

Integrating "Exercise Is Medicine" into primary care workflow: a study protocol

Sarah E. Linke[®], Gene "Rusty" Kallenberg[®], Rick Kronick[®], Ming Tai-Seale[®], Kimberly De-Guzman[®], Borsika Rabin[®]

Department of Family Medicine and Public Health, UC San Diego, 9500 Gilman Drive, Box 0725, La Jolla, CA 92093-0725, USA

Correspondence to: S. E. Linke, slinke@health.ucsd.edu

Cite this as: *TBM* 2021;11:921–929 doi: 10.1093/tbm/ibaa088

© Society of Behavioral Medicine 2020. All rights reserved. For permissions, please e-mail: journals.permissions@oup.com.

Abstract

As a major contributor to the burden of most chronic diseases, insufficient physical activity (PA) creates a significant financial burden on the health care system. Numerous interventions effectively increase PA, but few are integrated into primary care clinic workflows. Exercise Is Medicine (EIM) is a global health initiative committed to the belief that PA is integral to the prevention and treatment of diseases and should be routinely assessed as a vital sign and treated in the health care setting. This paper describes an in-progress embedded quality improvement (QI) project that integrates EIM into routine clinical practice. A combination of implementation science (IS) and QI models are used to adapt, implement, and evaluate the integration of EIM into six primary care clinics. The Practical, Robust Implementation and Sustainability Model (PRISM) guided preimplementation evaluation and adaptation of EIM protocol, materials, and delivery strategies. The learning evaluation QI model is used to design, test, refine, and implement EIM using rapid, 3 month Plan-Do-Study-Act microcycles. Learning meetings are used to obtain feedback and optimize workflow. The Stirman Framework is used to document adaptations to the program throughout implementation. Reach, adoption, implementation, effectiveness, and maintenance outcomes embedded within PRISM will guide the program evaluation to determine sustainability and scalability. Using an innovative approach of combining IS and QI methods to improve the identification of primary care patients with insufficient PA to increase their activity levels has great population health potential. Our work will inform the best approaches for EIM integration in primary care.

Keywords

Exercise Is Medicine, Physical activity, Implementation science, Quality improvement, Health care services research

INTRODUCTION

National physical activity (PA) guidelines recommend engaging in 150–300 min of moderate aerobic activity, 75–150 min of vigorous aerobic activity, or an equivalent combination of the two per week [1]. Estimates based upon self-reported PA of primary care patient populations indicate that approximately 30% of U.S. adults meet these guidelines [2]. Identifying individuals with insufficient PA and helping them to increase their PA is a high priority

Implications

Practice: This implementation science (IS) and quality improvement (QI) study will evaluate and provide practical recommendations and tools for incorporating an efficient system of measuring and prescribing exercise in routine primary care practice visits.

Policy: The results of this study will inform potential health policies around mandated insurance coverage and reimbursement for health care providers to spend time discussing exercise with patients as a prevention and/or treatment method for physical and mental health problems.

Research: The methodology of this study will inform future IS and QI research efforts to improve and evaluate the incorporation of exercise and other health behaviors (e.g., diet/nutrition) into the health care setting.

given the convincing evidence that it poses as much of a risk to health as other established risk factors that are routinely screened for and treated in primary care [3] and creates a significant financial burden on the health care system [4], accounting for approximately 11% of health care expenditures [5].

Although none of the delivery channels used to promote PA has significantly moved the needle on a population health level [6], primary care providers (PCPs) are recognized as a promising channel because of their ability to reach a large segment of the population and their reputation as a trusted source of health information [7]. Numerous randomized controlled trials on delivering PA counseling in primary care settings have demonstrated the effectiveness of this approach [8, 9]. A meta-analysis of this literature revealed an odds ratio of 1.42 (1.17–1.73) of meeting PA guidelines and a 0.25 (0.11–0.38) standardized mean difference following PCP advice based on self-report data [9]. Despite evidence

TBM page 921 of 929

supporting the cost-effectiveness of PA counseling in primary care (€1,120-€15,860 per QALY gained, which is more cost-effective than many pharmaceutical interventions) [8], only one third of patients reported receiving PA counseling from their PCPs in a 2010 National Health Interview Survey [10]. Key reasons for this are that PCPs often lack the training and time required to provide effective PA counseling [11]. Innovations in practice support (e.g., efforts by medical assistants [MAs] and point of care electronic medical records [EMR] decision support) could make PCPs more efficient and effective in providing PA counseling. In addition, PA promotion may be even more effective when delivered by trained health behavior counselors or coaches within primary care clinics who can devote more time to addressing barriers and strategies to overcome them [12].

Exercise Is Medicine (EIM) is a global health initiative managed by the American College of Sports Medicine based on the premise that PA should be routinely assessed as a vital sign and "treated" in the health care setting [13, 14]. EIM was designed to be readily implemented into health care systems worldwide with adaptations necessary to fit within the existing structures of each system. The cornerstone of EIM is the Physical Activity Vital Sign (PAVS), which consists of two questions that assess the frequency and duration of moderate-to-strenuous exercise patients engage in weekly [15]. The PAVS tool is optimally used in the clinic setting when integrated into EMR systems [2]. Using the validated PAVS tool along with providing an exercise "prescription" and brief motivational intervention in clinical practice has been linked to favorable metabolic outcomes [2, 14, 16-18].

Due to the gaps in the integration of EIM into realworld practices, we turn to implementation science (IS) to understand how to systematically deploy and utilize evidence-based approaches to improve the quality and effectiveness of health promotion, health services, and health care in primary care [19, 20]. The quality improvement (QI) approach analyzes practice performance and reduces process variation to improve the outcomes of these processes both for patients and the health care system [21]. One approach that serves as the basis for many QI models is known as the Plan-Do-Study-Act (PDSA) cycle [22]. The combination of IS and QI approaches has great potential to support the iterative, sustainable, and meaningful implementation of evidence-based practices in the context of real-world health care settings. Multiple studies that have combined methodology from OI and IS research have found increases in the efficiency, timeliness, and pragmatic relevance of their studies, as well as an ability to better align with the dynamically changing inner and outer context [23-25].

The goal of this paper is to describe the protocol of a study that innovatively combines IS

and QI strategies to promote a standardized and semiautomated EIM program. The study aims to systematically adapt and implement EIM within six primary care clinics and utilize a QI model to conduct rapid PDSA microcycles to iteratively adapt it. The mixed methods study will conduct multilevel program evaluations to determine its overall reach, the extent to which each component was delivered, how it was perceived by patients and providers, and whether it is sustainable from cost and reimbursement standpoints. Being embedded researchers and practicing clinicians has enabled us to develop the strong foundation, infrastructure, and climate necessary to conduct IS and QI projects, such as EIM. This study was approved by the UC San Diego Institutional Review Board (IRB) as an exempt project (IRB #180968) to complete the initial preimplementation data collection, and the IRB added the implementation phase in as a QI component so that the entire project remained cohesive.

METHODS

Setting

The study takes place within the six faculty primary care clinics at UC San Diego Health, including three family medicine and three general internal medicine clinics. The six clinics were chosen because they are the only faculty clinics within the UC San Diego Health System and, at the time of study conception, were the only primary care clinics at which we had an integrated behavioral health (IBH) presence. Since then, multiple other community clinics (nonfaculty primary care clinics) have opened, and IBH has established a footprint in them as well. We plan to continue the EIM rollout to the other clinics after solidifying our presence at the original six clinics. Geographically, these six clinics cover diverse parts of San Diego N County and serve >70,000 patients from urban, suburban, and rural areas. These clinics have a long history of EMR use with prior successful efforts to impact care through EMR-related interventions. This offered opportunities to create EIM components in the EMR and integrate them into the standard workflow. The study also leverages the existing model by offering patients a referral to a health and wellness specialist for brief exercise health coaching at no cost to them. Simultaneously with the initial EIM launch, new EMR and nursing clinical workflows were being implemented to universally screen patients for mental and behavioral risk factors (e.g., depression, anxiety, and alcohol and drug use), briefly address results with patients, and subsequently refer them to IBH providers for further evaluation and referral or treatment, if indicated. EIM was launched independently but in parallel with this effort.

page 922 of 929 TBM

Providers

Providers involved in the delivery of EIM include MAs, PCPs (including attendings and residents), and health and wellness specialists (for exercise health coaching). The health and wellness specialist team is comprised of providers from various mental and behavioral health disciplines, including health coaching, marriage and family therapy, clinical psychology, and social work. The specific roles of each of these providers are described later in this protocol. We are still exploring options for staffing our health coaching team long term. Our goal is to hire full-time health coaches employed by the health care system. The development and trial of billing current procedural terminology (CPT) codes for third-party payor reimbursement for health coaching services are currently happening on a national level. If/when these codes are approved and valid, we plan to explore utilizing them to generate the revenue required to sustain the service we are currently offering at no cost. To bill for these codes, individuals would be required to obtain a certification in health coaching and meet other requirements set forth by the governing body.

IS and QI models

We combined IS and QI models and methods to guide the planning, design, implementation, and continuous adaptation of the EIM initiative to fit within the evolving needs and priorities of our health care system (see Fig. 1). Specifically, we use the Practical, Robust Implementation and Sustainability Model (PRISM) [26] and the adapted and expanded Stirman framework [27] (IS models) combined with the learning evaluation model [28] (QI).

Practical, Robust Implementation and Sustainability Model

PRISM is a comprehensive model for translating effective research into practice by systematically identifying organizational factors to consider [26]. PRISM considers important implementation concepts from the diffusion of innovations, the chronic care model, and the model for improvement. PRISM highlights four components that influence implementation success: (a) organizational and participants characteristics; (b) intervention characteristics from the organizational (medical facility) and participants' perspectives (i.e., patients and providers); (c) implementation and sustainability infrastructure (training and support); and (d) external environment. It also incorporates outcomes of reach, effectiveness, adoption, implementation, and maintenance (better known as the RE-AIM framework).

Adapted and expanded Stirman framework

The adapted and expanded Stirman framework [27] allows for the systematic assessment and documentation of interventions prior to and throughout their implementation. The framework enables researchers to focus on potential changes to the original intervention and the balance between fidelity to evidence-based core components and local customization to fit local context, including workflow [25, 29].

Learning evaluation model

Learning evaluation blends QI and implementation research methods with an emphasis on drawing systematic and transportable lessons from health care innovations implemented across multiple organizations in fluctuating, real-world settings. The

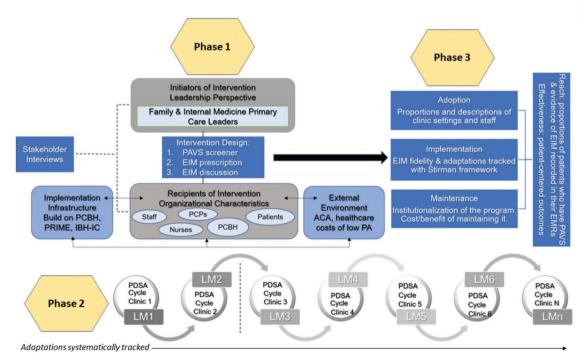


Fig 1 | The integration of Practical, Robust Implementation and Sustainability Model and learning evaluation models.

overarching idea of learning evaluation model [28] is that assessment needs to be flexible, grounded, iterative, contextualized, and participatory to foster rapid and transportable knowledge. This approach integrates the implementation and evaluation of interventions by establishing feedback loops that allow the intervention to adapt to ongoing contextual changes. Feedback loops are guided by learning meetings that are conducted within each setting after its PDSA cycle. Learning meetings are used to gather feedback and generate ideas for improvement and facilitate adaptations.

Integration of PRISM, adapted and expanded Stirman, and the learning evaluation model

Figure 1 depicts how the three models are combined to conduct the three phases of the study. Figure 2 provides a summary about what happens in each of the three phases of the study.

Phase 1: preimplementation evaluation *Overview*

We used PRISM [26] to guide a comprehensive preimplementation evaluation and adaptation of the EIM initiative, protocol, materials, and delivery strategies. This included input from key stakeholders and leaders, providers, staff, and patients, as well as information about the internal and external environment and existing infrastructure (see Fig. 1). Table 1 contains sample questions from the interviews and focus groups we conducted and links them with the PRISM domains they address. Full interview guides are located in the Supplementary Appendix.

We conducted key informant interviews with health system and primary care clinic leaders to obtain information regarding institutional support and any barriers that may affect the implementation infrastructure and small group interviews with clinical providers to collect more in-depth contextual information and input regarding clinic culture and workflow issues. We addressed the anticipated concerns raised by leadership by making the study protocol as streamlined and automated as possible to reduce any potential time burdens on providers. By providing resources, such as the PA manual and free health coaching, and programming the other

components of the program into Epic, the burden on providers is minimized. Our goal was to save providers' time by building these automated systems to reduce their load. The leadership expressed satisfaction with and support of our approach.

We also conducted two patient focus groups (total N = 8) to obtain feedback about the PA manual that we created as a resource for patients and to reduce the burden on providers during their discussions with patients about exercise. We used a semistructured guide (see Supplementary Appendix) to lead patients, who were recruited by their PCPs, through a 90 min review and discussion of the manual. Participants were given a \$30 Amazon gift card for their time. One assistant lead the discussion (with supervision by the PI), while one took detailed notes and another took notes about the main points on a white board for all participants to see during the discussion to ensure that their feedback was accurately understood and captured. The notes were synthesized, and primary themes were identified. Overall, patients had positive feedback about the manual and highlighted that it was a "good starting place" to begin PA. Their main suggestions for improvement revolved around including more geographically diverse places to be active in San Diego, adding sections on stretching and water sports, and general editing. The revised PA manual can be found at the following website: https://tinyurl.com/EIMUCSD.

After synthesizing and reviewing this information, we made adaptations to the generic EIM protocol and used the adapted and expanded Stirman framework to systematically document these changes. For example, we added the PAVS to e-checkin, which enables patients to complete it via their own portal prior to their appointment. We also added an option for patients to speak with a health coach about exercise. Most of the workflow was automated by 9 programming clinical decision points and reminders in the local EMR (Epic). Decisions about the original workflow and all subsequent adaptations are made together by the lead researcher and the lead physician to ensure an equal partnership and representation of ideas from both research and practice standpoints.

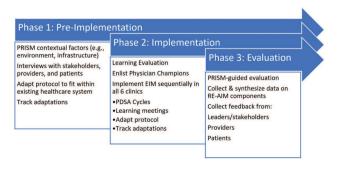


Fig 2 | Summary of the three phases of the study.

page 924 of 929

Table 1 | Practical, Robust Implementation and Sustainability Model (PRISM) domains addressed in preimplementation interviews and focus groups

PRISM domain	Participant group	Sample questions
Implementation infra- structure	Providers	"What ideas do you have for maximizing efficiency in workflow related to the PAVS evaluation and EIM discussions in routine clinic visits?" "Let's discuss your experience with clinical reminders (e.g., banners, required vs recommended clinical reminders). Considering what has worked well or not so well with other assess/advise/act metrics, what ideas do you have for making EIM reminders as efficient and effective as possible?"
External environment	Clinic and health care leaders	"I'm interested in learning about your impressions of the current climate in primary care here. For example, a lot of talk has centered around physician burnout. In your opinion, do you believe primary care has the capacity for incorporating an initiative like EIM at this time?" "Considering the climate as well as the potential benefits and barriers of this initiative, what are your thoughts regarding the implementation of EIM at this time?"
Intervention design	Patients	"What did you like or dislike about each section?" "Could you give feedback on the user friendliness of the manual?" "Would you rather have an online or printed version? Why?"

Summary of preimplementation findings

Overall, the reception of the EIM initiative has been extremely positive. Nearly 100% of leaders, providers, and staff members that we have interviewed have expressed their support for the importance of exercise in the health and well-being of patients and acknowledged that it has historically not been emphasized enough in the training, culture, and practice of medicine in this system. Leadership (Associate Chief of Clinical Affairs, Chief of Family Medicine, and Family Medicine and Internal Medicine Clinic Leaders) expressed support for the rollout of this initiative while also cautioning that primary care is currently overwhelmed with changes in multiple areas, including their compensation structure, shortened appointment times, and other initiatives (e.g., universal screening for depression, anxiety, drugs, alcohol, and trauma) and, as a result, is facing lower morale and an increase in physician and staff burnout. Armed with this institutional knowledge, we spoke with each clinic leader and jointly evaluated the readiness of their clinic and discussed the appropriate timing of implementing this initiative. We also enlisted volunteer "physician champions" at each clinic to promote the initiative and generate enthusiasm among their peers.

Phase 2: implementation and refinement

We are currently using the learning evaluation [28] QI model to iteratively pilot, refine, and implement the PAVS and EIM within each of the six primary care clinics using rapid, 3 month PDSA microcycles followed by learning meetings to gather feedback and generate ideas for improvement to optimize workflow [30]. Thus far, we completed the pilot at Clinic 1, are currently implementing at Clinic 2, and expect to implement at the remaining four clinics over the next 15 months.

Adaptations

We piloted the adapted protocol at Clinic 1 over the course of 1 year, during which time we made multiple adaptations and refinements to the protocol to increase efficiency and to better align with the existing workflow. We routinely solicit input and feedback from all providers and staff at Clinics 1 and 2 to gather information about any problems or programming glitches they may encounter and to generate ideas for improvement, and we will continue this process at each subsequent clinic. We work closely with the programmer to ensure that all features of the system are working properly by conducting test simulations and relaying problematic issues reported to us by providers and staff. Examples of adaptations that we have made to date based on this refinement procedure include the following:

- 1) Automating the referral to health coaching. We initially relied on the PCPs and/or nurses to proactively ask patients if they would like to speak with a health coach about exercise and notify our health coaching team by finding them in another area of the clinic, calling them at a work station, or sending them a message through the EMR. Referrals were very low during this time period (averaging two per week). Based on provider feedback, we automated the referral system by adding a question to the PAVS, asking patients if they would like to speak with a health coach about exercise ("Yes" or "No") and then automatically sending referrals to the health coaching team for all "Yes" responses. This change added one more click for the MAs entering the PAVS but saved time and effort overall. We saw a significant change in the number of referrals (averaging 15 per week) immediately after the change was implemented.
- 2) Increasing the frequency of the banner reminder for PCPs to discuss and document EIM. We created a clinical reminder (i.e., an orange banner stating: EIM

page 925 of 929

completed, follow-up needed [add .EIM to your note]) to automatically notify PCPs that they should discuss and document EIM if clinically appropriate. Initially, we programmed the banner to appear only once (the first time the PAVS questionnaire was completed) for each patient. We quickly realized that culture change would take longer and decided to program the banner to appear at each visit the PAVS questionnaire was completed, prompting the PCP to take action when the time and circumstances of the visit allowed. Although providers sometimes complain of experiencing "banner fatigue," this change reflected a better alignment with other clinical reminder-banners and immediately resulted in a 33% increase in EIM documentation and positive feedback from providers.

Current workflow

The current workflow is described below and depicted in Fig. 3. It contains three main branches that operate independently from each other, assuming the PAVS questions are entered in the EMR at the first step.

- The first branch (<150 or ≥150 min/week) covers the automatic features of adding a diagnosis (Z72.3 or Z78.9) to the problem list and visit diagnosis and also printing an automatically tailored exercise prescription in the After Visit Summary with a web link to a PA manual (https://tinyurl.com/EIMUCSD) that contains comprehensive information about exercise, including local resources and sample plans.
- The second branch covers the PCP workflow. After a PAVS is completed, a clinical reminder (i.e., banner) appears on the PCP's view of the patient visit. The banner reminds them to (a) consider whether or not to discuss exercise with the patient using clinically relevant information (e.g., purpose of the visit and competing issues) and (b) document that decision using the .EIM smartphrase in the progress note. Both a visit diagnosis and a problem list entry indicate whether the patient meets or does not meet the goal of adequate PA. Providers are trained to address the patient's active problem list at each visit, so, by including PA status on the problem list, providers are more likely to address it, especially in patients with chronic diseases where PA has clear potential impact (e.g., diabetes, hypertension, and obesity).

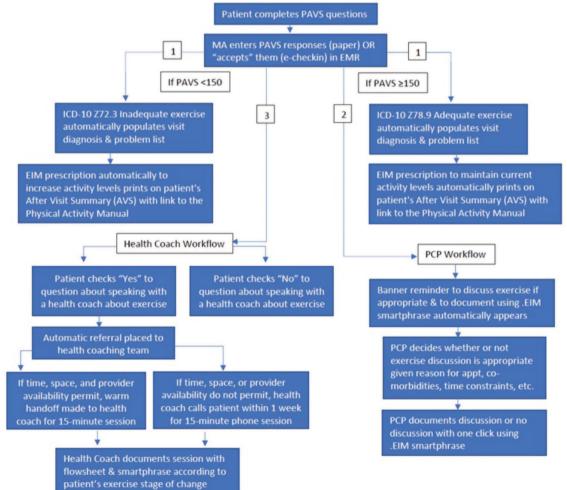


Fig 3 | Overview of the workflow, including clinical decision points.

page 926 of 929

3) The third branch covers the health coaching workflow. An automatic referral to the health coaching team is triggered by the patient's "Yes" response to the question: "Would you like to speak with a health coach about exercise?" Initially, health coaching sessions were conducted in person at the clinic immediately following the PCP visit. However, after the workflow changed to the automated self-referrals to health coaching, we moved to a telehealth system to accommodate the increasing volume, which would not be feasible to do in clinic given personnel and space constraints. The health coaches are currently employed by the study. We are currently not billing for these sessions but have plans to test billing options using health coaching and/ or health behavior assessment and intervention CPT codes in the near future. Successfully billing for at least a fraction of these visits will be critical to the sustainability of this initiative. We plan to hire full-time health coaches employed by the health care system after the current grant funding ends.

Phase 3: evaluation

We are using RE-AIM components as key outcomes. These outcomes are embedded within the PRISM [26] and will guide a comprehensive program evaluation to help determine the program's implementation and potential for successful long-term sustainability and scalability. Brief summaries of each of the RE-AIM evaluation components are provided below.

- Reach. We will report the number and proportions of
 patients reached in each of the six clinics by comparing
 the numbers of patients who had evidence of EIM in
 their EMR (reached) to those who were eligible, defined as patients who had a PCP appointment during
 the study period (estimated 120,000/year). We will also
 examine sociodemographic characteristics of patients
 reached and compare them with patients who were
 not reached in order to identify differential reach and
 evaluate the generalizability of the program.
- Effectiveness. We will collect quantitative and qualitative
 patient-centered outcome data, including changes in
 PAVS scores and measures of related health conditions
 (obesity, hypertension, and diabetes), as well as perceptions of EIM via consumer satisfaction surveys sent to
 a random subset of patients after PCP visits. In the absence of a randomized trial, we will be circumspect in
 attributing changes in PAVS scores to EIM.
- Adoption. We will describe the qualitative characteristics
 of the clinics and collect quantitative data from Epic on
 EIM documentation on both clinic and provider levels
 to characterize the adoption of the program. Surveys will
 also be collected from providers to obtain their feedback
 about the program. This information will help to identify any differences in acceptability and to improve the
 quality and sustainability of this program in the future.
- Implementation. Using data from the EMR, we will analyze the percentage of eligible patient visits during

- which different components of the EIM intervention, including the PAVS, EIM discussion, EIM prescription, health coaching referral, and health coaching visits, were delivered (i.e., program fidelity). Surveys and interviews will be used to collect information about patient and provider reasons for completing or not completing any of these components to identify and better understand the feasibility, acceptability, and potential barriers. This information will help to improve the program's implementation in future iterations.
- Maintenance. We will evaluate maintenance by the extent to which the program has been institutionalized, as evidenced by continued implementation after the PDSA cycle ends in each clinic and the cost of continuing to deliver it. We will examine any changes in measures of reach and implementation (proportions) over time and conduct cost analyses by examining the total costs involved with running the program (nonreimbursable provider time, program setup, and EIM materials).

DISCUSSION

This study examines the adaptation and integration of EIM with referral to health coaches into routine primary care visits and evaluates the program from patient, provider, and health care systems perspectives. We are uniquely positioned to leverage the existing infrastructure within our health system to investigate the practical aspects of implementing the EIM initiative into its primary care clinics and refining it to fit within the variable workflow and cultural norms of each clinic. We are innovatively combining two health services research approaches to accomplish our goals of implementing and continuously adapting and evaluating this initiative to fit within the evolving needs and priorities of the health care system.

EIM is a global initiative and has been integrated into health care systems in at least 39 other countries worldwide [13]. The PAVS was first implemented in an EMR in clinical practice in 2010 [2, 16, 31]. An examination of EMRs found that 86% of all eligible patients (n = 1,793,385) had a PAVS score in their record, which will serve as the benchmark for our own reach outcomes. Although results suggest that the PAVS tool raises awareness about the pervasive problem of insufficient PA in primary care, relying solely on the PCP to address the issue with patients is unlikely to move the PA needle enough to meet guidelines for most patients who require more support [14, 15, 18, 32-35]. The additional EMR modifications we implemented may well assist PCPs in paying attention to patients' PA levels as part of their effort to better control chronic diseases and promote health. Furthermore, our adaptation of offering brief health coaching visits to address barriers and social support for PA and provide connections with local resources to

TBM page 927 of 929

help support patients' motivation to increase PA is an attempt to fill this important gap. Finally, the original EIM workflow relied heavily upon medical assistants to ask patients the PAVS questions aloud and record the information for the provider to view upon arrival to the exam room. This approach may work well within the existing workflow and culture at some institutions, but it is not the cultural norm within our primary care clinics. Therefore, we also adapted the program by developing our own implementation strategy to fit within the existing workflow (patients complete the PAVS via e-checkin, which goes directly into the EMR, or paper questionnaire in the waiting room, from which the MA enters the data in Epic).

Future plans and dissemination efforts

The long-term goal of our research is to develop an implementation toolkit that will enable our health system to sustain EIM and other health systems to adapt and integrate the EIM initiative into their primary care practices.

- We will document all of the specific strategies and activities that have been utilized during the study, focusing on the key stakeholder, patient, and provider input and feedback.
- We will provide information on facilitators and barriers, as well as suggestions for overcoming experienced problems to be considered in future projects.
- 3) We will develop standardized manuals with the information necessary to replicate the modified and enhanced EIM program in other health care systems. They will include the materials and information other health care providers would need to replicate the trial or implement the intervention.

Summary

Identifying individuals with insufficient PA and helping them to increase it is a high public health priority. This study uses IS and QI frameworks to (a) systematically collect contextual information and (b) adapt, implement, and (c) evaluate an existing PA screening and promotion program in primary care. The combination of IS and QI methodology and models has great potential to inform the meaningful, real-world implementation of evidence-based approaches. Our study is one of the few using this combined approach and is the first that we are aware of to use this approach to systematically implement and evaluate the EIM initiative. The study has mechanisms in place to adjust according to changing and competing demands, and it leverages EMR automation, a growing focus on universal screening and health promotion in primary care and an existing foundation of IBH to provide patients with brief health coaching. We will report the outcomes from this currently in-progress study in the future.

SUPPLEMENTARY MATERIAL

Supplementary material is available at *Translational Behavioral Medicine* online.

Acknowledgments:

Funding: This study was funded by a career development award (KO8HSO26517; SEL, PI) from the Agency for Healthcare Research & Quality (AHRQ). The pilot study was funded by two internal grants: a University of California, San Diego Department of FMPH Pilot Award and an Academic Senate Award.

Compliance with Ethical Standards

Conflicts of Interest: All authors declare that they have no conflicts of interest.

Authors' Contributions: SEL led the study design and wrote all sections of the paper; GK co-designed the workflow, assisted with implementation, and edited the paper; RK provided study design oversight and edited the paper; MT provided study design oversight and edited the paper; KD assisted the study and edited the paper; BR conceived of the combined implementation science/quality improvement design and edited the paper.

Ethical Approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional review board where the study was conducted and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors.

Informed Consent: For this implementation and quality improvement study formal consent is not required.

References

- Piercy KL, Troiano RP, Ballard RM. The physical activity guidelines for Americans. JAMA. 2018;320(19):2020–2028.
- Coleman KJ, Ngor E, Reynolds K, et al. Initial validation of an exercise "vital sign" in electronic medical records. Med Sci Sports Exerc. 2012;44(11):2071–2076.
- Yach D, Hawkes C, Gould CL, Hofman KJ. The global burden of chronic diseases: Overcoming impediments to prevention and control. *JAMA*. 2004;291(21):2616–2622.
- Oldridge NB. Economic burden of physical inactivity: Healthcare costs associated with cardiovascular disease. Eur j Cardiovasc Prev Rehabil. 2008;15(2):130–139.
- Carlson SA, Fulton JE, Pratt M, Yang Z, Adams EK. Inadequate physical activity and health care expenditures in the United States. *Prog Cardiovasc Dis.* 2015;57(4):315–323.
- Heath GW, Parra DC, Sarmiento OL, et al. Evidence-based intervention in physical activity: Lessons from around the world. *Lancet*. 2012;380(9838):272–281.
- Estabrooks PA, Lee RE, Gyurcsik NC. Resources for physical activity participation: Does availability and accessibility differ by neighborhood socioeconomic status? *Ann Behav Med*. 2003;25(2):100–104.
- Garrett S, Elley CR, Rose SB, O'Dea D, Lawton BA, Dowell AC. Are physical activity interventions in primary care and the community cost-effective? A systematic review of the evidence. Br j Gen Pract. 2011;61(584):e125–e133.
- Orrow G, Kinmonth AL, Sanderson S, Sutton S. Effectiveness of physical activity promotion based in primary care: Systematic review and metaanalysis of randomised controlled trials. BMJ. 2012;344:e1389.
- Barnes PM, Schoenborn CA. Trends in adults receiving a recommendation for exercise or other physical activity from a physician or other health professional. NCHS Data Brief, no 86. Hyattsville, MD: National Center for Health Statistics; 2012.
- AuYoung M, Linke SE, Pagoto S, et al. Integrating physical activity in primary care practice. Am J Med. 2016;129(10):1022–1029.

page 928 of 929

- Balasubramanian BA, Cohen DJ, Clark EC, et al. Practice-level approaches for behavioral counseling and patient health behaviors. Am J Prev Med. 2008:35(5 suppl):S407–S413.
- Lobelo F, Stoutenberg M, Hutber A. The exercise is medicine global health initiative: A 2014 update. Br i Sports Med. 2014;48(22):1627–1633.
- Sallis R. Exercise is medicine: A call to action for physicians to assess and prescribe exercise. *Phys Sportsmed*. 2015;43(1):22–26.
- 15. Sallis, R. Developing healthcare systems to support exercise: Exercise as the fifth vital sign. *Br J Sports Med.* 2011;45(6):473–474.
- Grant RW, Schmittdiel JA, Neugebauer RS, Uratsu CS, Sternfeld B. Exercise as a vital sign: A quasi-experimental analysis of a health system intervention to collect patient-reported exercise levels. *J GEN INTERN MED*. 2014;29(2):341–348.
- Greenwood JL, Joy EA, Stanford JB. The physical activity vital sign: A primary care tool to guide counseling for obesity. J PHYS ACT HEALTH. 2010;7(5):571–576.
- Sallis RE, Matuszak JM, Baggish AL. Call to action on making physical activity assessment and prescription a medical standard of care. Curr Sports Med Rep. 2016;15(3):207–214
- 19. Eccles MP, Mittman BS. Welcome to implementation science. *Implement Sci.* 2006;1(1):1.
- Tabak RG, Khoong EC, Chambers DA, Brownson RC. Bridging research and practice: Models for dissemination and implementation research. Am j Prev Med. 2012;43(3):337–350.
- Berwick DM, Godfrey BA, Roessner, J. Curing health care: New strategies for quality improvement. J Healthc Qual. 1991;13(5):65–66. https:// journals.lww.com/jhqonline/Fulltext/1991/09000/Curing_Health_ Care_New_Strategies_for_Quality.18.aspx.
- Taylor MJ, McNicholas C, Nicolay C, Darzi A, Bell D, Reed JE. Systematic review of the application of the plan-do-study-act method to improve quality in healthcare. *BMJ QUAL SAF*. 2014;23(4):290–298.
- Leonard C, Lawrence E, McCreight M. Implementation and dissemination of a transition of care program for rural veterans: A controlled before and after study. Implement Sci. 2017;12(1):123.
- Ovretveit J, Mittman B, Rubenstein L, Ganz DA. Using implementation tools to design and conduct quality improvement projects for

- faster and more effective improvement. Int j Health Care Qual Assur. 2017;30(8):755-768.
- Rabin BA, McCreight M, Battaglia C, et al. Systematic, multimethod assessment of adaptations across four diverse health systems interventions. Front Public Health. 2018;6:102.
- Feldstein AC, Glasgow RE. A Practical, Robust Implementation and Sustainability Model (PRISM) for integrating research findings into practice. Jt Comm J Qual Patient Saf. 2008;34(4):228–243.
- Stirman SW, Miller CJ, Toder K, Calloway A. Development of a framework and coding system for modifications and adaptations of evidence-based interventions. *Implement Sci.* 2013:8:65.
- Balasubramanian BA, Cohen DJ, Davis MM, et al. Learning evaluation: Blending quality improvement and implementation research methods to study healthcare innovations. *Implement Sci.* 2015;10:31.
- Hall TL, Holtrop JS, Dickinson LM, Glasgow RE. Understanding adaptations to patient-centered medical home activities: the PCMH adaptations model. *Transl Behav Med*. 2017;7(4):861–872.
- Heslin PA. Better than brainstorming? Potential contextual boundary conditions to brainwriting for idea generation in organizations. J Occup Organ Psychol. 2009;82(1):129–145.
- Young DR, Coleman KJ, Ngor E, Reynolds K, Sidell M, Sallis RE. Associations between physical activity and cardiometabolic risk factors assessed in a Southern California health care system, 2010-2012. Prev Chronic Dis. 2014;11:E219.
- Joy EL, Blair SN, McBride P, Sallis R. Physical activity counselling in sports medicine: A call to action. Br j Sports Med. 2013;47(1):49–53.
- Sallis RE. Exercise in the treatment of chronic disease: An underfilled prescription. Curr Sports Med Rep. 2017;16(4):225–226.
- Sallis RE, Baggish AL, Franklin BA, Whitehead JR. The call for a physical activity vital sign in clinical practice. *Am j Med.* 2016;129(9):903–905.
- Sallis R, Franklin B, Joy L, Ross R, Sabgir D, Stone J. Strategies for promoting physical activity in clinical practice. *Prog Cardiovasc Dis*. 2015;57(4):375–386
- Ragsdale MA, Mueller J. Plan, do, study, act model to improve an orientation program. J NURS CARE QUAL. 2005;20(3):268–272.