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ORIGINAL ARTICLE

"I do not have time. Is there a handout I can use?": combining physicians' needs and behavior change theory to put physical activity evidence into practice

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Abstract
Summary Guidelines for physical activity exist and following them would improve health. Physicians can advise patients on physical activity. We found barriers related to physicians' knowledge, a lack of tools and of physician incentives, and competing demands for limited time with a patient. We discuss interventions that could reduce these barriers.
Introduction Uptake of physical activity (PA) guidelines would improve health and reduce mortality in older adults. However, physicians face barriers in guideline implementation, particularly when faced with needing to tailor recommendations in the presence of chronic disease. We performed a behavioral analysis of physician barriers to PA guideline implementation and to identify interventions. The Too Fit To Fracture physical activity recommendations were used as an example of disease-specific PA guidelines.
Methods Focus groups and semi-structured interviews were conducted with physicians and nurse practitioners in Ontario, stratified by type of physician, geographic area, and urban/rural, and transcribed verbatim. Two researchers coded data and identified emerging themes. Using the behavior change wheel framework, themes were categorized into capability, opportunity and motivation, and interventions were identified.
Results Fifty-nine family physicians, specialists, and nurse practitioners participated. Barriers were as follows: Capability–lack of exercise knowledge or where to refer; Opportunity–pragmatic tools, fit within existing workflow, available programs that meet patients' needs, physical activity literacy and cultural practices; Motivation–lack of incentives, not in their scope of practice or professional identity, competing priorities, outcome expectancies. Interventions selected: education, environmental restructuring, enablement, persuasion. Policy categories: communications/marketing, service provision, guidelines.
Conclusions Key barriers to PA guideline implementation among physicians include knowledge on where to refer or what to say, access to pragmatic programs or resources, and things that influence motivation, such as competing priorities or lack of incentives. Future work will report on the development and evaluation of knowledge translation interventions informed by the barriers.

Keywords Guidelines · Healthcare provider · Implementation science · Knowledge translation · Osteoporosis · Physical activity

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Introduction

Uptake of physical activity guidelines would improve health and reduce mortality in older adults. Although research and

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guidelines reinforce the need for strength and balance training, regular participation in both these activities among older adults is as low as 5%, and inactivity remains highly prevalent [1, 2]. Barriers to physical activity in older adults have been identified, such as how to adapt exercise in the presence of chronic disease [3–5]. Accordingly, disease-specific physical activity guidelines have emerged. An example is the Too Fit to Fracture exercise and physical activity recommendations to promote consistent, evidence-based messages pertaining to exercise and physical activity for individuals with osteoporosis [6, 7]; these recommendations highlight the importance of muscle strengthening, balance training, attention to posture and spine sparing, and aerobic physical activity (Table 1). Although guidelines are one mechanism to raise awareness of research evidence, they may not reach all knowledge users, or address barriers to knowledge use.

When it comes to implementation of physical activity guidelines, primary care providers and specialists not only need to be aware of guidelines, but also how to interpret and tailor them for patients, and address questions about physical activity, either directly or via referral. Previous studies have reported physician's perceived barriers to implementing physical activity or clinical guidelines in both healthy and those with chronic co-morbidities as lack of familiarity with recommendations, inadequate knowledge of physical activity counseling and prescription, lack of time during consultations and disagreement with recommendations [8–13]. However, previous work has been limited to a description of barriers, without further advancement of theory-based intervention design. Further, having multiple disease-specific physical activity guidelines may be overwhelming, and prior work does not help us understand or address physicians' barriers to integrating them in individual patients. For example, population based guidelines emphasize aerobic physical activity and muscle strengthening, but individual patients may need tailoring to conditions such as knee osteoarthritis (e.g., knee extensor strengthening), osteoporosis (e.g., posture exercises, spine sparing, weight bearing) or fall prevention (e.g., balance exercises). Finally, previous reports are often focused on primary care physicians, not specialists or nurse practitioners (NPs).

Knowledge translation (KT) is the process of "…raising knowledge users' awareness of research findings and facilitating the use of those findings." [14] In accordance with the Knowledge-to-Action cycle, to foster uptake of research, one needs to adapt the knowledge to the context in which it is to be applied, understand the barriers and facilitators to behavior change, and use that information to select and tailor interventions. The behavior change wheel (BCW) approach can be used to understand behaviors, and the context in which they occur, prioritize target behaviors and develop interventions [15]. The BCW theoretical model that posits that capability, opportunity and motivation govern behavior (COM-B). COM-B can be used to inform a "behavioral analysis" of what needs to change, and guide the selection of intervention functions and policy categories. The aims of the current study were to identify physicians' and NPs' perceptions of the barriers to and facilitators of implementation of exercise and physical activity recommendations using Too Fit To Fracture as the example; and to perform a behavioral analysis and identify intervention options using the COM-B model. Our broader goal was to understand physicians' and NPs' behaviors when it comes to advising on physical activity, and how to translate exercise and physical activity evidence to practice in general, using the Too Fit To Fracture recommendations as a "test" case.

Methods

Study setting and framework

The current study is one part of a KT initiative conducted in Ontario, Canada, in partnership with Osteoporosis Canada, and represents the Knowledge-to-Action Cycle step, "assess barriers to knowledge use", as well as the initial phases of the "selection, tailoring, and implementation of interventions" step. We used the behavior change wheel (BCW) [15], a non-linear framework linking essential behavioral conditions necessary for behavior change (capability, opportunity and motivation) to interventions aimed at addressing deficits in the behavioral conditions, and policies appropriate for facilitating the interventions to occur.

BCW step 1: define the problem in behavioral terms

We assembled a team that included a primary care physician, specialists in geriatrics and internal medicine, physical therapists, kinesiologists and a representative from Osteoporosis Canada. The desired behavior was defined by the team as those outlined in the Too Fit To Fracture recommendations [6, 7]—that individuals with osteoporosis participate in a multicomponent exercise program and adopt spine sparing strategies—with frequency, intensity and duration consistent with the recommendations (Table 1). The multicomponent exercise program should include aerobic physical activity and exercises to improve muscle strength, balance and posture, each with defined frequencies, intensities and durations.

BCW steps 2 and 3: selecting and specifying the target behavior

The desired behavior can be shaped by a system of behaviors, such as health care provider or exercise professional behavior (e.g., counseling, referrals, Fig. 1). Herein, we present an analysis of physicians' and NPs' behaviors; analyses of other target groups will be presented elsewhere. The team discussed

Table 1 Summary of exercise and physical activity recommendations for individuals with osteoporosis [6]

Type	How often per week?	Osteoporosis	Osteoporosis and history of vertebral fracture	Examples and comments
Resistance exercise	≥2 days a week	8–12 repetitions per exercise. Intensity at 8–12 repetitions maximum[a]	8–12 repetitions per exercise. Aim for 8–12 repetitions maximum[a]. Prioritize form and alignment over intensity.	≥Exercise each for legs; arms; chest; shoulders; back. Use exercise bands, weights, or body weight against gravity. 1–3 sets/exercise. Train at low-moderate intensity initially if sedentary, conditions affecting activity, high fracture risk, strength training novice
Balance exercise	Daily	Progress from standing exercises to dynamic. Should be individualized to be a sufficient challenge to balance		Static examples are semi-tandem stance, one-leg stand, shift weight between heels and toes while standing. Dynamic examples are tai chi, tandem walk, dancing, walking lunges
Aerobic physical activity	≥5 days per week, ≥150 min/-week	Moderate to vigorous intensity	Moderate intensity	Do bouts of 10 min or more –accumulate 150 min/week. On a 0–10 scale where 0 = rest, and 10 = maximum effort, aim for intensity of 5–8. Moderate: You are breathing heavier than usual. You can have a conversation while doing it, but you could not sing. Vigorous: You are breathing much heavier than usual. You would not be able to converse or sing without stopping to take a breath.
Exercises for back extensor muscles	Daily	Emphasis on endurance for back extensors. Perform "holds" 3–5 s.		Example: Lie face up on firm surface, knees bent, feet flat. Use pillow only if head does not reach floor. Lift arm and extend to behind crown of head, as if reaching for a candy that is out of reach on the floor, hold. Repeat 3–5 times.
Spine sparing and fall prevention	Apply to daily activities, leisure activities, exercise	May be able to continue most activities with attention to activity considerations.	The risks of exercise machines, many classes and some ADLs may outweigh benefits. In addition to activity considerations, consult with physical/occupational therapist on safe performance of daily activities, leisure activities, exercise.	Activity considerations: • Modify activities that flex (bending forward) or twist the spine; most risky when rapid, repetitive, weighted, bending all the way forward, or twisting to the side. • Avoid lifting to or lowering from the floor. • Avoid high fall risk or contact sports. • Use hip hinge instead of spinal flexion to bend, and step-to-turn instead of twisting.

[a] Repetitions maximum (RM) refers to the maximum level of resistance or difficulty for a given exercise that can be performed for the stated number of repetitions e.g., 1RM squat is the maximum amount of weight you can lift with good form in a squat one time, 8RM bicep curl is the maximum amount of weight you can lift in a bicep curl eight times

candidate behaviors performed by physicians (primary care or specialists) or NPs, including communicating the recommendations to patients, referring patients to exercise professionals (e.g., physical therapist, kinesiologist), referring patients to exercise classes; demonstrating exercises; demonstrating spine sparing strategies; providing patients with printed resources or information; referring patients to other sources of self-management information; and developing plans to implement recommendations. The following criteria were used to prioritize criteria: the likelihood that the behavior could be changed, the impact of the change in behavior, the potential that the change in behavior would spill over to other behaviors, and the potential to measure the change. The research team considered the contexts in which the behavior(s) could occur, what behaviors needed to be performed and by whom, when, and where they needed to do it, and with whom (e.g., which patients, or with which supporting health care professionals or services).

BCW step 4: identify what needs to change using the COM-B model

To finalize the selection (BCW step 2) and specification (BCW step 3) of behaviors, and inform what needs to change (BCW step 4), we conducted concurrent descriptive, qualitative studies with the target groups. Physicians (primary care

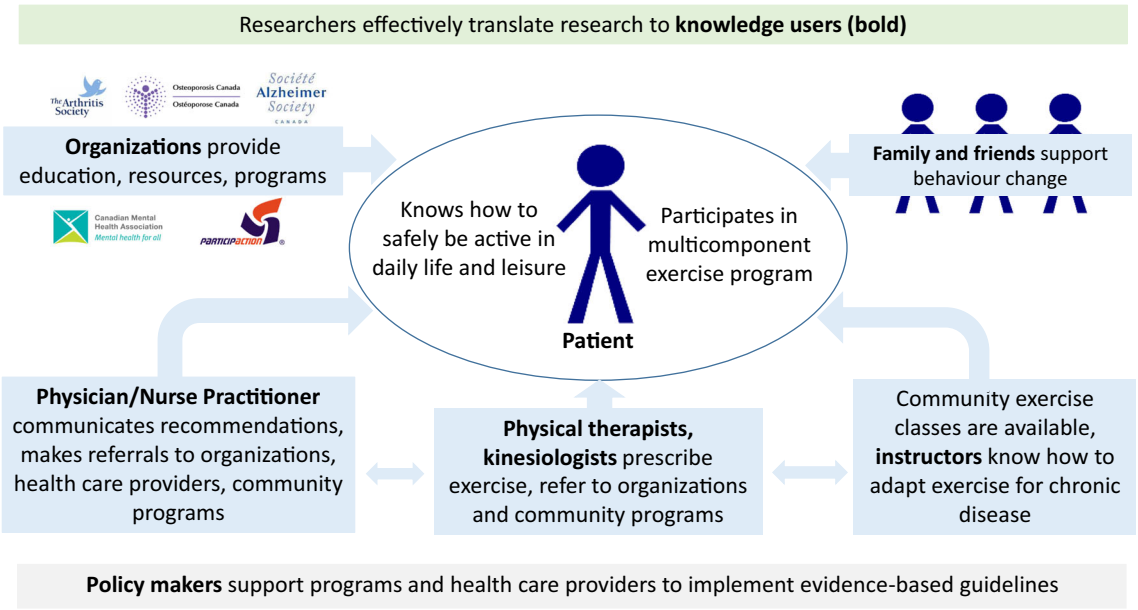

Fig. 1 Patient physical activity behaviors occur in a system of behaviors. Potential target knowledge users are indicated in *bold text*, with the associated behaviors that are proposed to influence patient behaviors

and specialists) and NPs were recruited to participate in one-on-one interviews or focus groups to understand their behaviors and the influences on their behaviors when it comes to implementation of evidence-based physical activity guidelines like Too Fit To Fracture [6, 7].

Stratified purposeful and snowball sampling were used to represent the diversity of geography and population density, including urban and rural locations from at least seven of the 14 Local Health Integration Networks (LHINs) in the province of Ontario. A rural location was defined as a population centre with less than 100,000 inhabitants while an urban centre has at least 100,000 inhabitants [16]. The specialist groups targeted were those thought to engage in osteoporosis management e.g., rheumatologists, internal medicine physicians, geriatricians, and endocrinologists. Recruitment strategies included contacting primary care groups and specialists by telephone and making connection with physicians or NPs via key informants and snowball sampling. All procedures performed in studies involving human participants were in accordance with the ethical standards of the Office of Research Ethics at the University of Waterloo and the McMaster University Research Ethics Board.

The physicians/NPs were mailed a one-page summary of the Too Fit To Fracture recommendations in advance. Discussions began with a summary of the recommendations. Interviews and focus groups were conducted by one of two moderators (LG or CM) using a semi-structured interview guide, with questions about their thoughts on the recommendations and their acceptability/usability, current practices, prior knowledge of the recommendations, barriers to using them in practice, what would be needed to implement them, characteristics of patients that would not be receptive or for whom it would be difficult to implement them and what might be needed for them, and their perceptions regarding supports (e.g., other health care professionals or community services). We asked about the acceptability and current practices/capabilities related to behaviors in the conceptual map (Fig. 1, e.g., referring to services, providing materials). The interview guide was revised as new categories or themes emerged. Discussions were audio recorded and transcribed verbatim.

Theory-guided thematic analyses were performed by two members of the study team (RC and LG). A third party resolved disagreements if they occurred. Data was first coded for major categories of information during open coding, where a category was defined as "concepts that pertain to the same phenomenon" [17]. Relationships and similarities among categories were discussed leading to the formation of themes. Thematic analyses were guided by the central behavior change model of the BCW, which posits that capability (e.g., physical, perceived), opportunity, and motivation govern behavior (COM-B model) [15]. Each component is further divided into two types: capability can refer to the *physical* capability (e.g., physical skills, stamina) or *psychological* capability (e.g., knowledge, cognitive skills); opportunity can refer to the *physical* opportunity (e.g., resources, physical barriers, time) or *social* opportunity (e.g., norms, social cues); and motivation can refer to the *reflective* motivation (e.g.,

goals, intentions, planning, beliefs) or *automatic* motivation (e.g., emotional or impulsive responses, habits, wants, and needs). To complete a behavioral analysis, the emergent themes related to behaviors and their barriers and facilitators were mapped onto the COM-B components.

BCW steps 5 and 6: identify intervention options—intervention functions and policy categories

The BCW provides tables for using the identified COM-B components to identify which strategies, among nine potential intervention functions and seven policy categories, would be expected to be effective, based on synthesis of 19 previously published behavior change frameworks [15, 18]. Candidate intervention functions and policy categories, and whether they meet the APEASE criteria (affordability, practicability, effectiveness/cost-effectiveness, acceptability, side-effects/safety, equity), are described.

Results

Fifty-nine physicians and NPs participated in the study; specialists included internal medicine physicians, endocrinologists, rheumatologists, geriatricians, and orthopedic surgeons (Table 2).

Table 2 Participant characteristics (n = 59)

Characteristics	Mean (SD)/n (%)
Age, mean (SD)	49.8 (11.2)[a]
Male/Female	25 (42.4)/32 (54.2)[a]
Family physicians, n (%)	27 (45.8)
Specialist, n (%)	22 (37.3)
Other, n (%)	4 (6.8)
Nurse practitioners, n (%)	6 (10.2)
Urban/Rural	56 (94.9)/3 (5.1)
Prior awareness of recommendations, n (%)	14 (23.7)[a]

[a] Some respondents did not or chose not to indicate age (n = 11), gender (n = 2) or whether they had prior knowledge of recommendations (n = 2)

BCW steps 2 and 3—select and specify the target behavior

Thematic analyses of physician/NP consultations and team meetings reinforced the need to choose a behavior that fits within existing workflow and does not require exercise-related expertise. Among the potential modifiable behaviors of physicians/NPs, the following were selected as targets:

- Physicians/NPs should communicate or reinforce (referring to print or web materials) the Too Fit To Fracture recommendations to patients who have osteoporosis presenting in primary care or specialist clinics;
- Physicians/NPs should refer patients with osteoporosis to exercise classes or exercise professionals, or to print or web materials.

BCW step 4—identifying what needs to change using the COM-B model

Emergent themes fell under the Psychological Capability, Physical Opportunity, Social Opportunity and Reflective Motivation categories of the COM-B model, with some concepts also falling under automatic motivation; themes where mapped to intervention functions (Table 3) and policy categories (Table 4).

Psychological capability—theme: I do not know what to do or where to refer

Physicians/NPs expressed a vague understanding of how to counsel on physical activity or exercise in general or specific to osteoporosis. One respondent explained, "None of us really have any training in how to advise patients about exercise. We tell them to go walking". That respondents often give generic advice to walk is in contrast with evidence-based physical activity guidelines, which emphasize multicomponent exercise programs including strength and balance training, and specific intensities, frequencies and durations. "I don't know what I am doing. Like what am I telling them to do? Buy an exercise band and do what with it? … Although I know what the recommendations are, I wouldn't know what to do." Another respondent stated, "… I would say don't bend over…don't have loads over your head trying to carry something….in the context of acute, if there's anything I could tell them that would alleviate their pain or speed their recovery, I don't know anything like that." Other areas of low knowledge or self-efficacy were exercise prescription, what to recommend in the presence of acute vertebral fracture, spine sparing strategies, back extensor exercises, activities with weights, and how to facilitate sustainable behavior change. Many voiced apprehensions at having to integrate divergent physical activity recommendations for patients with multiple comorbidities, and that they experience "guideline overload"; it is difficult to keep current. For example, there was concern about what to do if someone had knee arthritis and osteoporosis; the weight-bearing exercises and balance training recommended for osteoporosis may not be tolerated by individuals with arthritis or with joint instability, or tailoring is needed. Although they reported that other professionals

Table 3 Mapping themes to intervention functions using the BCW framework

COM-B component	Is there a need for a change?	Intervention functions	Does the intervention function meet the APEASE criteria?[a]
Physical capability	No: physicians/NP have physical skills	No change needed	
Psychological capability	Yes: physicians/NP do not know what to advise or where to refer	Education	Could educate on key messages to give patients
		Training	May not be practicable, unless part of continuing education
		Enablement	Could create referral processes
Physical opportunity	Yes: physicians/NP need pragmatic tools, resources, programs that meet patient needs	Training	May not be practicable, unless part of continuing education or as part of changes to medical school curriculum
		Restriction	Not acceptable
		Environmental restructuring	Could create environmental cues and referral processes
		Enablement	Could increase trained exercise professionals or resources
Social opportunity	Yes: consider physical activity literacy, norms, language	Restriction	Not acceptable
		Environmental restructuring	Consider language, literacy, norms in cues/referral processes
		Modeling	Not practicable or affordable unless peer champions can model, influence norms
		Enablement	Consider language, literacy, norms in patient tools
Automatic motivation	Maybe: physicians/NP lack incentives (reinforcement[b])	Training	May not be practicable, unless part of continuing education
		Incentivization	Not affordable
		Coercion	Not acceptable or practicable
		Environmental restructuring	Could create cues, referral processes or resources to reinforce behavior
Reflective motivation	Yes:physicians/NP do not believe physical activity counseling is part of professional identity, motivation is influenced by competing priorities and outcome expectancies	Education	Could educate on key messages and evidence for efficacy
		Persuasion	Persuasive communication on actions they can take within scope of practice, tools available, create positive outcome expectancies
		Incentivisation	Not affordable
		Coercion	Not acceptable or practicable
Interventions selected: education, environmental restructuring, enablement, persuasion			

[a] *APEASE* = affordability, practicability, effectiveness/cost-effectiveness, acceptability, side-effects/safety, equity

[b] Reinforcement is a domain in the Transtheoretical Domains Framework that maps on to automatic motivation in the COM-B framework. Only those intervention functions relevant to the reinforcement domain are listed in the table

should implement physical activity guidelines, respondents had minimal knowledge of where to refer patients. One respondent stated "...we do have a falls program in our hospital where I do send patients, but there is nothing in the community that is providing something useful that I am aware of." Of note, the province of Ontario had recently funded free exercise classes for seniors, but when asked, few were aware of them. A participant said, "…it is hard to know about what resources are out there, what options are there." Other reported facilitators included prompts (e.g., from patients, electronic medical records), education in medical school, videos on exercise, and one-page handouts.

Physical opportunity—theme: Access to pragmatic interventions

Respondents reported that financial restrictions or transportation presented barriers for seniors that in turn presented a barrier to implementation. Many expressed the idea that, "There [are] some expensive stuff… a lot of people can't afford that. It should be a lower cost. Transportation is another big one…it's not easy for people to get to these places." Physicians/NPs in rural locations often work in isolation with limited personnel and financial resources within their clinic, and patients may have to travel further to access the limited community resources available. One rural respondent

Table 4 Using the BCW framework to identify policy categories to deliver interventions

Potential policy categories	Selected intervention functions that could be delivered by category	Does the policy category meet APEASE criteria?
Communications /marketing	Education, persuasion	Yes
Guidelines	Education, persuasion, Environmental restructuring, enablement	Guidelines exist, so creating new ones unlikely to add value, but could create summary tools or continuing education or restructure environment to facilitate guideline implementation
Fiscal measures	Environmental restructuring, enablement	Not practicable or acceptable
Regulation	Education, persuasion, environmental restructuring, enablement	Not practicable, affordable to enforce, or acceptable
Legislation	Education, persuasion, environmental restructuring, enablement	Not practicable or acceptable
Service provision	Education, persuasion, enablement	Yes
Environmental/social planning	Environmental restructuring, enablement	Not practicable or equitable because of variation in social/physical environment

Policy categories selected: communications/marketing, service provision, and guidelines

Policy categories selected from among potential policy categories is shown in bold

experienced, "difficulties in regards with structured programs and group exercise is that the people who are rural and remote, they fall through the cracks…because nothing is available…". Poor connections to, and time required to identify, confirm quality of, and refer patients to community services are barriers, "I am busy and [the community service] is busy and there is not the direct communication that would be ideal and it's often back and forth through paper." Time during consultation was a barrier, and pragmatic interventions, and referral pathways were identified as facilitators. One respondent explained, "You work within existing resources and workflow…." Physicians/NPs also wanted tools that are comprehensive enough to equip the patient with an understanding of what to do (e.g., examples of balance exercises). Educating and empowering patients to prompt them to discuss physical activity was a suggested facilitator, as was getting the word out on exercise programs and resources (e.g., emails from College of Family Physicians).

Social opportunity—theme: Physical activity norms and language

Physicians/NPs perceived that patients of some cultural backgrounds were less receptive to engaging in physical activity or exercise as it is not part of cultural norms, and lack of English fluency was a barrier; interventions should be tailored for different cultures. Respondents noted that many patients had limited physical activity literacy, for example "They do a lot of housework, work around the house, and they never sit down. But that's not what I mean. I asked someone to show me how they stretch and they showed me, and I was just dismayed at what it was that they thought stretching was…that any movement at all constitutes exercise."

Gender was perceived to influence receptiveness, "...women are more likely to engage in exercise than men". Men are seen as unwilling to engage in traditionally female-dominated activities, "I find that men are not willing to go to group classes, although some are. They're usually a little more willing to go to the gym and try things there so I think maybe different things work better for men than women." That the recommendations were evidenced-based, connected to Osteoporosis Canada, and provided details on what exercises, how to tailor and spine sparing were perceived as facilitators. A participant expressed, "[The guidelines are] evidence based recommendations so I'm very comfortable with their validity".

Reflective motivation—theme: It's not my scope of practice. There are competing priorities.

Some physicians/NPs did not feel that counseling patients on physical activity was part of their scope of practice. One respondent stated, "My job is to introduce concepts…but allied health actually deliver it". On the contrary, some specialists felt that family physicians should advise on physical activity. One respondent expressed the need for, "someone to sit down and go through [the recommendations] with [the patient] to either show them, have a group, or refer them to group". Respondents said that if they were unfamiliar with an exercise class or an exercise professional's training, they were less inclined to refer due to concerns for the patient's safety, particularly for patients at high risk of fractures or adverse events—demonstrating not only reflective motivation, but also *physical opportunity* i.e., need for good match between patients and programming, and *automatic motivation* i.e., the need to build trust and reduce fear. If physicians/NPs do refer, "Usually [physicians] will have one or two physios that they feel comfortable sending their patients to because… Patients seem to like them, patients seem to go to them and follow up and maybe they even improved their

symptoms." Unsupervised exercise was also a concern: "Typically, my population is frail enough that doing [physical activity] alone, especially initially, is not advisable or recommended." Respondents' motivation was also influenced by goals of care, and the need to prioritize them in patients with multiple comorbidities: "Most of my patients have three, four, or five underlying chronic diseases… Besides treating the pain and all the other stuff we have to get organized for these folks going out of hospital. It becomes an issue of competing priorities." One respondent explained, "They are so shell shocked by the time they leave me hearing that they have Alzheimer's disease that their osteoporosis exercise takes second shift to that".

Physicians'/NPs' motivations to counsel on physical activity may depend on the expected outcome, which in turn was influenced by patient characteristics. Age was reported as a barrier; older patients were perceived as unmotivated, "It's not their agenda this stage in their life", while it was perceived that for younger patients, seniors' exercise classes were not appealing. Physicians/NPs' motivations were influenced by their perceptions of patients' motivation, or lack of it—"It is easier to just get them to pop a pill than it is to commit to long term exercise". Physicians/NPs perceive families and caregivers as both barriers and facilitators. One physician expressed, "Spouses, family members are also there. They can be helpful but they can also be a barrier…those who would say okay let's go out and exercise … those who will say you know what, you're in so much pain, let's not do anything". If a patient was a caregiver themselves, the physician/nurse practitioner did not want to burden them. A suggested facilitator was to create incentives to counsel patients on physical activity, such as being allowed to bill for time spent. Another incentive would be knowing their actions were making a difference, creating positive outcome expectancies. One respondent said, "After years of working in this area and studying the behavior change people do not do something just because you tell them to".

Discussion

We went beyond generating a list of barriers to implementation of physical activity evidence among physicians/NPs, and identified themes linked to theory-guided behavior change strategies. We identified that the following things need to change: knowledge on what to advise patients when it comes to physical activity and where to refer, opportunity to access interventions that are pragmatic and fit within existing resources and workflow, consideration of physical literacy or norms among patients, improving motivation among physicians/NP to make promotion of physical activity guidelines part of their professional identity and goals of care, and fostering positive outcome expectancies. That said, it was clear that some behaviors, such as teaching patients exercises, or going beyond brief advice on key messages, are not realistic, and arguably, better suited to exercise professionals. What emerged is the initial selection of education, environmental restructuring, persuasion and enablement as intervention functions, and communications/marketing, service provision, and guidelines as policy categories that can be used to deliver them (Tables 3–4). Our next step is to integrate consultations with physicians, patients, and exercise professionals to develop specific content and implementation of behavior change interventions; the Too Fit to Fracture recommendations and the associated summary sheet [19] (Fig. 2) serve as examples of potential interventions. Our work can be applied beyond osteoporosis care; our conceptual map of behaviors that influence uptake of physical activity recommendations in older adults (Fig. 1), and our learnings about barriers and potential interventions could be evaluated, applied or evolved for implementation of other disease-specific or generic physical activity guidelines.

That physicians/NP lack capability or knowledge regarding physical activity counseling is not news [11–13, 20], but our study went beyond that to identify specific knowledge gaps, including those specific to osteoporosis. For example, they lack knowledge on basic exercise concepts, as well as how to advise someone with osteoporosis on how to move safely in daily life, manage pain or adapt exercise for osteoporosis, such that they often default to generic restrictions or exercise recommendations (e.g., walking, weight-bearing exercise). Low exercise or physical activity expertise, in combination with poor awareness of community resources or exercise professionals, indicates a gap in medical/nursing education or continuing education opportunities, and in the coordination of health care services. The effectiveness of referral pathways may depend on the awareness of pathways, existence of professional relationships, and an understanding of the importance of referring to allow the patient to get optimal care [21–23]. Our work suggests pairing communication/marketing strategies with guidelines and service provision, which intuitively makes sense; if we want physicians/NP to tell patients what the guidelines are and refer, the programs and resources need to exist, be accessible via seamless referral processes, and address the barriers that physicians identified, i.e., low cost, led by exercise professionals with expertise to deal with multiple medical conditions, and have enough variety to address preferences, needs or social norms among people with varying ages, genders and abilities.

Respondents stating that many patients, or certain patients (e.g., elderly, frail, multiple chronic conditions) are not motivated to exercise was common, implying that physician/NP physical activity counseling behavior is contingent on their outcome expectancies. In other words, physicians/NPs are motivated to advise on physical activity if they perceive that patients are likely to change behavior. Embedding physical activity recommendations as part of evidence-based guidelines behooves the physician/NP to share them with all

Fig. 2 An example of a patient summary sheet

patients, irrespective of perceived motivation; however, guidelines alone may not change behavior without other interventions, such as reminders or feedback [24]. Concurrent interventions directed at patients may be needed. Patient-directed interventions improve knowledge, health service use, and physical activity [25, 26]. Indeed, physicians/NPs encouraged education of patients to empower them to prompt physicians/NPs to act, and facilitate referrals, which may be considered a form of environmental restructuring. Patient and physician education and enablement may be fostered through service provision by communities, or advocacy organizations, such as Osteoporosis Canada or comparable organizations internationally. However, our work suggests that educational materials need to address gender-, age- and culture-specific norms or preferences, and consider language barriers in multiethnic communities, as well as physical literacy [27]. In addition, reaching all patients with education may be challenging, whereas a systemic process for prompting communication of physical activity recommendations may be more efficient. A system alerting general practitioners of osteoporosis risk, either alone or in combination with patient education and prompts to see their physician, has been shown to improve behavior consistent with guidelines related to diagnostic testing and prescribing [24].

Although messages from physicians/NPs can be a catalyst for health behavior change [28–32], our consultations revealed that physical activity counseling is not always compatible with their professional identity and goals of care. It has been suggested that physicians/NPs do not need to be primarily responsible for physical activity counseling, that they should be defined as physical activity promoters who use their limited time to communicate evidence-based physical activity guidelines and then refer to community based supports [33, 34]. What emerged from our consultations was that it was not realistic to expect physicians/NPs to go beyond stating a few key messages, and providing a handout or referral, and that they would need tools in their environment or patients to prompt them. The implementation of reminders, a form of environmental restructuring, may be effective, especially if built into electronic medical records and requiring responses to continue [24]. A physical activity EMR tool employed by Kaiser Permanente, a US healthcare consortium, led to systemic physician behavior change i.e., increase in exercise counseling and progress (1.5 million visits, 696,267 adults, 1196 physicians), and obese and diabetic patients exposed to the tool had greater weight loss and relative HbA1c decline, respectively, compared to those not exposed [35]. Physicians/NPs frequently suggested a need for a clear, concise one-page summary of the recommendations to educate patients, which would enable consistent, evidence-based messages (i.e., also educates physician/NP on what to say) and link the patient to additional resources. Educational materials in addition to other

interventions have had modest effects on behavior change [36]. Audit and feedback may be a persuasive way to change behavior [37]. Allowing physicians to bill for physical activity counseling provides incentives for behavior change was suggested, but may not be realistic, and the effectiveness of monetary incentives on physicians' practice quality is unclear [37–39].

The strengths of this study include the large sample size and the diversity in clinical specialties and settings (e.g., urban vs. rural, independent physician vs. family health team, primary care, NPs, and specialists), resulting in a wide range of identified barriers, facilitators and resource needs. We acknowledge a few limitations. First, this study gained only a few perspectives from physicians who practice in rural or northern regions, where barriers and facilitators likely differ from urban centers. Consequently, resultant interventions may not be as feasible or sustainable in rural or northern centers. Second, our recruitment was largely driven by referrals within networks, which may capture similar minded participants, limiting the diversity of emerging themes. However, the recruitment strategy is an effective strategy for hard to reach populations. Furthermore, the sample may be over-representative of physicians who are already providing adequate care or those with an established interest in implementing the recommendations. Our consultations were made in the context of community-dwelling adults, and may not be applicable to those in long-term care, however, there are fracture prevention recommendations specific to that setting that include recommendations on fall prevention, hip protectors, and exercise [40]. Future work will integrate our findings with consultations with patients and other knowledge users, and culminate in the development of multifaceted knowledge translation interventions.

In conclusion, when presented with the Too Fit To Fracture Exercise and Physical Activity Recommendations, key barriers to implementation among physicians/NPs include knowledge on where to refer or what to say, access to pragmatic programs, resources or referral processes, and their own lack of motivation. The emerging role for physicians/NPs was as a promoter of physical activity guidelines and a facilitator of referral to exercise programs and resources. Interventions should include education on key messages, enablement of behavior change, persuasion, and environmental restructuring. Guidelines, communications/marketing or service provision are potential policy categories that should be considered for delivery of interventions.

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Compliance with ethical standards Informed consent was obtained from all individual participants included in the study, which was approved by the Office of Research Ethics at the University of Waterloo and the McMaster University Research Ethics Board.

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Conflicts of interest L. Giangregorio has consulted for ICON on behalf of Eli Lilly. No other conflicts of interest relevant to this work.

References

1. Merom D, Pye V, Macniven R et al (2012) Prevalence and correlates of participation in fall prevention exercise/physical activity by older adults. Prev Med (Baltim). 55(6):613–617. doi:10.1016/j.ypmed.2012.10.001
2. Colley RC, Garriguet D, Janssen I, Craig CL, Clarke J, Tremblay MS (2011) Physical activity of Canadian adults: accelerometer results from the 2007 to 2009 Canadian Health Measures Survey. Health Reports 22(1):7–14 http://www.ncbi.nlm.nih.gov/pubmed/21510585. Accessed November 24, 2016
3. Morgan F, Battersby A, Weightman AL et al (2016) Adherence to exercise referral schemes by participants - what do providers and commissioners need to know? A systematic review of barriers and facilitators. BMC Public Health 16:227. doi:10.1186/s12889-016-2882-7
4. Simmonds BAJ, Hannam KJ, Fox KR, Tobias JH (2016) An exploration of barriers and facilitators to older adults' participation in higher impact physical activity and bone health: a qualitative study. Osteoporos Int 27(3):979–987. doi:10.1007/s00198-015-3376-7
5. Desveaux L, Goldstein R, Mathur S, Brooks D (2016) Barriers to physical activity following rehabilitation: perspectives of older adults with chronic disease. J Aging Phys Act 24(2):223–233. doi:10.1123/japa.2015-0018
6. Giangregorio LM, Papaioannou A, MacIntyre NJ, et al. (2014) Too Fit to Fracture: exercise recommendations for individuals with osteoporosis or osteoporotic vertebral fracture. *Osteoporos Int 25(3): 821-835*. doi: 10.1007/s00198–013–2523-2 .
7. Giangregorio LM, McGill S, Wark JD, et al. (2015) Too Fit To Fracture: outcomes of a Delphi consensus process on physical activity and exercise recommendations for adults with osteoporosis with or without vertebral fractures. *Osteoporos Int 26(3): 891-910*. doi: 10.1007/s00198–014–2881-4 .
8. Hawker G, Carroll J, Jaakkimainen L et al (2003) Information needs in the management of osteoporosis in family practice: an illustration of the failure of the current guideline implementation process. Osteoporos Int 14(8):672–676. doi:10.1007/s00198-003-1421-4
9. Lugtenberg M, Burgers JS, Besters CF, Han D, Westert GP (2011) Perceived barriers to guideline adherence: a survey among general practitioners. BMC Fam Pract 12:98. doi:10.1186/1471-2296-12-98
10. Francke AL, Smit MC, de Veer AJE, Mistiaen P (2008) Factors influencing the implementation of clinical guidelines for health care professionals: a systematic meta-review. BMC Med Inform Decis Mak 8:38. doi:10.1186/1472-6947-8-38
11. Cornuz J, Ghali WA, Di Carlantonio D, Pecoud A, Paccaud F (2000) Physicians' attitudes towards prevention: importance of intervention-specific barriers and physicians' health habits. Fam

Pract 17(6):535–540 http://www.ncbi.nlm.nih.gov/pubmed/11120727. Accessed November 22, 2016
12. Yarnall KSH, Pollak KI, Østbye T, Krause KM, Michener JL (2003) Primary care: is there enough time for prevention? Am J Public Health 93(4):635–641 http://www.ncbi.nlm.nih.gov/pubmed/12660210. Accessed November 22, 2016
13. Flocke SA, Crabtree BF, Stange KC (2007) Clinician reflections on promotion of healthy behaviors in primary care practice. Health Policy 84(2–3):277–283. doi:10.1016/j.healthpol.2007.04.003
14. Canadian Institutes of Health Research. Guide to Knowledge Translation Planning at CIHR: Integrated and End-of-Grant Approaches. http://www.cihr-irsc.gc.ca/e/45321.html. Accessed November 22, 2016.
15. Michie S, Atkins L, West R (2014) The behaviour change wheel: a guide to designing interventions, 2nd edn. Silverback Publishing, Sutton
16. Statistics Canada. From urban areas to population centres. http://www.statcan.gc.ca/eng/subjects/standard/sgc/notice/sgc-06. Accessed November 22, 2016
17. Corbin JM, Strauss A (1990) Grounded theory research: procedures, canons, and evaluative criteria. Qual Sociol 13(1):3–21. doi:10.1007/BF00988593
18. Michie S, van Stralen MM, West R (2011) The behaviour change wheel: a new method for characterising and designing behaviour change interventions. Implement Sci 6:42. doi:10.1186/1748-5908-6-42
19. Osteoporosis Canada. Too Fit To Fracture. http://www.osteoporosis.ca/osteoporosis-and-you/too-fit-to-fracture/. Accessed January 18, 2017
20. Kennedy MF, Meeuwisse W (2003) Exercise counselling by family physicians in Canada. Prev Med (Baltim) 37(3):226–232. doi:10.1016/S0091-7435(03)00118-X
21. Webb AJS, Butterworth RJ (2015) Clinical neurology and neurosurgery determinants of clinical effectiveness and significant neurological diagnoses in an urgent brain cancer referral pathway in the United Kingdom. Clin Neurol Neurosurg 132:37–40. doi:10.1016/j.clineuro.2015.02.014
22. Harris MF, Pascoe S, Crossland L et al (2012) Patients with colorectal cancer: a qualitative study of referral pathways and continuing care. Aust Fam Physician 41(11):899–902 http://www.ncbi.nlm.nih.gov/pubmed/23145425. Accessed November 22, 2016
23. Jamous KF, Jalbert I, Kalloniatis M, Boon MY (2014) Australian general medical practitioner referral pathways for people with different ocular conditions. Clin Exp Optom 97(2):152–159. doi:10.1111/cxo.12102
24. Tzortziou Brown V, Underwood M, Mohamed N, Westwood O, Morrissey D (2016) Professional interventions for general practitioners on the management of musculoskeletal conditions. Tzortziou Brown V, ed. *Cochrane Database Syst Rev 5: CD007495*. doi: 10.1002/14651858.CD007495.pub2
25. Coulter A, Ellins J (2007) Effectiveness of strategies for informing, educating, and involving patients. BMJ 335(7609):24–27. doi:10.1136/bmj.39246.581169.80
26. Greaves CJ, Sheppard KE, Abraham C et al (2011) Systematic review of reviews of intervention components associated with increased effectiveness in dietary and physical activity interventions. BMC Public Health 11:119. doi:10.1186/1471-2458-11-119
27. Longmuir PE, Tremblay MS (2016) Top 10 research questions related to physical literacy. Res Q Exerc Sport 87(1):28–35. doi:10.1080/02701367.2016.1124671
28. Long BJ, Calfas KJ, Wooten W et al (1996) A multisite field test of the acceptability of physical activity counseling in primary care: project PACE. Am J Prev Med 12(2):73–81 http://www.ncbi.nlm.nih.gov/pubmed/8777071. Accessed November 22, 2016
29. Oldridge NB, Jones NL (1983) Improving patient compliance in cardiac exercise rehabilitation: effects of written agreement and self-monitoring. J Card Rehabil 3(4):257–262
30. Sallis JF, Hovell MF (1990) Determinants of exercise behavior. Exerc Sport Sci Rev 18:307–330 http://www.ncbi.nlm.nih.gov/pubmed/2192898. Accessed November 22, 2016
31. Law M, Tang JL (1995) An analysis of the effectiveness of interventions intended to help people stop smoking. Arch Intern Med 155(18):1933–1941 http://www.ncbi.nlm.nih.gov/pubmed/7575046. Accessed November 22, 2016
32. Russell MA, Wilson C, Taylor C, Baker CD (1979) Effect of general practitioners' advice against smoking. Br Med J 2(6184):231–235 http://www.ncbi.nlm.nih.gov/pubmed/476401. Accessed November 22, 2016
33. McPhail S, Schippers M (2012) An evolving perspective on physical activity counselling by medical professionals. BMC Fam Pract 13:31. doi:10.1186/1471-2296-13-31
34. Whitlock EP, Orleans CT, Pender N, Allan J (2002) Evaluating primary care behavioral counseling interventions: An evidence-based approach. Am J Prev Med 22(4):267–284. doi:10.1016/S0749-3797(02)00415-4
35. Grant RW, Schmittdiel JA, Neugebauer RS, Uratsu CS, Sternfeld B (2014) Exercise as a vital sign: A quasi-experimental analysis of a health system intervention to collect patient-reported exercise levels. *J Gen Intern Med*. 29(2): 341-348. doi: 10.1007/s11606–013–2693-9 .
36. Grimshaw JM, Shirran L, Thomas R et al (2001) Changing provider behavior: an overview of systematic reviews of interventions. Med Care 39(8 Suppl 2):II2–I45 http://www.ncbi.nlm.nih.gov/pubmed/11583120. Accessed November 22, 2016
37. Graham I, Tetroe J, Gagnon M (2013) Knowledge dissemination. In: Straus SE, Tetroe J, Graham ID (eds) Knowledge translation in health care moving from evidence to practice, 2nd edn. John Wiley & Sons, Toronto, pp 75–92
38. Scott A, Sivey P, Ait Ouakrim D et al (2011) The effect of financial incentives on the quality of health care provided by primary care physicians. Cochrane Database Syst Rev 9:CD008451. doi:10.1002/14651858.CD008451.pub2
39. Flodgren G, Eccles M, Scott A, Sheppard S (2013) Financial incentive interventions. In: Straus SE, Tetroe J, Graham ID (eds) Knowledge translation in health care moving from evidence to practice, 2nd edn. John Wiley & Sons, Toronto, pp 222–226
40. Papaioannou A, Santesso N, Morin SN et al (2015) Recommendations for preventing fracture in long-term care. CMAJ 187(15):1135–1144. doi:10.1503/cmaj.141331E450-61