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Original Article

Knowledge and Perception of Personal Activity Intelligence (PAI) among Medical Students: A Cross-Sectional Study

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ABSTRACT

Background: Personal Activity Intelligence (PAI) is a novel metric designed to quantify the health benefits of physical activity based on individual heart rate data. Previous studies have demonstrated that maintaining a PAI score of 100 or more per week can reduce the risk of cardiovascular disease and mortality, enhancing overall quality of life. However, awareness and acceptance of PAI among healthcare professionals and the general public are limited. This study investigates the knowledge, attitudes, and practices regarding PAI among medical students, who are pivotal in promoting health awareness and behaviors.

Objective: To assess the knowledge, attitudes, and practices of Personal Activity Intelligence (PAI) among medical students at Lahore Medical and Dental College.

Methods: This descriptive cross-sectional study was conducted over six months, from June 2023 to December 2023, at the Lahore College of Physical Therapy, LMDC. A non-probability convenient sampling technique was employed, resulting in a sample size of 300 participants, determined using the Taro Yamane formula with a 95% confidence interval and a 0.05 error margin. Participants included medical students aged 18-28 years who provided informed consent. Data were collected using a self-structured questionnaire, which was reviewed by 12 academic and 5 clinical faculty members for reliability and validity. The questionnaire, converted to a Google Form, comprised sections on general information, PAI awareness, physical activity levels, and the use of fitness trackers. Statistical analyses were conducted using SPSS version 25, with categorical variables summarized as numbers and percentages, and continuous variables as means ± standard deviation.

Results: Out of 300 participants, 72% were female and 28% were male, with a mean age of 21.53 ± 1.94 years. Regarding wearable devices, 45.8% used them for assessing physical activity. Awareness of PAI was low, with 23.7% familiar with it, 36% having heard of it, and 40.3% unaware. Only 11% had used PAI to track physical activity. Most students (82.8%) strongly believed in the importance of regular physical activity. The use of fitness trackers showed that 36% were currently using such devices, and among them, 63% included PAI features. However, confidence in interpreting PAI data was limited, with only 10.7% feeling very confident.

Conclusion: The study revealed a significant lack of awareness regarding PAI among medical students, despite a generally positive attitude towards its potential benefits. There is a need for enhanced educational efforts to improve PAI knowledge and integration into medical curricula, addressing barriers such as device availability and data interpretation.

Keywords: Personal Activity Intelligence, PAI, Medical Students, Physical Activity, Health Metrics, Cardiovascular Disease Prevention, Fitness Trackers, Health Education, Digital Health Tools, Cross-Sectional Study.

INTRODUCTION

Personal Activity Intelligence (PAI), a novel personalized metric for tracking physical activity, was developed with the objective of simplifying the quantification of weekly physical activity (PA) needed to reduce the risk of premature cardiovascular diseases (CVD), the leading cause of mortality globally (1). PAI uniquely considers factors such as age, sex, maximal heart rate, and resting heart rate, providing a tailored reflection of how the body responds to PA (2). Research indicates that achieving 100 PAI weekly can prevent

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premature death from CVD and other causes, suggesting that PAI may serve as an effective tool for determining the necessary amount of PA to maintain health.

Insufficient PA is a major risk factor for non-communicable diseases (NCDs) and mortality worldwide, as highlighted by the WHO. Annually, inadequate PA levels contribute to five million deaths, reduce life expectancy by 3-5 years, and increase the risk of NCDs by 20-30% (3). PA is known to prevent and manage several co-morbid conditions, including hypertension (HTN), overweight, and obesity, in a cost-effective manner without medication. It also enhances mental health, quality of life, and delays the onset of dementia (4)(5). Evidence suggests that cardiorespiratory fitness (CRF) may be a more reliable predictor of adverse health outcomes than PA alone (6).

To address barriers to PA, the Cardiac Exercise Research Group (CERG) developed PAI, aiming to make it easier to quantify weekly PA requirements to reduce the risk of premature mortality from NCDs (2). PAI can be integrated into self-assessment heart rate devices, identifying favorable weekly heart rate patterns during PA. PAI, which measures the body's response to PA, factors in sex, age, and maximum and resting heart rates, converting weekly heart rate variations into a straightforward score—0 representing inactivity and 100 representing adequate activity. A score of 100 PAI can be achieved through various volumes and intensities of PA, provided the heart rate exceeds a specific threshold, allowing individuals to engage in preferred activities while still meeting PA requirements.

Achieving a weekly score of 100 PAI has been shown to mitigate the clustering of CVD risk factors associated with sedentary behavior (7). Furthermore, obtaining 100 PAI is linked to a reduced risk of CVD and all-cause mortality in both the general population and patients with CVD, independent of adherence to PA guidelines (2)(8). This underscores PAI's potential as a valuable metric for assessing the amount of PA necessary to achieve significant health improvements. However, previous research on PAI has relied on single baseline evaluations, which may be influenced by confounders and changes in baseline PA levels over time. Consequently, it remains unclear whether maintaining a low or adequate PAI score, or changing the score over time, affects mortality risk estimations (9).

PAI, as an easily understandable metric of physical activity, is associated with a reduced risk of premature death from all causes and CVD. Achieving a score of 100 PAI weekly confers a similar reduction in mortality risk, regardless of adherence to current PA recommendations. PAI could be incorporated into self-assessment heart rate devices, enabling individuals to self-monitor their activity levels and achieve maximum health benefits (2).

Students, with their diverse age, lifestyle, and activity levels, represent an interesting demographic to assess awareness of PAI. Targeting students can provide insights into the understanding of this health and fitness metric among younger individuals at a critical stage of developing lifelong habits. The period between ages 18 and 26, often considered the university period, can be stressful for many students and influenced by various environmental factors (10). Increased awareness and understanding of PAI among students could lead to healthier lifestyles and improved cardiovascular health and overall wellness.

Self-reporting tools remain the most common method for measuring physical activity. It is crucial to recognize both the benefits and limitations of these methods and continually strive to improve their quality (11). This study employs a self-structured questionnaire encompassing various dimensions, using motivational interviewing as a person-centered approach to encourage individuals to assess their motivation. This technique fosters self-reflection through diverse strategies (12). Wearable fitness trackers (WFTs) offer the advantage of seamlessly integrating into daily routines to monitor activities, providing real-time feedback that can enhance awareness, motivation, and self-efficacy, ultimately fostering a natural inclination towards increased physical activity levels (13).

MATERIAL AND METHODS

The study was designed as a descriptive cross-sectional study conducted over a period of six months, from June 2023 to December 2023, at the Lahore College of Physical Therapy, LMDC. A non-probability convenient sampling technique was employed, resulting in a sample size of 300 participants. The sample size was determined using the Taro Yamane formula with a 95% confidence interval and a 0.05 error margin, based on a population size (N) of 1200 and an error margin (e) of 0.05, yielding n = 1200 / (1 + 1200(0.05)^2) = 300. The study included participants who were enrolled as medical students at Lahore Medical and Dental College, aged 18-28 years, and who provided informed consent to participate in the study.

A self-structured questionnaire was developed as the research instrument, consisting of three distinct sections. The data collection procedure was meticulously designed to ensure both the reliability and validity of the questionnaire. Initially, an expert review was conducted involving 12 experienced physiotherapists from Lahore College of Physical Therapy's academic faculty and 5 from Ghurki Trust and Teaching Hospital's clinical faculty. Their insights were instrumental in identifying and rectifying any errors or deficiencies in the questionnaire.

The questionnaire was subsequently transformed into a digital format using Google Forms, facilitating online distribution and data collection. Participants were first presented with an informed consent form that comprehensively explained the study's purpose,

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data usage, and participants' rights, allowing them to provide their consent electronically. Upon accessing the Google Form, participants were directed to complete all sections of the questionnaire, which covered general information, awareness of Personal Activity Intelligence (PAI), and details about their physical activity levels and use of fitness trackers.

Data collection was conducted seamlessly as participants submitted their responses via the Google Form, ensuring secure storage of data in a digital format and minimizing risks associated with manual data entry. Following data collection, the data underwent rigorous analysis using appropriate statistical methods and software. Data were manually entered into Excel and then transferred to the Statistical Package for Social Sciences (SPSS) software version 25 for analysis. Participants who did not complete all questions in the survey or who provided contradictory answers on close-ended questions were removed from the sample. Categorical variables were summarized using numbers and percentages, while continuous variables were summarized by means and standard deviation (SD).

The study adhered to ethical standards consistent with the Declaration of Helsinki. Ethical approval was obtained from the institutional review board of Lahore Medical and Dental College. All participants were informed about the study's aims and procedures and provided informed consent electronically before participation. Confidentiality and anonymity of the participants were maintained throughout the study, and the data were used solely for research purposes.

Through the meticulous execution of this comprehensive data collection procedure, the study aimed to gather high-quality data and establish the reliability and validity of its research findings. The analysis phase was crucial in drawing meaningful conclusions and insights pertinent to the research objectives, ultimately contributing to the understanding of the knowledge and perception of Personal Activity Intelligence (PAI) among medical students.

RESULTS

Table 1: Descriptive Statistics of Wearable Device

Wearable Device For Assessing Physical Activity	Frequency	Percentage
Yes	141	45.8%
No	167	54.2%

Table 2: Awareness of Personal Activity Intelligence

Variables	Responses	Frequency	Percentage
Familiarity with Personal Activity Intelligence	Yes, I'm familiar with it	73	23.7%
	I've heard of it but don't know much about it	111	36%
	No, I've never heard of it	124	40.3%
PAI Description	Yes, I do	120	39%
	No, I don't	115	37.3%
	Maybe	73	23.7%

Table 3: Descriptive Statistics of Physical Activity Level

Variables	Responses	Frequency	Percentage
Do you believe that regular physical activity is essential for overall health and well-being?	No, I don't believe	5	1.6%
	Not sure	9	2.9%
	Yes, I strongly believe	255	82.8%
	Yes, I somewhat believe	39	12.7%

Table 4: Descriptive Statistics of Engagement in Physical Activity

Variables	Responses	Frequency	Percentage
How often do you engage in moderate to vigorous physical activities (e.g., running, swimming, cycling, and team sports) in a typical week?	I don't engage in physical activity	76	24.7%
	Occasionally (1-2 times a week)	82	26.6%
	Rarely (less than once a week)	86	27.9%

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Variables	Responses	Frequency	Percentage
	Regularly (3-4 times a week)	44	14.3%
	Very regularly (5 or more times a week)	20	6.5%

Table 5: Descriptive Statistics of Health and Fitness Tracker Usage

Variables	Responses	Frequency	Percentage
Are you currently using any fitness tracker or health app that provides insight into your physical activity and health?	Yes	111	36%
	No	197	64%
If you are using a fitness tracker or health app, does it include PAI as one of its feature?	Yes	70	63%
	No	25	22.25%
	I'm not sure	16	14.4%
Have you ever actively used PAI to track and measure your physical activity and its impact on your health?	No, I haven't used PAI for tracking	207	67.2%
	Yes, occasionally	66	21.4%
	Yes, Regularly	35	11.4%
How confident are you in interpreting and understanding the PAI data provided by fitness trackers or health apps?	Very Confident	33	10.7%
	Somewhat confident	60	19.5%
	Not very	57	18.5%
	Not at all	46	14.9%
	Neutral / unsure	112	36.4%

Table 6: Descriptive Statistics of Incorporating PAI

Variables	Responses	Frequency	Percentage
Do you think PAI could be a useful tool to help you stay motivated and maintain a healthy lifestyle?	Yes	170	55.2%
	No	19	6.2%
	Maybe	119	38.6%

Table 7: Descriptive Statistics of Motivation with PAI-based Recommendation

Variables	Responses	Frequency	Percentage
Would you be more motivated to engage in physical activity if you received personalized PAI-based recommendations from a fitness tracker or health app?	Maybe	89	28.9%
	No, it would not make a difference	39	12.7%
	Yes, it would be motivating	180	58.4%

Table 8: Descriptive Statistics of Overall Awareness of PAI

Variables	Responses	Frequency	Percentage
Categories of Overall Awareness of PAI	No Awareness	109	35.4%
	Least aware	112	36.4%
	Moderately Aware	69	22.4%
	Highly Aware	18	5.8%

In assessing the use of wearable devices for tracking physical activity, it was found that 45.8% of the participants (141 individuals) reported using such devices, while 54.2% (167 individuals) did not use any wearable devices for this purpose (Table 1). This indicates a fairly balanced distribution of wearable device usage among the medical students surveyed.

When exploring the awareness of Personal Activity Intelligence (PAI), the results showed a varied level of familiarity. Specifically, 23.7% (73 participants) were familiar with PAI, 36% (111 participants) had heard of it but did not know much about it, and 40.3% (124 participants) had never heard of it (Table 2). Furthermore, when asked if they could describe PAI, 39% (120 participants) responded affirmatively, 37.3% (115 participants) said they could not, and 23.7% (73 participants) were unsure (Table 2).

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The belief in the importance of regular physical activity for overall health and well-being was overwhelmingly positive among the participants. A significant 82.8% (255 participants) strongly believed in the necessity of regular physical activity, while 12.7% (39 participants) somewhat believed in it. Only a small fraction, 1.6% (5 participants), did not believe in its importance, and 2.9% (9 participants) were unsure (Table 3).

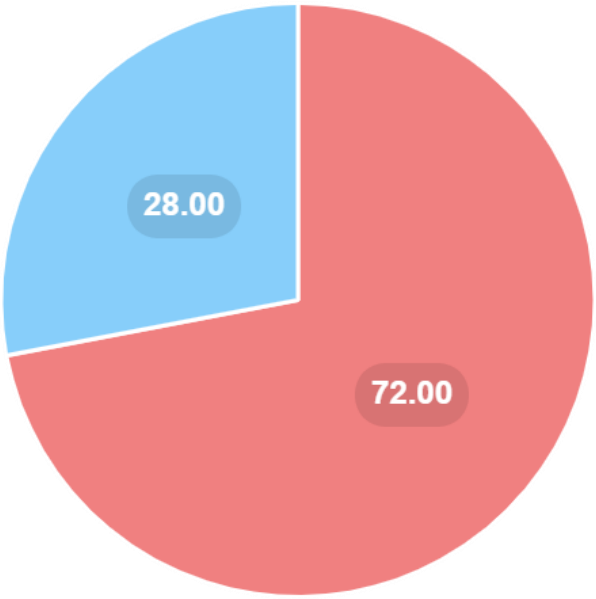
Regarding the engagement in moderate to vigorous physical activities, 24.7% (76 participants) reported not engaging in such activities, while 26.6% (82 participants) occasionally engaged in these activities (1-2 times a week). Additionally, 27.9% (86 participants) rarely engaged in physical activity (less than once a week), 14.3% (44 participants) engaged regularly (3-4 times a week), and 6.5% (20 participants) engaged very regularly (5 or more times a week) (Table 4).

In terms of health and fitness tracker usage, 36% (111 participants) were currently using a fitness tracker or health app, while 64% (197 participants) were not. Among those using fitness trackers, 63% (70 participants) reported that their device included PAI as a feature, 22.25% (25 participants) did not have PAI included, and 14.4% (16 participants) were unsure (Table 5). Furthermore, when asked about actively using PAI to track and measure their physical activity, 67.2% (207 participants) had never used PAI for tracking, 21.4% (66 participants) used it occasionally, and 11.4% (35 participants) used it regularly (Table 5).

Confidence in interpreting and understanding PAI data provided by fitness trackers or health apps varied among the participants. Only 10.7% (33 participants) felt very confident, 19.5% (60 participants) felt somewhat confident, 18.5% (57 participants) were not very confident, 14.9% (46 participants) were not at all confident, and 36.4% (112 participants) were neutral or unsure (Table 5).

When considering the potential of PAI as a motivational tool, 55.2% (170 participants) believed that PAI could help them stay motivated and maintain a healthy lifestyle, 6.2% (19 participants) did not think it would be useful, and 38.6% (119 participants) were unsure (Table 6). Furthermore, regarding motivation through personalized PAI-based recommendations from fitness trackers or health apps, 58.4% (180 participants) stated that it would be motivating, 12.7% (39 participants) believed it would not make a difference, and 28.9% (89 participants) were uncertain (Table 7).

Overall awareness of PAI was assessed on a scale from no awareness to high awareness. The results revealed that 35.4% (109 participants) had no awareness of PAI, 36.4% (112 participants) were least aware, 22.4% (69 participants) were moderately aware, and only 5.8% (18 participants) were highly aware (Table 9). These findings underscore the varied levels of familiarity and engagement with PAI among medical students, highlighting the potential for increased educational initiatives to enhance awareness and utilization of this metric in promoting physical activity and overall health.



The study included 300 participants, with a notable majority comprising 72% females and 28% males (Figure 1).

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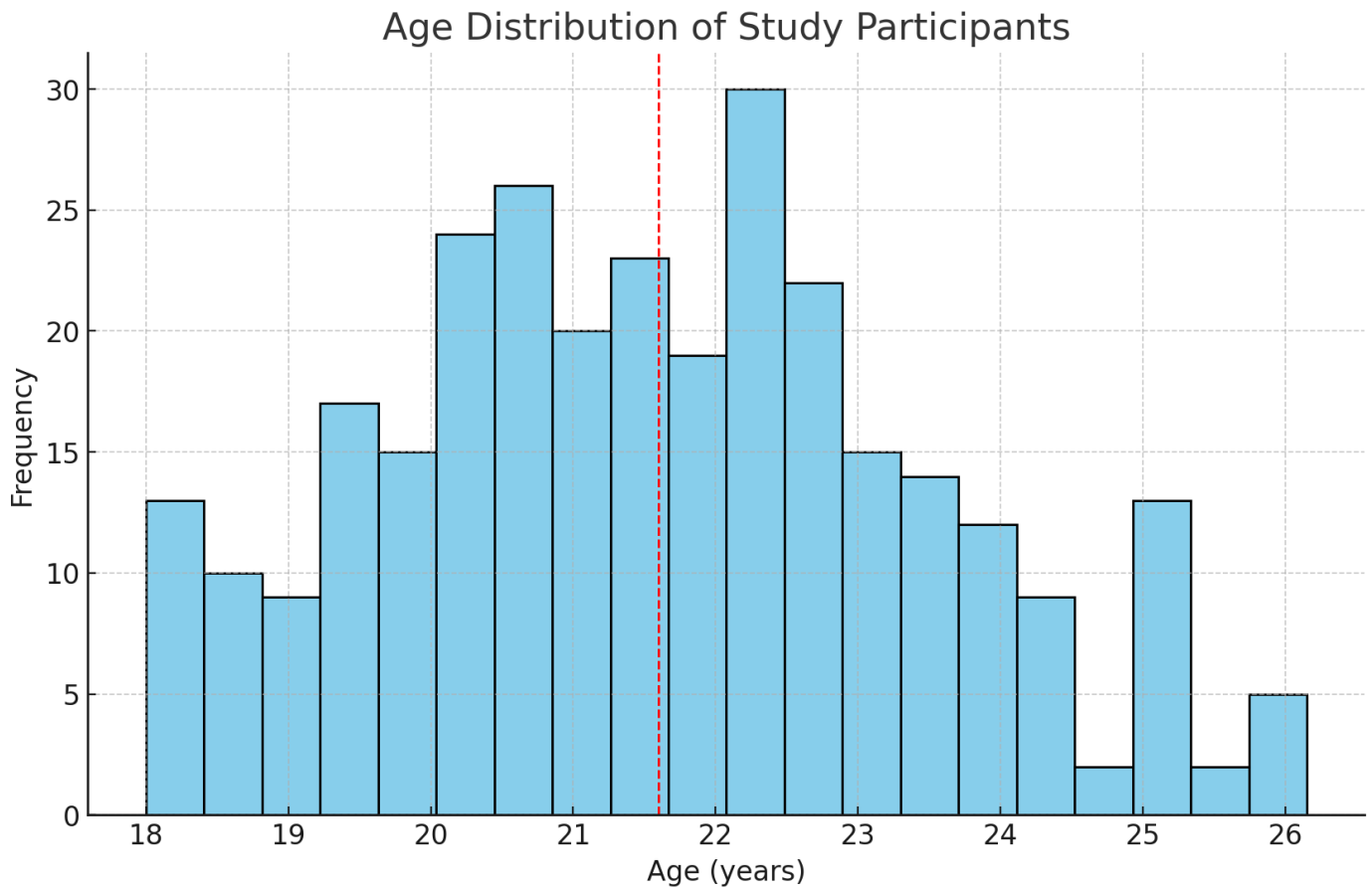

The average age of the participants was 21.53 years, with a standard deviation of 1.94 years, highlighting the young demographic predominantly aged between 18 and 28 years (Figure 2).

DISCUSSION

The primary objective of this study was to assess medical students' knowledge and perception of Personal Activity Intelligence (PAI), a new metric for tracking physical activity based on heart rate data. Previous research has indicated that maintaining a PAI score of 100 or more per week can reduce the risk of cardiovascular disease and mortality, while also improving quality of life and fitness. However, awareness and acceptance of PAI among healthcare professionals and the general public remain limited. This study aimed to bridge this gap by evaluating the level of knowledge, attitudes, and practices regarding PAI among medical students, who are future practitioners and role models for patients.

The main findings revealed a low level of knowledge about PAI among the medical students, as assessed by a self-structured questionnaire. Several factors likely contributed to this low knowledge score, including the lack of exposure to PAI in the medical curriculum, limited availability of PAI-compatible devices and apps in the local market, and minimal media coverage and promotion of PAI within the country. Additionally, the participants were predominantly in their preclinical years of medical education, which might have influenced their interest and familiarity with PAI and other aspects of physical activity and health.

Despite the low knowledge levels, the participants' attitudes towards PAI were generally positive. Most agreed that PAI is a useful and motivating tool for promoting and monitoring physical activity. However, some expressed concerns regarding the accuracy and validity of PAI, the feasibility and affordability of PAI devices and apps, the privacy and security of PAI data, and the potential impact of PAI on the doctor-patient relationship and the role of health professionals. These concerns echo those reported in other studies on the perception of artificial intelligence and digital health among healthcare professionals and students (16). Addressing these issues and providing adequate education and training on PAI's benefits and limitations are crucial for integrating PAI into medical education and practice.

The practice of using PAI among the participants was notably low, with only 11% having used PAI to track and measure their physical activity. The primary reasons for not using PAI included the lack of access to PAI devices and apps, a preference for other physical activity metrics and methods, and low awareness and knowledge of PAI. However, participants who used PAI reported that it helped

them increase their physical activity level and intensity, monitor their progress, and achieve their goals. They also found PAI easy to use and understand, providing personalized and meaningful feedback. These findings align with a previous study that evaluated the effect of PAI monitoring on physical activity and quality of life in cardiac rehabilitation patients, which found that PAI monitoring increased physical activity, improved quality of life, and enhanced motivation and satisfaction (17).

The implications of this research are significant, suggesting that PAI is a promising and innovative metric that can potentially improve the physical activity and health outcomes of medical students and their patients. However, increasing awareness and knowledge of PAI among medical students and integrating PAI into the medical curriculum and practice are necessary. Overcoming barriers such as the availability and affordability of PAI devices and apps, ensuring the reliability and validity of PAI data, and addressing ethical and legal aspects of PAI are also crucial. Further research is needed to evaluate the effectiveness and impact of PAI across different populations and settings and to compare PAI with other physical activity metrics and methods (18-21).

This study had several limitations. It was confined to one medical school, which may not represent the diverse perspectives and experiences of medical students from various institutions. Conducting a cross-sectional study limited the ability to observe changes in knowledge and perception of PAI over time among the same participants. Participants' responses might have been influenced by social desirability bias, potentially skewing the data as they provided answers they believed were expected. Additionally, relying primarily on self-reported responses introduced the possibility of recall bias, where participants might not accurately remember or report their experiences and perspectives regarding physical activity and PAI.

CONCLUSION

This study highlighted a significant lack of awareness regarding Personal Activity Intelligence among medical students, underscoring the need for tailored educational efforts to enhance their understanding and promote better health outcomes. By addressing the identified barriers and incorporating PAI into the medical curriculum, future healthcare providers can be better equipped to utilize this innovative metric to improve physical activity and health outcomes for themselves and their patients.

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