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# Health professionals' perceptions about physical activity promotion in diabetes care within primary health care settings in Oman

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## Abstract

**Background:** As part of formative work to inform an interventional design to increase physical activity (PA) in patients with type 2 diabetes in Oman, this qualitative study aimed to determine health professionals' perception of barriers and opportunities, personnel responsibilities and plausible PA promotional approaches.

**Methods:** Four focus group discussions were carried out with groups of health care professionals (family physicians, dieticians and health educators, managers and general practitioners). All discussions were audio recorded and transcribed. Responses were analysed using a thematic analysis.

**Results:** Barriers to PA reported by participants (n = 29) were identified at three levels: health care system (e.g. deficient PA guidelines); individual (e.g. obstructive social norms) and community (e.g. lack of facilities). Participants felt that a multilevel approach is needed to address perceived barriers and to

widen current opportunities. In the presence of various diabetes primary care providers, the potential for dieticians to include individualised PA consultations as part of their role was highlighted. Participants felt that consultations should be augmented by approaches within the community (volunteer support and/or appropriate facilities). However, despite lack of experience with technology supported approaches and motivational tools, the telephone application “WhatsApp” and use of pedometers were considered potentially suitable. The need for training in behaviour change techniques and clearly communicated intervention guidelines was emphasised.

**Conclusions:** A multi-component approach including PA consultations, possibly led by trained dieticians, technological routes for providing support along with community mapping for resources appear to offer promising approaches for further PA intervention studies within diabetes primary health care.

Keywords: Public health, Health profession, Evidence-based medicine

## 1. Introduction

Type 2 diabetes (T2D) is a global health problem especially in the Middle East and North Africa (MENA) region including countries of the Gulf Cooperation Council (GCC), including Oman. Globally, the number of people with diabetes is expected to increase from 415 million adults to 642 million by the year 2040 [1]. In Oman, estimated prevalence of diabetes has increased considerably from 12.3% in 2008 to 14.8% in 2015, exceeding global rates [1, 2, 3]. It is therefore essential that effective management strategies are developed to better manage diabetes.

Physical activity (PA) is fundamental in the management of T2D [4, 5]. Extensive research across diverse populations has reported significant effects of PA in both prevention and control of diabetes. Moderate increases in PA have been shown to reduce HbA1c, and improve insulin sensitivity, fat oxidation and lipid storage in muscle [6]. In Oman, the best available evidence on prevalence of meeting PA recommendations in adults with T2D is 15% [7]. More recently, formative work undertaken to explore PA in diabetes care using the Global Physical activity Questionnaire (GPAQ) [8] showed that only 21% of adults with T2D met the World Health Organizations’ (WHO) recommended levels of PA [9]. These rates are considerably less than those reported in populations with T2D in the UK (34%) [10] and USA (36 to 50%) [11] and are of great concern.

Diabetes management in Primary Health Care (PHC) in Oman is managed by a multi-disciplinary team of health professionals (HPs) namely doctors, nurses, dieticians, and health educators. Current Omani diabetes management guidelines [12] recommend that PA is to be discussed with all patients, but the level of awareness and indeed implementation of these guidelines by health professionals (HPs) is unknown. Globally, evidence on PA promotion indicates that it remains an

under-used component in diabetes care [13]. Only a small number of studies have reported any PA counseling by diabetes HPs and this appears to have been due to lack of time, confidence, knowledge, training, and resource to provide ongoing support [14, 15, 16, 17, 18].

However, a number of methods of reinforcing PA promotion in diabetes primary care have been evaluated and shown to be effective and feasible [5, 19]. PA interventions for adults with T2D can be delivered in a clinical or community practice context, and can be provided in various settings, by various professionals, using various modes of delivery [20]. However, there is no consensus on what are the optimal PA intervention components. Significant improvements in glycaemic control are associated with interventions of longer duration (e.g. 6–12 months) [21], or where PA advice is combined with dietary advice [22]. Furthermore, PA consultations linked to a theoretical framework of behaviour change and tailored to the needs of individuals with T2D are more effective than more general PA advice [20].

On the other hand, pedometers have been widely reported as an effective follow up and monitoring tool to increase PA behaviour [23]. An intervention in Belgium using pedometers in a population with T2D showed them to be successful in increasing the number of steps with subsequent improvements in patients' blood pressure [24].

However, the majority of the research to date has been undertaken in controlled research environments, mainly in western countries [21]. Little is known if these interventions work if undertaken in everyday practice, especially in Arabic speaking countries where culture, tradition and health care settings are distinct. The current study aimed to determine the perceptions of HPs on PA promotion for adults with T2D within a local clinical primary care setting in Oman. Specifically, it aimed to explore the following (with respect to PA promotion) objectives:

- The perceived barriers and opportunities
- Who should be responsible for the delivery of PA interventions
- The perceived intervention components that could possibly be implemented
- The required resources/actions to integrate PA in diabetes care

## 2. Methods

### 2.1. Setting and conceptual framework

As part of a series of studies to inform a PA intervention design for adults with T2D [9, 25] including the exploration of barriers to performing physical activity in patients with T2D, the current study presents the results of four focus group discussions (FGDs) conducted in June–July 2015 to explore perceptions of HPs from different disciplines on possible PA interventions within routine diabetes

primary care [14]. Planning a feasible PA intervention within a clinical setting requires the views of health care providers at different health care levels [26]. Hence, this approach was guided by an ecological model of health behaviour [27], and a literature review was undertaken. Focus group discussions were chosen over in-depth interviews, because it was felt that the dynamic group interactions would allow better insights across group disciplines [28].

This qualitative research is based on an interpretative phenomenological analysis (IPA) method of understanding a group's perception of a particular topic using purposeful sampling [29].

## 2.2. Participants

Participants were recruited because they were healthcare professionals currently involved in the delivery of aspects of the diabetes care service in Oman. To ensure sufficient diversity of opinion, HPs involved in diabetes primary care from multiple disciplines (family physicians, dieticians, health educators, health managers and general practitioners) were recruited to the FGDs (participants of the same discipline in each group). The aim was to recruit between six and ten participants per focus group [28]. Participants (doctors, dieticians, health educators, and nurses) in all health centres in Muscat region were invited by written request by the Director of Primary Health Care in the Directorate of Health Services. The invitation letter was addressed to the head of each health centre to inform the potential participants about the date and venue of the FGDs and invite them to take part in the discussions. Subsequently, a list of staff who were willing to participate was sent to the Director of Primary Health Care and shared with the primary investigator (TSA) of this study. An information sheet describing the study and summarizing the available evidence from Oman [15, 30, 31] was shared with the participants as part of their invitation letters. The information provided included evidence on low levels of PA and high prevalence of non-communicable diseases, particularly diabetes, in the Omani population. This was expected to encourage participation and build interest on the subject. Follow-up telephone calls were made to arrange a time and place for the interviews. Although Arabic was the mother tongue for all participants, all interviews were conducted in English, since it is the common working language in the health sector in Oman.

## 2.3. Methodological approach

All focus groups were organised in a conference room with a semi-circle sitting arrangement at a time and date convenient for the participants and researchers. All participants provided informed consent. The focus groups, lasting 60–150 min, were led by a trained facilitator (TSA) and assistant facilitator (SA), audio-recorded and subsequently transcribed. The assistant facilitator took notes during

the discussions and made sure the facilitator did not overlook any participants trying to add comments. Discussions continued until saturation of new information was reached.

## 2.4. Topic guide

A semi-structured topic guide contained prompt questions eliciting participants' perceptions on the barriers and opportunities to promote PA in diabetes care, and their suggestions on allocation of responsibilities, possible intervention components and required resources/actions (see [Table 1](#)) [28]. The topic guide was then reviewed by the research team, and pilot-tested in a mixed group of six health professionals (one doctor, one nurse, two health educators and two dietitians). Changes were made to ensure common understanding and dynamic discussion. Because the pilot FGD revealed that participants were not fully aware of the common PA terminologies for intervention methods, an explanatory summary diagram highlighting examples of PA delivery methods (e.g. consultations and pedometers) was given to all participants before the start of each FGD.

## 2.5. Analysis

Data obtained from the audio tapes were transcribed verbatim and then analysed using Nvivo 11 [32]. The approach used followed thematic content analysis [28] in line with the key aims of the study. Initial transcripts were read several times by authors TSA and SMA followed by open coding, grouping and categorizing data according to emerging themes. A coding scheme was then developed based on the major recurrent themes. Themes and sub-themes were cross-checked independently by two researchers (SA, and YA). The final themes and sub-themes were revised by a qualitative researcher (ZA) as a further measure of inter-rater reliability. Continuity of interpretation was ensured by one researcher (TSA), being responsible for the data collection and analysis. Transcripts were re-visited whenever conflicting interpretations of themes occurred.

## 2.6. Ethics

Prior to the commencement of each focus group, an explanation about the aim of the study was given along with details of what participation would entail. Written informed consent (in which participants' anonymity and confidentiality was assured) was provided by each participant. The study was approved by the Regional Research and Ethical Review Committee, Ministry of Health, Muscat, Oman.

**Table 1.** Topic guide.

Questions	
Opening	<ol style="list-style-type: none"> <li>1. To what extent does your work in the diabetes clinic involve addressing PA?</li> <li>2. How important do you think addressing PA is among the various health priorities in your routine diabetes clinic?</li> </ol>
Introductory	<ol style="list-style-type: none"> <li>3. Who are the health professionals currently providing PA information to people with diabetes in PHC – if any? How and in what format?</li> </ol>
Transition	<ol style="list-style-type: none"> <li>4. In relation to PA and T2D how comfortable are you with the following: <ul style="list-style-type: none"> <li>• Your ability to motivate and build self-confidence in patients for more PA</li> <li>• Your confidence to discuss and assess PA with patients attending diabetes clinics</li> <li>• Your ability to use behavior change techniques in patients for more PA</li> <li>• Your willingness to endorse PA along with the other health professionals involved in diabetes care in PHC?</li> </ul> </li> </ol>
Key	<ol style="list-style-type: none"> <li>5. What are the <ul style="list-style-type: none"> <li>• Barriers to PA promotion in diabetes management in PHC?</li> <li>• Opportunities to PA promotion in diabetes management in PHC?</li> </ul> </li> <li>6. Who can best be responsible of PA promotion in the current primary diabetes care?</li> <li>7. Based on reflections from literature, what are your thoughts on the following physical activity delivery methods: <ul style="list-style-type: none"> <li>• Physical activity consultations</li> <li>• Encouraging walking is one of the successful interventions for patients with diabetes, how can this be done?</li> <li>• Using technology to promote PA in patients with T2D</li> </ul> </li> <li>8. What could be useful components for an effective physical activity intervention in diabetes care?</li> <li>9. What resources/actions are needed to integrate PA in routine diabetes care in PHC?</li> </ol>
Ending	<ol style="list-style-type: none"> <li>10. Is there anything else you would like to add?</li> </ol>

### 3. Results

Twenty-nine HPs participated in the FGDs. All of them were involved in diabetes primary care across Oman. More than half ( $n = 17/29$ ) were doctors, of which three were additionally mid-level managers at central (ministerial), regional and departmental levels. The remaining participants were nurses ( $n = 5/29$ ) dieticians ( $n = 4/29$ ) or health educators ( $n = 3/29$ ). The majority of the participants were females ( $n = 20/29$ ).

Mean  $\pm$ SD years of work experience was  $8 \pm 4$  (range = 5–21) years with family physicians having the most years of experience within the group. However, irrespective of experience participants expressed that: a) PA is a health priority in routine diabetes clinics b) their contribution to address PA was limited and ranged from unremarkable to simple and general PA advice. Current PA promotion in diabetes care was described as “inadequate”, “inconsistent” and “unstructured”. Participants in the manager group expressed “no” confidence to discuss and assess PA with patients attending diabetes clinics, nor the ability to motivate, build self-confidence or use behaviour change techniques in patients for more PA. Participants of other groups used variable terms such as “less”, “not sure” and/or “somewhat sure” for the same. Nonetheless, they all highlighted their uncertainties in addressing PA in diabetes care. However, all groups expressed strong willingness to endorse PA along with the other health professionals involved in diabetes care in PHC.

#### 3.1. Barriers and opportunities to delivery of PA promotion in diabetes primary care

Three recurring themes related to barriers and opportunities to addressing PA in diabetes care were identified: the health care system, individual/intrapersonal (patient related) factors, and the environment/community.

##### 3.1.1. Health care system related barriers and opportunities to PA promotion

###### 3.1.1.1. Barriers

The main barriers identified across the groups were lack of PA supportive guidelines/standards, lack of resources including knowledge and skills for effective PA promotion, lack of facilities and overall limited space available for patient instruction.

*“Lack or poorly communicated physical activity guidelines and physical activity standards from the central (ministerial) level to the clinical (practical) levels” GP 6*

*“Am not sure about my knowledge and skills to support physical activity in patients with diabetes who may have multiple comorbidities and require structured physical activity advice, not just a general statement” Dietician 7*  
*“We don’t have a private place to sit with the patient” Dietician 1*

Other barriers that were cited included lack of educational materials, poor PA referrals, inadequate manpower, and diabetes clinics restricted to morning shifts. It was also noted that contrary to other primary care programs in Oman, PA is not integrated in the electronic primary health care information system limiting operationalization of PA services.

*“Physical activity is not considered in the primary health information system ‘ALSHIFA’ which makes it difficult to prescribe, follow up or evaluate” Family Physician 5.*

### *3.1.1.2. Opportunities*

HPs were highly motivated to undertake PA promotion in diabetes care and willing to share the responsibilities of promoting PA with colleagues and patients. Implementing potential PA interventions in the health centre or the community was considered feasible. Additionally, the family physician group suggested gathering data from patients through research on perceptions and barriers to PA in order to identify potentially effective PA interventions.

*“Another thing which I believe in is the sharing, I really believe that we will not be able to do it alone, so we need everybody – and especially the patients – on-board” Family Physician 4*

*“We need more studies about perceptions and then about the barriers” Family Physician 6.*

## **3.1.2. Individual/interpersonal patient related barriers and opportunities to PA promotion**

### *3.1.2.1. Barriers*

Cultural norms of the acceptability of physical inactivity, sedentary jobs and use of domestic helpers were common barriers identified at the individual/interpersonal level. Females were perceived to be more prone to inactivity due to the cultural and societal restrictions. Terms such as “lazy”, “not willing”, “not motivated”, “no self-confidence” were used to describe inactive individuals.

*“In our culture (we don’t view physical activity as important?), taking medicine is enough, no need for physical activity” Family Physician 5*

*“Most of the Omani people are becoming sedentary at work” Dietician 5*



*“Our main problem is with the females, whom, they don’t have the time, they don’t have the place to do it, and . . . they have many social commitments”*  
Manager 8

### 3.1.2.2. Opportunities

Participants stressed the importance of personalising PA interventions to patients as they may be at different levels of readiness to perform PA. Provision of the available social (family) support for PA was equally recommended by participants.

*“Patients’ readiness to carry out physical activity has to be evaluated”*  
Dietician 2

*“We need to emphasise group, family and friends ‘social’ support for physical activity, especially for the population in the diabetic clinic who are elderly”*  
Manager 7

### 3.1.3. Environment/community related barriers and opportunities for PA promotion

#### 3.1.3.1. Barriers

All participants perceived a lack of PA facilities, particularly safe walking areas. Moreover, potential PA facilities within the community, in schools, are under-utilized by the public. Hence, participants felt that other PA stakeholders (sectors) were not supporting the Ministry of Health in PA promotion or implementing opportunities effectively. Although hot weather was mentioned, opportunities for indoor activities and PA in the early morning were also discussed.

*“We can’t utilize facilities in the community (school sports halls) for physical activities especially in the evening times when it’s closed”* Manager 3

*“The other sectors should cooperate with us”* Manager 1

*“Weather is a problem, but we can select a time where the weather is acceptable, like early mornings”* Manager 3

#### 3.1.3.2. Opportunities

The term “community mapping” was used by a senior manager who thought health workers should be aware of PA facilities within the geographical catchment areas of primary health care centres, in order to facilitate PA referrals when advised. Interestingly, available volunteering health groups were perceived to be under-utilized for PA promotion compared to other primary health care programs.

*“Community mapping for physical activity facilities (places and volunteering buddies) to inform health care providers is a good idea to improve PA referrals” Manager 6*

*“The Ministry of Health has utilized an active group of volunteers from the community to promote maternal and child health programs such as breastfeeding, I think we can utilize this group to promote physical activity too” GP 1*

### **3.2. Allocation of responsibilities within diabetes primary care**

There was no consensus on who should take the responsibility of PA for adults with diabetes in PHC. Interestingly, due to uncertainties towards how to deal with PA promotion in the presence of comorbidities, dieticians did not feel that it could be their responsibility. However, other HPs thought that PA responsibilities should be allocated to the dieticians, as combining dietary advice with PA was perceived as appropriate. In fact the dieticians and health educators group went on to suggest new recruitments such as physiotherapists or trained PA nurses. Family physician doctors, on the other hand, suggested a team approach to promote PA in diabetes care, but since associating PHC services/programs to a focal point is the norm, they could then be the coordinators along with the dieticians to deliver PA services.

*“It is the dietician’s role to promote physical activity to patients with diabetes”  
GP 1*

*“Physiotherapist or a trained physical activity nurse” Dietician 3*

*“The entire team is responsible, but if we have to choose, I would say the doctor, ‘us’”. Family Physician 1*

### **3.3. Intervention components and required resources to address PA in diabetes primary care**

Three main themes identified from a systematic review by Matthews et al. [20] were proposed for discussion: PA consultations (face to face, group or phone), PA sessions, and/or use of technology.

#### ***3.3.1. PA consultations (face to face, group or phone)***

Consultations were the most desirable intervention component although HPs did not feel skilled to undertake this. However, due to participants’ hesitancy on what to say, why, where and when, they all consistently recommended extensive training for the team involved in diabetes care.

Group consultations on the other hand were not welcomed in the current primary care setting due to associated complex arrangements (time, space, and logistics).

Except for the dietician group, use of pedometers was not recognized, but generally welcomed.

*“Physical activity consultation is one important part that we can integrate it in diabetes care” Family Physician 2*

*“It should be well-structured physical activity consultations. I think no one is well trained in this field” Family Physician 4*

*“I know that physical activity consultations linked to behaviour change is more effective, but we don’t know how to do it” GP 4*

*“Some people like face to face physical activity consultations which I think is better as not everyone has access to telephones, and don’t forget the cost of calling” Dietician 4*

*“I believe in our Omani culture face to face physical activity consultations would be better than phone or group or any other settings. People here like the patient-doctor interaction, especially in the initial visits” GP 6*

*“Group consultations are difficult to manage. I mean we need more space, time and other logistics” Dietician 4*

### 3.3.2. PA sessions

Participants thought that arranging services to promote PA, mainly walking sessions, supervised by the health centre was a good idea (and a precedent had been set with previous self-help groups and campaigns). However, such activities were not encouraged within the campus of the health centre due to the lack of safe and appropriate places to walk. Walking (individually, accompanied by somebody or in a group) was the most common type of PA viewed as acceptable, and was encouraged by all groups irrespective to disease condition or individuals’ age. Volunteers from the community were suggested by health educators in the dietician group to be linked to patients with diabetes who are willing to walk but lack social support to undertake this. The manager group felt that aerobic, resistance or Zumba classes could be arranged by staff from health centres for patients in a private gym, however it may not be sustainable.

*“I don’t feel bringing physical activity sessions to the health centre is a good idea. However, health educators may arrange and manage activities within the community” Family Physician 8*

*“We have these beautiful volunteers called the support group who are underutilised in PA promotion for diabetes care. We can use them to organise walkathons in the neighbourhoods or link them to walk patients. We also have the association like the elderly association of woman and the Omani Women Association who can do something similar to anti-smoking activities” Dietician 7*

*“I also think health centres can coordinate with nearby private facilities ‘the gym’ for possible aerobic, Zumba or resistance exercises for interested young patients perhaps, but then sustainability may be an issue for a larger group of patients” Manager 8*

### **3.3.3. Use of technology**

Participants felt unsure of the benefits of technology for older individuals and those with limited education. The use of tablet, and PA promotional websites were favoured for young patients who were more likely to be familiar with technology. Telephone applications and use of smart devices such as “watches/bracelets”, smart games such as Nintendo “Wii” consoles, and digital personal trainers were only mentioned by the family physician group, however cost was perceived as a drawback. Interestingly, use of a common telephone application “WhatsApp” to promote PA in diabetes care was commonly suggested:

*“Nowadays using WhatsApp is common [simple phone application], maybe we can introduce it to promote PA” Manager 6*

## **3.4. Required resources to promote PA for adults with type 2 diabetes**

The most repeated prerequisite by all groups was establishing a supportive environment for PA promotion in the PHC setting, namely structural changes, for example a consultation room, in order to provide privacy to patients. Additionally, clear and well communicated guidelines across health workers and PA stakeholders were highly recommended. Most importantly, accredited PA training for all health care professions involved in diabetes care would need to be embedded and/or medicalized within PHC continuous professional development (CPD) training programs. Training for all was perceived as essential to overcome problems of staff shortages related to the uneven distribution of staff delivering primary diabetes care in health centres and their rapid turnover rate due to maternity leaves, retirement and transfers to other health centres. This was hoped to maintain and sustain service delivery for PA promotion.

Proposed training topics were variable including: PA definitions, guidelines, measurements, consultation skills including behaviour change techniques (goal setting and motivation), and follow up and monitoring tools.

*“Physical activity is not medicalized and hence there are no standard follow up, monitoring or evaluative tools for it in primary care” Family Physician 1*  
*“Prepare a physical activity friendly environment in the health centre. For example encourage health care workers to move (active meetings), ensure private consultation rooms and everyone in the health centre should participate” GP 1*

## 4. Discussion

The current qualitative study is part of a formative piece of work to inform a PA intervention design in diabetes care in Oman. Similar questions were asked a population of T2D patients in a quantitative cross-sectional study reported elsewhere [9]. Consistent with ecological models of health behaviour [27], the responses from the multidisciplinary groups of this study reflect perceptions of the multidimensional influences on PA and the necessity for multilevel actions to address them. Given the sparse evidence available on appropriate PA interventions for Arab populations, this study provides a framework/model for the design and integration of PA in routine diabetes primary care that can be subsequently evaluated.

Three themes were identified: barriers related to the health care system, individual/interpersonal factors, and the environment/community. In the current study HPs expressed concerns relating to inconsistent and outdated PA guidelines. The recent Omani diabetes management guidelines on PA are based on outdated evidence and therefore require revision as the last production was in 2015 [12]. Guidance on PA recommendations for adults with diabetes has been described in several studies [33, 34], however further details for implementation are required. Since it is a norm to have a representative body for health programs in Oman Ministry of Health, assigning one for implementing PA services would be ideal to execute PA guidelines (at least 150 min of moderate to vigorous physical activity or 75 min of vigorous PA/week or an equivalent combination of moderate- and vigorous-intensity PA achieving at least 600 MET-minutes per week [35] across HPs involved in diabetes care. Additionally, other constraints related to availability of consultation rooms, educational materials, manpower, timing of diabetes clinics, and integration of PA in the current health information system need to be developed and included in an executive PA promotion action plan.

At the individual/interpersonal patient level, socio-cultural barriers, particularly the restrictions noted for women such as limited safe PA facilities and walking tracks, are reported from other Arab communities in the Middle East [36] and the USA [37, 38]. Hence, PA promotion should be targeted to address females' inactivity levels through widening available opportunities.

Perceived barriers which were related to the environment/community were similar to findings of other studies, namely hot weather and limited PA facilities [39]. PA interventions should therefore consider walking tracks and special culturally appropriate exercise facilities and services e.g. women only exercise classes.

It was agreed that in an ideal health care setting all HPs should have the responsibility and skills to effectively deliver PA information. In fact PA endorsement by health workers in PHC settings is reported as one of the seven

investments that work in promoting PA [40]. Research suggests that patients consider their GP to be the most trusted source of PA advice [41]. However, despite mixed views on responsibilities for PA promotion, the tendency was for dietitians to be the favoured sources for both diet and PA promotion by study participants in the current local PHC setting. Patients with T2D have previously reported finding it easier to manage dietary changes when in combination with PA [42].

Face to face consultations were valued over telephone and/or group consultations by participants, especially for initial consultations. This could be justified by the cultural preferences to discuss health issues in private; especially that females in Arabic speaking countries namely Oman may not feel comfortable to discuss their weight, health and PA behaviour in group settings [3]. Additionally telephone consultations may not be accepted given the time and cost associated with using phone services. However, since evidence showed that telephone counselling is an effective method of increasing levels of PA in women with T2D in Western countries, such as the USA [43], it is wise to consider its application in future PA interventions.

While the current study identified barriers to PA promotion by HPs, another complimentary formative study showed that lack of willpower was the frequently reported barrier to performing PA by patients with T2D [44]. Hence, the use of motivational tools such as pedometers was welcomed by all HPs in the current study. Pedometers have been shown to be helpful in increasing PA levels and in improving metabolic parameters in patients with diabetes in several previous studies [24, 45]. An advantage with pedometers is their ability to increase the motivation to be more active and less sedentary on a daily basis, therefore future PA interventions should include pedometer use.

Furthermore, effectiveness of community involvement in PA promotion has consistently showed positive outcomes [46, 47]. Referrals to an organized community PA resource, such as walking buddies (community volunteers), and neighbourhood gym may all be adopted.

Finally, irrespective of who the PA focal point is in PHC. An intense training to health care providers on PA is required including benefits, definitions, recommendations, type, measurements, dealing with multiple comorbidities and evaluation. To ensure sustainability, training workshops were advised within primary health care CPD activities. More importantly, behaviour change training was highly recommended.

#### 4.1. Study limitations

It should be noted that the facilitator (TSA) had worked with all study participants for several years, and thus, familiarity with all participants may have introduced

bias, with participants providing socially desirable responses. However, efforts to minimize potential bias were taken through firm FGDs facilitation skills and data collection [28]. Additionally, we are unable to assess how representative the views reported in this study are of those of the wider population of HPs working in diabetes care within PHC across the different regions of Oman. All participants have a very good working knowledge of English, but their responses may have been limited since the interviews were not conducted in their mother tongue, Arabic. Another potential limitation is that sitting time and sedentary behaviour were not included as specific topics for discussion within the focus groups. Prolonged sitting time has been identified as an independent risk factor for diabetes, cardiovascular disease, and all-cause mortality [48]. Hence, further studies are required to explore sitting time and sedentary behaviour in adults with T2D in Oman.

## 5. Conclusion

This study highlighted key perceived barriers and opportunities for a PA program for patients with T2D. Despite clinical, individual, and environmental factors that could limit PA behaviour, opportunities do exist within the positive spirit of health care workers for PA promotion. This study proposed an intervention with multiple components across clinical and community contexts. In the presence of various diabetes primary care providers, dieticians were considered best to provide face to face PA consultations linked to behaviour change techniques. Participants were excited to introduce “WhatsApp” and pedometers as follow-up, and monitoring PA tools. Additional community support was recommended from the current available resources (volunteers/PA facilities). To initiate and sustain PA promotion, a training program needs to be institutionalized within the current CPD activities for all health care providers in primary care.

## Declarations

### Author contribution statement

Thamra Al Ghafri, Samiya Al-balushi, Zakiya Al-busaidi, Yahya Alfarsi: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Saud Alharthi: Conceived and designed the experiments; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Elaine Bannerman, Angela Craigie: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

Annie S. Anderson: Conceived and designed the experiments; Performed the experiments; Wrote the paper.

### Competing interest statement

The authors declare no conflict of interest.

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### Additional information

Data associated with this study (transcripts of the focus group discussions) is available on request and approval from the Oman Ministry of Health.

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