of this study include the high compliance rate of 87.2% and the improvements in individual self-efficacy, YBT, sit-up, and 2-mile run performance following the intervention. Additional findings of this study were the worsening of HBMS perceived consequences indicating they perceived less consequences to injury, perceived benefits indicating they perceived less benefits to participating in IPPs, and community-led self-efficacy indicating their comfort in participating if the IPP when led by an athletic trainer, coach, or strength coach decreased. Additionally, several subscales of the TPBS worsened including perceived benefits indicating they perceived less benefits to participation in an IPP, perceived barriers indicating they perceived more barriers to participation, social norms indicating lack of support in participation from important individuals, social influence indicating lack of research support for participation, and intention to participate. The most frequent reason for lack of participation in the DIME was time.

We hypothesized that attitudes towards participation in IPPs would improve following the infographic and participation in the DIME intervention. Unfortunately, the only improvement was in individual self-efficacy. The cadets felt more confident in their ability to participate in IPPs on their own following the intervention. This aligns well with a previous study done within club sport athletes where an intervention improved both individual and community-led self-efficacy.[7]

However, an additional study found that individuals who participated in an IPP had more positive attitudes towards participation which did not occur in our study.[9]

One of the potential reasons why there was a lack of improvement in attitudes was the main portion of the intervention that was designed to improve attitudes was an infographic included in the Qualtrics survey. The average amount of time spent on the Qualtrics surveys that included the infographics was 36 seconds compared to 26 seconds on the survey without the infographic. This indicates participants only spent about 10 seconds reading the content on the infographic. Future research should investigate other delivery methods of the benefits, barriers, and potential solutions to the barriers that may better engage the participants. Although a majority of the attitudes did not improve, the cadets were able to achieve a high overall compliance rate with the program at 87.2%.

We hypothesized that functional performance would improve following participation in the intervention. There were significant improvements in performance on the YBT, sit-up, and 2-mile run. These results align well with a previous study that found the DIME to improve performance on the sit-up, push-up, and 2 mile run test.[14] However, there failed to be improvements on the push-up test and LESS test. These results do not align with previous literature indicating improvements in landing technique following participation in the DIME.[15] This study also used the "train the trainer" method, but first provided thorough training to the physical education instructors who then trained upperclassman to implement the DIME. Researchers then continued to monitor the delivery of the DIME and provided daily feedback to the instructors. There is a potential in our study that the cadets were performing the exercises to improve landing technique, but the cadet leaders were not providing appropriate feedback. There were only 3 cadet leaders and they may not have been able to watch all of the cadets when performing the exercises. Future research should investigate appropriate ways to use the "train the trainer" method in IPPs that require feedback. An additional difference between the two studies was the use of the LESS-real time in our study versus the LESS which uses cameras to record the jumps. There is a potential that the differences in methodology led to differences in results.

The most common reasons for lack of participation in the IPP were time, other training, location, and slept in. The participants completed the IPP during their regularly scheduled physical training which occurred at 6am. Due to the timing of the delivery of the IPP, time and slept in are understandable barriers. The average bed time for college students is 1:54am while the average wake time is 9:17am.[16] Therefore, the IPP occurred more than 3 hours before the average wake time for college students. Two of the other reasons were other training and the location of the program. There may be a need to develop strategies that would assist with the program being delivered in a home setting to allow the cadets to participate wherever they are and at a time that is more convenient for their schedule. Future research should focus on developing implementation strategies that would assist the cadets with overcoming these common barriers.

There were several limitations associated with this study. First, the follow-up measure that was intended to be completed in April of 2020 was not able to be collected. We were unable to see what changes would occur in compliance or functional performance once the infographics were no longer being delivered. The DIME program was led by cadets that volunteered to lead the program. There is a potential that the cadets did not provide appropriate feedback to the participants and therefore the DIME was not appropriately delivered. An additional limitation of the study is the cadets continued to participate in outside activities and the researchers did not control the types of

activities the cadets did. There is a potential that outside activities could affect performance on functional activities. The participants included in the study were only Army ROTC cadets from a private university in Georgia and the results of this study may not be generalizable to ROTC cadets in other branches.

CONCLUSION

The infographic intervention and participation in the DIME was only able to improve compliance, self-efficacy, and functional performance on the YBT, sit-up test, and 2-mile run. Additionally, other attitudes towards participation in IPPs worsened after the intervention. The use of infographics using Qualtrics may not be the best delivery method for this population. Future research should investigate alternative strategies to improve attitudes towards IPP participation in order to enhance compliance.

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REFERENCES

1. Scott SA, Simon JE, Van Der Pol B, Docherty CL. Risk Factors for Sustaining a Lower Extremity Injury in an Army Reserve Officer Training Corps Cadet Population. *Mil Med*. 2015;180(8):910. doi:10.7205/MILMED-D-14-00618
2. Cameron KL, Owens BD. The Burden and Management of Sports-Related Musculoskeletal Injuries and Conditions Within the US Military. *Clin Sports Med*. 2014;33(4):573-589. doi:10.1016/j.csm.2014.06.004
3. Cameron KL, Hsiao MS, Owens BD, Burks R, Svoboda SJ. Incidence of physician-diagnosed osteoarthritis among active duty United States military service members. *Arthritis Rheum*. 2011;63(10):2974-2982. doi:doi:10.1002/art.30498
4. Hübscher M, Zech A, Pfeifer K, Hänsel F, Vogt L, Banzer W. Neuromuscular training for sports injury prevention: a systematic review. *Med Sci Sports Exerc*. 2010;42(3):413-421. doi:10.1249/MSS.0b013e3181b88d37
5. Sugimoto D, Myer GD, Bush HM, Klugman MF, McKeon JMM, Hewett TE. Compliance With Neuromuscular Training and Anterior Cruciate Ligament Injury Risk Reduction in Female Athletes: A Meta-Analysis. *J Athl Train*. 2012;47(6):714-723 doi:10.4085/1062-6050-47.6.10
6. Iversen MD, Friden C. Pilot study of female high school basketball players' anterior cruciate ligament injury knowledge, attitudes, and practices. *Scand J Med Sci Sports*. 2009;19(4):595-602.
7. Gabriel EH, McCann RS, Hoch MC, Cramer RJ. An intervention based on the health belief model led to improvements in self-efficacy towards ERIPP participation and functional performance in club sport athletes: a pilot study. *J Sci Med Sport*. 2020; 23(10): 921-926. DOI: 10.1016/j.jsams.2020.04.002
8. Gabriel E, Powden C. Benefits and Barriers Associated with Intention to Participate in Injury Prevention Programs in ROTC Cadets. I*nt J Athl Ther Train*. 2022; DOI: https://doi.org/10.1123/ijatt.2020-0112
9. Finch CF, White P, Twomey D, Ullah S. Implementing an exercise-training programme to prevent lower-limb injuries: considerations for the development of a randomised controlled trial intervention delivery plan. *Br J Sports Med*. 2011;45(10):791-796 6p.
10. Gabriel EH, Hoch MC, Cramer RJ. Health Belief Model Scale and Theory of Planned Behavior Scale to assess attitudes and perceptions of injury prevention program participation: An exploratory factor analysis. *J Sci Med Sport.* May 2019;22(5):544-549. doi:10.1016/j.jsams.2018.11.004
11. Powden CJ, Dodds TK, Gabriel EH. The Reliability of the Star Excursion Balance Test and Lower Quarter Y-Balance Test in Healthy Adults: A Systematic Review. *Int J Sports Phys Ther*. 2019;14(5):683.
12. Padua DA, Boling MC, Distefano LJ, Onate JA, Beutler AI, Marshall SW. Reliability of the landing error scoring system-real time, a clinical assessment tool of jump-landing biomechanics. *J Sport Rehabil*. May 2011;20(2):145-56.
13. Carow SD, Haniuk EM, Cameron KL, et al. Risk of lower extremity injury in a military cadet population after a supervised injury-prevention program. *J Athl Train*. 2016;51(11):905-918.
14. Peck KY, DiStefano LJ, Marshall SW, et al. Effect of a lower extremity preventive training program on physical performance scores in military recruits. *J Strength Cond Res*. 2017;31(11):3146-3157.
15. DiStefano LJ, Marshall SW, Padua DA, et al. The Effects of an Injury Prevention Program on Landing Biomechanics Over Time. *Am J Sports Med*. Mar 2016;44(3):767-76. doi:10.1177/0363546515621270

16. Okano K, Kaczmarzyk JR, Dave N, Gabrieli JD, Grossman JC. Sleep quality, duration, and consistency are associated with better academic performance in college students. *NPJ Sci.*. 2019;4(1):1-5.