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Barriers and facilitators of self-care in adults with pre-diabetes: a directed qualitative content analysis

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Abstract

Background Adults with prediabetes are at 5 to 15 times higher risk of developing type 2 diabetes compared with others. Without self-care behaviors to promote health and prevention, more than 70% of them will ultimately develop type 2 diabetes during their lives.

Method This was a qualitative study guided by the directed content analysis method. Purposive sampling was done with maximum demographic diversity. The experiences of adults with prediabetes (39 people) and healthcare workers (6 people) were assessed through individual, face-to-face, semi-structured interviews lasting between 30 and 45 min for four months, from June to November 2023.

Results Five main themes were found to be influential on the self-care behaviors of adults with prediabetes after analyzing the data: intrapersonal factors, interpersonal level factors, organizational factors, community-level factors, and public policy factors. The important barriers were a lack of screening programs, lack of knowledge about prediabetes and how to modify and change lifestyles, cultural practices, insufficient counseling, lack of prediabetic peers and groups, inflexible work environment, lack of native digital applications, lack of self-care behavior assessment tools for counseling, and financial problems. The major facilitators were motivation, support from family and friends, and the availability of resources in the community.

Conclusion Our findings suggest that a multilevel approach is needed to address these barriers and facilitators. These findings will help guide strategies to develop programs that impart knowledge and skills to improve the self-care behaviors of prediabetics.

Keywords Prediabetes, Self care, The socio-ecological model, Iran

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Introduction

The International Diabetes Federation has reported that around 374 million people worldwide have prediabetes [1]. In Iran, the prevalence of prediabetes has been reported as 25.4% (2021) [2–4].

Type 2 diabetes nursing care focuses on managing the behavior of people with the disease and its complications. In contrast, prediabetes nursing care focuses on prevention and encourages people to adopt self-care behaviors to prevent diabetes [5].

Self-care behaviors in people with prediabetes refer to behaviors such as diet plan management, physical activity, accepting responsibility for one's health, self-actualization, and managing interpersonal relationships and stress, which can prevent diabetes and complications caused by it by keeping blood sugar within normal limits [6–8].

Type 2 diabetes prevention programs have widely been implemented and proven to be effective in helping people lose weight and improve health behaviors such as participating in physical activities and eating a balanced diet. However, a systematic review by Barry et al. (2017) reported that only 27% of the population at risk of type 2 diabetes completed the diabetes prevention programs [9].

In various studies on type 2 diabetes prevention programs and the promotion of health self-care behaviors, participants reported barriers such as lack of time and money, lack of access to clinics and clinical institutions, especially for people living in rural areas or too far from urban centers to attend Type 2 diabetes prevention programs. In addition to the mentioned cases, lack of motivation, insufficient knowledge, lack of awareness of one's situation, insufficient social support, and insufficient understanding of the empowerment process are other critical barriers to participation in type 2 diabetes prevention programs [10–12].

However, surveys suggest that primary care providers seldom counsel patients with prediabetes about lifestyle modification, and their rate of referral to lifestyle promotion centers or personal health coaching programs is low and unknown [12].

In a qualitative study by Kandula, et al. [13], which assessed healthcare providers' views regarding the diagnosis and treatment of prediabetes, because of the high number and variety of emergency patient referrals to prevention centers and time limitations, some healthcare providers see focusing on prediabetics as a waste time and resources [13, 14].

To improve the effectiveness of diabetes prevention programs and interventions in any society and to ensure that adults adhere to these programs and engage in self-care behaviors, multiple factors that affect behavior have to be identified. The factors with direct impact include a) individual (or intrapersonal), b) interpersonal, and c) community factors. Health theories and models can provide researchers with an initial framework to assess these factors. The social-ecological model allows us to depict the people's experiences through their various interactions at the individual, interpersonal, organizational, social, and governmental-political levels. Various studies have used this model to assess the facilitators and barriers for different populations [15, 16]. Following analysis of our data, we identified the social-ecological model as an approach to organizing our findings. This model allows us to consider facilitators and barriers more comprehensively and take advantage of the potential to improve care for adults in the prediabetes stage and prevent type 2 diabetes.

Considering that preventive interventions and lifestyle modifications effective in reducing the incidence of diabetes and prediabetes are time-consuming and tend to slacken over time, investigating barriers and facilitators effective in long-term adherence to lifestyle changes at different individual and transpersonal levels can be beneficial. Therefore, this study aims to examine the barriers and facilitators of self-care behaviors of adults in the prediabetes stage in Iranian society.

Method

Comprehensive health centers, the Lipid and Glucose Study Center of Shahid Beheshti University of Medical Sciences, Tehran, and the Diabetes Clinic of Shahid Labafinejad Hospital, Tehran, were chosen as study settings because of the availability of laboratory and demographic information on people with prediabetes, as well as access to other participants, including diabetes nurses, general doctors, diabetes specialists, nutrition specialists and nutrition experts, and clinical psychologists. Also this study has been reported according to the Standards for Reporting Qualitative Research (SRQR) guideline (supplementary file).

Study design and participants

This qualitative study is based on the directed content analysis method [17], which was conducted to explain the self-care experiences, barriers, and facilitators of adults with prediabetes. The social-ecological model was used to classify the barriers and facilitators experienced by adults with prediabetes (while performing self-care behaviors) and other participants (healthcare professionals) [18]. Considering barriers and facilitators together according to the various elements of this model can improve and promote new interventions and approaches to improve self-care behaviors in adults with prediabetes. Purposive sampling was done with maximum diversity in age (between 19 and 60 years) [3], gender, marital status,

religion, ethnicity, education, body mass index, duration of awareness of prediabetes, and family income level. The participants in this study included adults with prediabetes with fasting blood sugar between 100 and 125 mg who were aware of their condition. Other participants included general and specialist doctors, diabetes nurses, clinical psychologists, and nutritionists with at least two years of experience working with prediabetes.

Data collection

Data were collected through semi-structured individual interviews in private rooms in the research mentioned above settings. After arriving at the study site, researchers invited adults with prediabetes with fasting blood sugar between 100 and 125 mg to the sampling center by phone or text message according to the available contact information. After face-to-face consultation with adults with prediabetes, assessing other inclusion criteria, and asking about the candidate's prediabetes status, the purpose of the study was outlined, and written informed consent was obtained for the detailed individual interview. Written consent was obtained from healthcare participants (general and specialist doctors, diabetes nurses, clinical psychologists, and nutritionists) as well.

The interviews typically lasted between 30 and 60 min and, on average 45 min. The interviews were conducted in Persian. In order to publish, all the quotes of the participants have been translated by a translator fluent in English (word by word and preserving the meaning).

The data collection process lasted approximately from June 2023 to November 2023. All interviews were conducted by the project PhD student who had received complete training on conducting qualitative studies and interviews using the interview guide. Individual interviews continued until data saturation was reached, until no new codes were extracted, and the codes were repetitive in the last two to three interviews.

Semi-structured interviews started with the following general questions, and according to the interviewees' answers, the interview process was directed toward achieving the primary goal of the research. Exploratory questions were asked for a deeper understanding.

> *"What feelings did you experience after finding out about your prediabetes condition?" "What behaviors have you adopted to control your blood sugar?" "What barriers have you encountered in pursuing these self-preservation behaviors?" "What were your preferences?" and "What has helped you maintain these behaviors?"*

The general question of the other participants, who were healthcare professionals, was "What barriers do adults with prediabetes experience in controlling blood sugar or adopting self-care behaviors?" "What facilitators do they have?" "What has promoted self-care behaviors and better blood sugar control in these people?" and "How about the opposite?" (supplementary file).

The interviews were recorded with the participant's knowledge and consent. At the end of each interview, at the earliest possible time, the interviews were heard several times and then transcribed verbatim. The states and characteristics of the participants were noted throughout the interviews. Under pseudonyms, the texts were transferred to MAXQDA 2020 software for data storage, retrieval, and analysis.

Data analysis

The interviews after being coded The analysis of the data obtained from the semi-structured individual interviews was done using Hsieh and Shannon's [17] directed content analysis method, according to the research framework and the socio-ecological model [19]:

The fundamental concepts of the model, which include individual and interpersonal factors, organizational and institutional factors, community factors, and public policy factors, were determined and selected as the main classes of the model. Each concept in the model was then characterized and identified as a subclass. Data analysis were conducted by the project PhD student and the research team. The initial stage of the process involved transcribing the interviews. Following this, the semi-structured interview texts were read several times to gain a comprehensive understanding of the text and achieve immersion, meaning units were determined. Each meaning unit was then assigned a code. A total number of 850 codes emerged. The first and third researchers coded the texts of the interviews separately. The coded text was reviewed by a responsible researcher (second researcher). Any disagreements were discussed to reach a consensus. Then codes similar or related to each concept were placed in common subclasses.

Trustworthiness

The validity and strength of the data were determined with Lincoln and Guba's approach [20] using four criteria: validity or acceptability, reliability, transferability, and confirmability. Data collection interviews were conducted quickly, and all participants were asked about the same topic. The researchers spent four months collecting the data. The research team reviewed the codes and data classification to achieve peer review. The full text of all interviews along with coding and initial classifications were sent to the second author. The full text of the 2 interviews with coding was sent to the third and fourth authors. The comments were used throughout the process to help implement, code, and extract the sub main

categories. The results were submitted to two university faculty members and the Tehran Lipid and Glucose Study Center (for external review). participant reviews were also done randomly by three participants to confirm the accuracy of the results. For this purpose, the interview text and the extracted codes were presented to the participants. In case of any discrepancy, it was considered and investigated. The researcher contacted the participants to clarify any unclear cases or misunderstood meanings through phone calls and emails. Sampling was performed with maximum diversity (ages, education, income etc.) to increase the transferability of the data. In addition to a full report of all steps taken, a clear explanation of the analysis process and participant quotes were also recorded to demonstrate that the results were related to the data [20].

Ethical considerations

This qualitative study is part of a PhD dissertation in nursing, approved by the Ethics Committee of Shahid Beheshti University of Medical Sciences with the code IR.SBMU.RETECH.REC.1401.476. Informed consent to participate in the study was obtained from individuals. The participants determined the interview time and place and were asked permission to record their voices.

Results

In this study, after face-to-face interviews with 46 participants, including 40 prediabetic adults (who were aware of their prediabetes for six months to 14 years, within the age range of 60–22 years, with fasting blood sugar between 100 and 125 mg and body mass index of 20–42), one diabetes nurse, one doctor, three nutrition consultants, and one psychologist (Tables 1 and 2), lasting 30–45 min, various barriers and facilitators were identified, which were classified into five main categories according to the socio-ecological model (Fig. 1).

This model was used to create main and subcategories for organizing a large quantity of extracted codes in this study. The extracted codes from the data analysis were placed in the main classes of the model and no new classes were added after the analysis.

Table 1 Demographic characteristics of adults with pre-diabetes

Row	Demographic characteristics	Subclasses	Number
1	Gender	Woman	30
		Men	10
2	Marital status	Single	8
		Married	32
3	Education	Postdoctoral	1
		PhD	4
		Master's degree	3
		Bachelor's degree	12
		Associate Degree	4
		High-school diploma	12
		Middle school	4
4	Ethnicity	Fars	30
		Lor (native of Luristan)	5
		Turk	1
		Kurd	3
		Gilak	1
5	Family income level	Medium to high	4
		Medium	12
		Average to low	12
		Low	2
6	Job	Government clerk	13
		Homemaker	16
		Retired	4
		Student	3
		Self-employed	4
7	Family history of diabetes	Yes	17
		No	23
8	Health insurance	Yes	38
		No	2
9	BMI (kg/m2)	20–24.9	16
		25–29.9	12
		30–34.9	7
		35–39.9	3
		40–45	2

Individual level factors

Perception

Knowledge

The obstacles mentioned by the participants for self-care are lack of knowledge and correct understanding about the difference between diabetes and prediabetes, difficulty tracking the complications of high blood sugar and not knowing how to prevent it, blood sugar-lowering pills, blood sugar-lowering herbs, not knowing how to control the effect of underlying diseases on blood sugar level, proper diet, bad nutritional habits, not knowing how to monitor blood sugar levels, cook food correctly, and perform proper physical activity.

> *"I need training to know how much to reduce food intake. What is the difference between prediabetes and diabetes? Believe me; I thought I had diabetes until you told me that I could return my blood sugar to its previous state."(Female, married, 52).*

Experiences and seeking information behaviors

Participants mentioned the following as the critical facilitators to improve their level of knowledge and awareness about prediabetes and self-care: knowledge gained based

Table 2 Participants specification (health care providers)

Row	Interview duration	Job	Age	Education	Work experience
1	45 min	Nutritionist	36	Masters	5 years
2	45 min	Psychologist	40	PhD in psychology	11 years
3	45 min	Diabetes nurse	42	Masters	5 years
4	45 min	Nutritionist	33	Masters	6 years
5	45 min	Nutritionist	40	PhD in nutrition	10 years
6	45 min	General practitioner	60	General physician	27 years

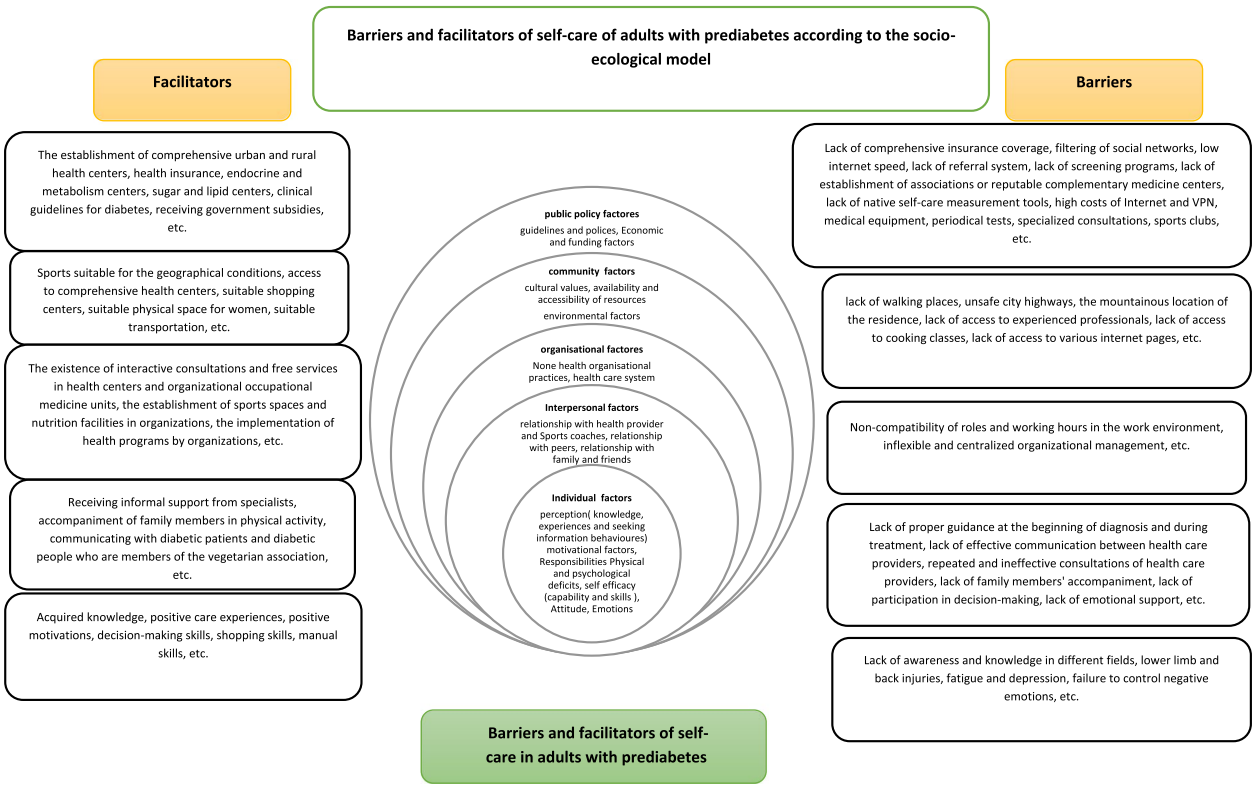

Fig. 1 Barriers and facilitators of self-care in adults with prediabetes

on the life experience and care of persons with diabetes, participating in diabetes education classes, following health programs in national media and academic studies, obtaining sufficient information about the units and list of nutritional replacements after numerous consultations, weight loss and the study of reliable scientific sources.

"Well, I Google my questions. I have looked information up for my parents and researched for them. They are also watching what they eat, so I know what they eat and what they do not. I try to do the same thing." (Female, married, 25).

Responsibilities

The increased burden of different responsibilities associated with taking on different roles both at home and in the workplace and working in shifts are some of the barriers that limit the time for self-care for people with prediabetes.

"What prevents me from exercising is taking care of my youngest child, who takes my time because they are still dependent and cannot take care of themselves." (Female, married, 55).

Physical and intellectual deficits

Physical injuries in the lower limbs and waist area, physical side effects of taking drugs to control other underlying diseases, physical limitations due to old age, fatigue, and depression are other self-care barriers mentioned by adults with prediabetes.

> *"Along the process, I became depressed. After taking antidepressants, I became lethargic. I could hardly prepare the children's food, let alone go for walks." (Female, married, 41).*

Motivation

Factors that cause motivation among adults with prediabetes include achieving goals and their positive effects, such as appropriate weight loss, lowering blood sugar levels, preventing the progression of prediabetes to diabetes, delaying the complications of high blood sugar, returning to normal blood sugar status, receiving attention and positive feedback from the family, looking good after weight loss, maintaining health, and feeling responsible for others and their health.

> *"Because I have always wanted to live healthily and avoid complications and suffering from diabetes like my father did, I try to control my sugar and take care of myself." (Female, married, 43).*

Attitude

Belief in not being too quick to acknowledge the existence of disease at home is one of the other barriers to self-monitoring in adults with prediabetes.

> *"I always say that one should not become proactive; I think if you buy a glucometer, you are anticipating it, and you will develop diabetes." (Female, married, 53).*

Self-efficacy

Capability

Managing planned weight loss on your own, having the power to make decisions and choose food when shopping, the ability to interpret the results of periodical tests, the ability to work with glucometers and blood pressure monitors, acquiring the skills of calorie counting and reading food labels, daily planning, and scheduling tasks, and the ability to use online services are abilities that people use to take better care of themselves.

> *"I went to various nutrition consultations and know the food units and their calories. Now I read the food labels; for example, I know what the number of calories means. For example, I know the calories of this item per gram and how many daily calories I should consume." (Female, married, 60).*

Skills

The skills that help a person take care of and control their blood sugar are baking homemade bread using whole grains and wholemeal bread, weaving carpets for mental relaxation and avoiding stress, reading, and writing, and dealing with artistic skills such as crocheting and pottery to prevent snacking, using mobile phones, reading English texts and articles.

> *"Another thing is to occupy my mind, feeling good and useful, and not overthinking life's tensions. I set a carpet tufting frame at home, and this occupation of carpet weaving is very calming for my mind. It helps my mind and does not allow me to think about negative things." (Female, married, 55).*

Emotion

After becoming aware of their disease, adults with prediabetes experienced various positive, negative, and neutral emotions, which caused behaviors such as denial, concealment, or acceptance. Factors that caused them to pursue self-care behaviors are shock, fear, and panic, such as fear of frequent insulin injections, diabetes complications, and worrying about disturbing family members.

> *"The reason for my denial was fear; even though I knew that we have a family history of diabetes, this fear and denial prevented me from doing anything about it until my blood sugar started going up." (Female, married, 47).*

Interpersonal factors

Relationships with health providers and sports trainers

Facilitators of self-care for adults with prediabetes at the interpersonal level received educational support, counseling, and companionship from healthcare providers, peers, friends, and family members.

The facilitators of self-care for health care providers in adults with prediabetes include receiving educational support from health care providers (doctors/nurses), receiving educational support from physiotherapists, sports trainers contributing to the continuation of exercise, doctors' help in choosing the method of blood sugar control, and receiving feedback in remote nutritional consultations.

> *"We also have a pro bono health center, where the doctor knows us, and we sometimes get advice from her." (Male, married, 50).*

The self-care support barriers related to health care providers included the doctor not providing proper guidance on how to manage prediabetes at the time of diagnosis, the doctor failing to establish effective

communication with the client, the doctor not providing proper guidance regarding the periodic check-up results, repetitive and ineffective psychological counseling, non-compliance of counseling with client's family income, the exclusivity of nutrition consultants to people with weight loss surgeries, the lack of motivated personnel in health centers, receiving repetitive and old information from health center personnel, not receiving a personally tailored program, and the sports trainer not involving the individual in the decision-making process.

"I am so upset because of my son's sugar problem. I do not have a problem with getting psychological counseling now that my sugar is borderline, but I do mind paying money and hearing the same things over and over because I went once, and they said the same things. Well, I have already read all of this on the Internet." (Female, married, 41).

Relationship with peers

Supports that adults with prediabetes have received for self-care included consultation with people with a history of weight loss surgery, peer group meetings in the vegetarian community, introduction to the vegetarian diet by friends with similar experience, and interaction with persons with diabetes in the family and relatives.

"Before Corona, I remember the vegetarian association invited people who had used this diet and had regained their health. These groups helped people meet and share their experiences, and we comforted each other." (Female, married, 57).

The absence of peer groups consisting of people with prediabetes has also been mentioned as one of the barriers.

"One of our relatives suffers from MS. They gather at the center from time to time and share their experiences and communicate with each other. However, I have not seen anything like that for people with prediabetes." (Female, married, 52).

Relationships with family and friends

Supports that facilitated self-care for adults with prediabetes included support received from family members (especially from the spouse) on taking drugs, doing and continuing exercise, shopping and eating out to maintain a healthy diet and emotional support when facing pressure.

They informally have received informal educational support from friends and relatives who are specialists in medicine, exercising or health applications. The use of the blood sugar and blood pressure monitoring equipment of relatives was another support received.

"My friends supported in going to the gym. Sometimes, something happened, or I was tired and did not want to go. If my friends had not been there and had not picked me up to go to the gym, I definitely would not have gone that day." (Female, married, 43).

The barriers mentioned by adults with prediabetes on self-care about their family included: Spouse's mental illness, loneliness caused by single life, having company and regularly entertaining children and grandchildren, restriction on travel by spouse, and loss of mother's companionship in child care.

"Exercise makes me feel better, but the thing is, I do not have time. I have to go to work. Both my mother and my mother-in-law used to be with me. They helped me take care of my children so I could go to the gym and exercise, but now they are no longer with me." (Female, married, 35).

Organizational and institutional factors

None-health organizational practices

Periodical check-ups in some occupational groups, arrangements in the professional mountaineering association, allocation of suitable sports space in the workplace, special discount on welfare services for students in sports, nutrition, and recreation by the university, and establishment of appropriate and free sports classes by the municipality for women under the supervision of a trainer are among the organizational facilities that prediabetic adults have been able to use for self-care.

"Our guild requires that we do a check-up every year. I became aware of my condition through these tests. Moreover, I check my blood sugar in these periodic tests that I have to take for my work." (Male, single, 37).

Self-care barriers included a lack of support from officials in adjusting working hours in the workplace and the lack of suitability of physical-mental classes (yoga) in sports halls with participants' abilities.

"I decided that I have to go swimming. I requested a reduction in my teaching hours from the head of the group, but they still have not made any arrangements." (Female, married, 37).

Health care system

Measures taken by health systems to facilitate the self-care process in adults with prediabetes included clinics with a set of centralized services (surgery, treatment, consultation, and care) for weight loss surgeries, free nutritional counseling at the hospital's diabetes clinic, monthly blood sugar checks with a glucometer at the health center, the provision of psychological counseling

services at the health center, and online interactive consultations and feedback by nutrition consultants in private centers.

"There is a glucometer in the health center where we live. From the time I became prediabetic until when I decided to take periodic tests to check my blood sugar, I checked my sugar monthly with this device and talked to the doctor." (Female, married, 53).

Community factors

Geography/ environment

The geographical and environmental conditions of the residence were important in choosing the type of physical activity mentioned by adults with prediabetes.

"As soon as I joined this team, it enabled me to continue exercising. We live in Damavand, and there are mountains all around us, and I like climbing. This is why I have this sport in my life." (Female, single, 44).

Barriers that affected a person's physical activity included small homes without yards, dangerous highways in the city, the absence of safe walking places, uphill walking places (near the home), and polluted air in big cities.

"Since the paths in our neighborhood have a steep incline, I am afraid of going out because of my weight gain; I am afraid of going out because I may fall and get hurt; then I would not be able to continue exercising." (Female, married, 60).

Availability and accessibility of resources

The existence of a comprehensive health center near home, access to walking roads, remote nutrition consultations, vegetarian associations, fruit and vegetable distribution centers with reasonable prices, sports parks for women, access to meditation courses and body and mind health courses (yoga, Pilates, etc.), access to health applications, access to green spaces with suitable sports facilities, availability of public transportation, access to internet packages and social networks, and access to health programs in the national media (radio and television), bookstores, and libraries as information sources are among the facilities available at the community level for adults with prediabetes.

"Fruit has become more expensive, and its purchase has decreased, but the municipality has established a wholesale fruit market in the city. I buy fruit there; it is more reasonable in terms of price." (Female, married, 55).

The barriers to access experienced by adults with prediabetes to self-care resources included lack of access to native and comprehensive applications, lack of reliable traditional or complementary medicine consultation centers, lack of access to sports counseling in times of physical injury, lack of suitable healthy cooking classes, lack of access to suitable food shopping centers, lack of access to experienced specialists in cities, and lack of access to social networks and useful educational pages on the Internet.

"I used Eryngium(Eryngium is a genus with 274 species, which belongs to the Umbelliferae family. It has anti-inflammatory, anti-cancer, and especially, anti-diabetic effects among the well-known medicinal plants) compete for my blood sugar, but I do not know how much to use. I do not know a specialist in traditional and complementary medicine, but I gained all my information from the general public and those who have diabetes and have experienced it. I went to different treatment centers but could not find a way to access and consult with them. There are apothecaries, but they work by experience." (Female, married, 55).

Cultural and community values/norms

Respecting women's privacy in public sports spaces is one of the facilitating factors. Barriers mentioned by women with prediabetes included people's unwillingness to marry those with health problems and society's non-acceptance of women cycling in the city.

"In our neighborhood, there is a park only for women. It is fenced, and you can wear sports clothes there. A cultural center recently opened another park with metal scaffolds, and they set up a canvas tent on those bars. There is a trainer, and women can exercise there for two hours every day." (Female, married, 55).

Public policy factors

Economic/Funding

The facilitating factors mentioned by adults with prediabetes included having health and supplementary insurance, receiving government subsidies, and employment (having a source of income).

"No, I have never stopped taking my medicine because of lack of money, but I have to be careful to put aside some money so I can buy y medicine every three months. For example, I might not buy some things to save up for my medicine. Alternatively, I put aside some of the monthly government financial aid. I save up for it. Of course, sometimes my children buy my medicine and do not take the money." (Female, married, 55).

Just as having health insurance has been a facilitating factor for some, not being covered by health insurance, the cost of installing a VPN, high internet costs, high transportation costs, the inability to provide monitoring equipment at home (glucometer strips/sphygmomanometer), inability to pay for laboratory fees (periodic and annual check-ups) despite insurance, inability to pay for specialized consultations (nutrition/doctor/psychologist), inability to pay for medical visits, inability to register in sports classes (swimming, aerobics), registration in sports sessions with a trainer, lack of finances to buy medicine, and inability to buy suitable and healthy food are mentioned as barriers to self-care behaviors.

"My aunt teaches on the Internet… the cost of buying Internet and installing a VPN is high…" (daughter of 60-year-old female client).

Guidelines and policies

The establishment of the Lipid and Glucose Study Center in Tehran (screening in three-year phases), endocrinology and metabolism centers, the compilation of the National Guidelines for Diabetes in Iran, and comprehensive health centers in all urban and rural areas have been facilitating measures at the public health policy level that health care workers and persons with diabetes noticed.

"There is a Glucose and Lipid Center, a national project investigating the risk factors of non-communicable diseases. This center has interacted with people of this region for about 20 years now. They take a series of tests, including fasting blood sugar, blood lipids, etc., every three years and fill out questionnaires. A few years ago, it did a series of interventions on lifestyle in the schools and large mosques for the people of this region. It showed how much it had reduced the progression rate of healthy individuals to prediabetic and from prediabetic to diabetic. This project is still going on, and people are at least aware of their blood sugar and fat. Most research projects are done and followed up in this center." (single, doctor, 60).

The barriers to public health policy understood by health counselors and adults with prediabetes include the filtering of social networks and low internet speed, lack of coherent and continuous diabetes prevention programs in comprehensive health centers, lack of a referral system from hospitals/private clinics to health centers, lack of a regular screening and referral program, lack of complementary medicine consultation centers beside modern medicine, and lack of scientific and specific tools for measuring and evaluating self-care behaviors in people with prediabetes.

"I do not know why they have filtered all social networks; what type of policy is this? I used to follow channels on Instagram and Telegram about exercise, general information, and cooking. By taking up this policy, they took away our easy access." (Female, married, 60).

Discussion

The main aim of this study was to investigate the barriers and facilitators of self-care in adults with prediabetes. According to the content analysis obtained through individual interviews, the results show that people with prediabetes face various barriers and facilitators at all levels of social-ecological model. The barriers and facilitators experienced by adults with prediabetes in Iran as a middle-income country are discussed below.

Individual level

The lack of knowledge has been highlighted in our study as a critical barrier to self-care behaviors by adults with prediabetes. A qualitative study from Iran supports our finding that prediabetics have inadequate knowledge regarding how to do physical activity [21].

A study by Ghisi et al. (2021) showed that, like people with diabetes, people with prediabetes cannot always follow a healthy diet for reasons such as financial problems and lack of knowledge and support [22]. Lim et al. (2019) assessed the barriers and facilitators of healthy eating in people with prediabetes in Singapore. They concluded that the lack of knowledge about healthy eating was one of the reasons for not meeting My Healthy Plate recommendations [23]. This study explained that knowing how healthy nutrition affects health is one of the most critical facilitators for meeting My Healthy Plate recommendations. These findings also confirm the results of the present study. A study by Kirsten J. Coppell et al. (2017), which was carried out to transfer nutritional knowledge to patients individually and in groups by nurses on diagnosis and three weeks, three months, and six months post-diagnosis, showed that this led to a significant weight loss in the intervention group compared to the control group. BMI and blood sugar decreased for three months in the intervention group [24].

Many factors, such as the individual's effort to acquire knowledge, the efforts of healthcare providers to prepare and compile appropriate content, the policies of health systems to make available the prepared content, and the interaction between clients and healthcare workers, are involved in the patients' acquisition of knowledge and

skills related to lifestyle change. However, according to a study by Lim et al. [23], the time mismatch between the classes and personal schedules may be one of the causes of patients' lack of nutritional knowledge. However, in the current study, Iranian adults with prediabetes said that the lack of suitable, coherent, and specific educational programs for people with prediabetes was the reason for their lack of sufficient knowledge.

Motivation has been one of the facilitators of self-care behavior in adults with prediabetes. Achieving health goals, such as returning glycemic indices to normal, losing weight, preventing the progression of prediabetes to diabetes, and the suffering that would result from its complications in adults with prediabetes have been mentioned as the critical motivations in most studies like the present study [25–27].

In a study by Man et al. (2020), which investigated independent and controlled motivation according to the theory of self-determination in people with prediabetes and its relationship with physical activity and control of blood sugar indicators, it was found that people with prediabetes who had decided to enjoy the positive effects of physical activity as part of their goals were more committed to doing their physical activity than people who were under pressure from others or had feelings of guilt or shame [28].

Lack of proper understanding of prediabetes, lack of awareness of its difference with type 2 diabetes, and the boundaries of each are other factors that people with prediabetes have repeatedly mentioned, both in the present study and in many other studies [29–31]. Misunderstanding in many cases resulted in the emergence of emotions with a negative burden, leading to denial and concealment of one's situation in adults with prediabetes [32].

The present study shows that some emotions, such as fear and concern, have negative effects. However, adults with prediabetes succeeded in managing them by knowing the cause of their occurrence in themselves using the experience they had in caring for people with diabetes. Some have experienced relief because they thought that prediabetes was not an actual disease [33] and not having symptoms meant the situation was not urgent [32]. Therefore, people with prediabetes experience a wide range of emotions, which can have different causes, such as lack of awareness, inadequate knowledge, incorrect understanding, and the experience of dealing with persons with diabetes.

Physical problems and injuries, especially in lower limbs, physical complications caused by aging, some underlying diseases, or the side effects of some medications are other barriers that affect the self-care process in adults with prediabetes. In this regard, a study by Lim et al. (2020), which examined the barriers and facilitators of physical activity, showed that adults with prediabetes do not have the knowledge and skills to exercise, which may increase their physical injuries. Some participants have mentioned their medical conditions and diseases, such as arthritis of the joints, as a barrier to engaging in physical activities, and fear of injury while doing physical activity is also specified as another barrier [34].

In the present study, the belief in not responding proactively to the disease at home, such as not buying a glucometer at home, was another barrier to self-monitoring in adults with prediabetes. In a study by Mishra et al. (2021), which assessed the reasons for non-participation in the yoga program for people at risk of diabetes, it was revealed that belief in traditional treatments and religious beliefs, such as the belief that God would restore their health was one of the barriers that, in some cases, even made patients discontinue medical consultation, blood tests, and their medicines [35].

The use of manual skills in adults with prediabetes has been among other strategies to control the situation. Adults with prediabetes tried to avoid stressful factors resulting in increased blood sugar and nervous overeating by taking up new hobbies. In this regard, a study by Amit Mishra et al. (2020) revealed that people with prediabetes with high perceived stress levels had higher HbA1C levels, which may be a critical factor in the progression of prediabetes into type 2 diabetes [36].

Interpersonal factors

In the present study, the self-care facilitators for adults with prediabetes at the interpersonal level included receiving educational support, counseling, and being accompanied by healthcare providers, peers, friends, and family members in implementing some self-care behaviors, such as walking or receiving periodical nutrition consultations.

Several studies have found that people with prediabetes repeatedly pointed to the lack of proper guidance and proper interactive relationships with health care providers, especially the doctor, as the first person they had contact with [15, 16, 18]. A study by Sungwon Yoon et al. (2022) aimed to identify facilitators and barriers to the reception of a community-based diabetes prevention program (DPP) from the perspective of people with prediabetes. This study showed that despite the strong interest of adults with prediabetes in receiving in-person recommendations from doctors, not receiving their recommendations from doctors and healthcare providers had become one of the critical barriers from a social point of view to the reception of this diabetes prevention program in Singapore [37]. The high number of patients and the low number of doctors have been mentioned as the reason for this problem [16]. This that the doctor

doesn't take the disease seriously has been mentioned by other studies as a factor [38].

Another facilitator mentioned by adults with prediabetes is receiving informal training and counseling from healthcare providers who are their family members, relatives, and friends. In the current study, adults with prediabetes were not members of specific prediabetes groups, and they were only supported by people with type 2 diabetes at the neighborhood and community levels. A study by Led ford et al. [39] assessed milestones affecting the health of people with prediabetes and diabetes; it is stated that receiving social support from peer groups, even online, helped people in self-care and did not allow them to feel lonely [39].

In a study by Dyeret al. (2020), it was said that women with prediabetes believed that peer groups with similar experiences are necessary but preferred membership in peer groups of the same gender to maintain privacy and self-confidence [40].

Female participants also pointed out other critical barriers, such as not receiving support from the spouse due to the spouse's mental disorder and, as a result, increased obligations and responsibilities in life and travel restrictions by a spouse. In a study by Azzi et al. [40], who investigated a group lifestyle intervention program, people with prediabetes admitted that they enjoyed being with their peer group and said that if their spouses participated in these cases, it would facilitate the desired changes at home [40].

Organizational and institutional factors

Adults with prediabetes have mentioned facilitators and barriers related to healthcare and non-healthcare systems. Municipal organizations, welfare affairs of universities, and occupational medicine departments of public and private organizations are non-healthcare organizations that facilitate self-care in adults. In addition to establishing physical structures, the above organizations have provided self-care for their clients by creating welfare facilities and regular and flexible procedures and programs. These include periodic health tests and tracking abnormal cases, establishing suitable sports spaces, providing self-service, changing food preparation, and increasing the right to choose food items. The most significant barrier related to the non-cooperation of the administration and management of the organizations is adapting the work hours, tasks, and job roles to the conditions of adults with prediabetes. It can be said that while the occupational medicine unit of the organizations may help to diagnose and inform their workers early about prediabetes following their periodical tests, it seems that the management style of organizations affects the process of performing and tracking self-care behaviors and changing lifestyles in adults with prediabetes. Lim et al. (2020) stated in their study that in addition to the flexible management of the organization, a flexible work environment, access to sports equipment and a place to exercise, and the existence of sports programs are among the facilitating factors for meeting the physical activity in people with prediabetes [23]. Other factors, such as the centralized management systems in organizations and lack of human resources and financial resources have reduced the flexibility of managers in organizations and led to their non-cooperation in adjusting the hours and work duties of their personnel. Other facilities related to the unique services for people with prediabetes and diabetes in comprehensive health centers, hospital diabetes clinics, and private clinics, such as the possibility of monthly blood sugar checks with a glucometer, access to a clinical psychologist, and accessible and interactive nutrition consultations have also increased for health organizations. In the current study, adults with prediabetes have rated the presence of psychologists in comprehensive health centers positively because they need to consult with a clinical psychologist to control nervous overeating and also to use non-pharmacological techniques instead of taking antidepressants (which cause depression and lethargy). In this regard, the study of Xia et al. [41] aimed to investigate the feasibility of delivering a low-dose mindfulness-based stress reduction (MBSR) intervention among prediabetes/diabetes patients in a clinical setting, it was determined that after eight sessions over 6–8 weeks, 90% of the participants in the intervention group had positive overall experience with the intervention. There was a significant reduction in depression score and Hemoglobin A1C [41].

Community factors

The results of the present study show that the prevailing values and culture of the society affect the marriage and physical activity of women diagnosed with prediabetes. Meanwhile, other studies have raised other cultural barriers related to having a healthy diet and the desire to comply with nutritional recommendations based on traditional foods [42]. In addition, the results of the present study revealed that although people have determined access to comprehensive health centers as one of the things that facilitate self-care, they have pointed to other barriers, such as the lack of reliable traditional or complementary medicine consultation centers, lack of access to sports consultations during physical injury, lack of proper and healthy cooking classes, and the need for improvement in the services and specialized consultations. Concerning health applications, adults with prediabetes use existing health applications that are not designed specifically for the Iranian society or people with prediabetes.

Most health applications in Iran, including those related to diabetes, have focused on the ease of use of the applications rather than enriching their scientific content [43].

Considering the importance of the existence of and access to health centers at the community level, the study by Campbell et al. [44] found that people who did not have access to health services, including the absence of a place where they could typically go to receive health care, and those who lacked health insurance were less aware of their prediabetic status [44], which can reduce their involvement in performing self-care behaviors.

Another issue that adults with prediabetes have raised regarding access to services at the community level is related to security. Security is especially important in physical activity, for example, in places for walking in big cities, and some studies have emphasized reliable transportation systems [45]and information sources [32].

Public policy factors

High costs related to transportation, Internet, following up laboratory tests or buying monitoring equipment, medicine, medical visits and specialized consultations, and gym memberships are among the critical financial barriers for adults with prediabetes. Also, in different studies, the increase in the educational program [30–46] and transportation costs [25] is mentioned by adults with prediabetes as a barrier.

Although there are basic and supplementary health insurances in Iran, some adults with prediabetes have not been able to receive health care services due to lack of insurance coverage. Employed people are covered by insurance through their jobs, and the source of income from their jobs is also mentioned as a facilitating factor. On the other hand, receiving monthly government financial aid, although small, has been a facilitator for many adults with prediabetes who receive it as a source of financial assistance.

DeJesus et al. (2018) studied a 12-week lifestyle modification coaching intervention by healthcare providers for people with prediabetes; they found that such programs are critical factors in reducing costs for people who want to change their lifestyles [47].

The present study has pointed to the establishment of the Lipid and Glucose Study Center of Tehran (screening in three-year phases), the development of the National Guidelines for Diabetes in Iran, and the existence of comprehensive health centers in all urban and rural areas as facilitating factors at the public health policy level by health care workers and adults. National diabetes prevention programs (DPP) are being implemented in public and private organizations worldwide so that people with prediabetes can receive care based on the results of evidence-based measures, and studies have also been done to investigate barriers and facilitators of their implementation [37, 46, 48].

Iran is also one of the countries trying to reduce the prevalence of diabetes and prediabetes by developing national guidelines for diabetes, establishing comprehensive health centers and endocrinology and metabolism research centers, and implementing lifestyle modification interventions [14]. However, the results of the present study indicate that the participants did not have the experience of participating in a coherent, comprehensive, and continuous program for people with prediabetes with their peers. Filtering social networks was a policy that limited the access of adults with prediabetes to many channels, web pages, educational programs, and digital software. In addition, from health care providers' point of view, the lack of regular screening and standard and local tools to monitor the self-care behaviors of these people to track and improve them in educational programs are other barriers. In this regard, other studies have found that people with prediabetes do not feel the need for screening due to the lack of physical symptoms [31, 35] or do not know about the existence and possibility of screening [49], and some societies have no screening facilities and policies [30].

Overall, the study discovered that sanctions, Internet filtering, and a lack of screening and referral systems are the main obstacles to self-care in prediabetes. Insufficient knowledge, lack of peer groups, and limited access to supportive experts are other major barriers to self-care.

The results of this study will help promote self-care interventions for people with prediabetes. For example, nurses can create applications (online and offline) with different features, such as discussion peer group forums, online consultations, and access to up-to-date educational materials, which can overcome many of the obstacles mentioned at different levels (e.g., lack of knowledge, lack of time, and lack of access to expert staff and peer groups).Considering the lack of referral and screening systems for prediabetes, as well as the availability of laboratory results in hospital laboratory databases, Health policymakers and health organizations can train specialists and implement interventions like Nurse-Led clinics, Nurse-Led Navigator health promotion programs, and eHealth Interventions (such as web portals and offline or online health apps) to encourage self-care behaviors in people with prediabetes.

A key finding of this study was that women face safety and freedom concerns when performing self-care behaviors. This raises the need for special attention to women in self-care programs in countries with similar cultural values and beliefs. In Iran and other Muslim countries, women cannot exercise in public places such as parks without wearing a proper hijab or permission from their

husbands. Healthcare professionals should consider cultural and religious factors when delivering interventions and choosing a more acceptable approach for clients.

The results of the present study come from a society whose health system has been focused on the treatment of diseases for years, and it is only during the last one to two decades that the health system transformation plan has focused on prevention. Most health system policies in Iran have focused on the treatment of diabetes and its complications rather than its prevention. This may have affected the results of the present study. Therefore, the results of this study can play a more effective role in health policymaking in countries with health systems similar to Iran. In addition, since Iran is a middle-income country, and some of the obstacles in this study point to the lack of facilities and equipment at the community level, or the low financial level, countries with a similar economic level can use the results of the current study.

In general, due to the high prevalence of diabetes in all world societies and the need to prevent it, all countries can improve programs and interventions based on the results of the present study, which do not conflict with the culture of their society.

In addition to diabetes, the results of the present study can help to improve prevention programs for other non-communicable diseases in society (such as cardiovascular diseases and their risk factors such as obesity, increased blood fat, and blood pressure).

Strengths and limitations of the study

The present study is one of the few studies that examine the barriers and facilitators of self-care behaviors in adults with prediabetes in Iran from the point of view of participants with maximum diversity and various healthcare workers through interviews to collect richer data. The results of this study can be the basis for many studies related to adults with prediabetes in Iran and other parts of the world. In addition to the obstacles, referring to the facilitators in the present study also helps other societies identify the potential in their society at different individual and non-individual levels of disease prevention. Due to the lack of access to macro-policymakers in healthcare, this study has not investigated the barriers and facilitators at the level of national-global collaboration concerning adults with prediabetes at the public policy level.

Conclusion

The results of the present study indicated that adults with prediabetes face different barriers to and facilitators of performing self-care behaviors.

Our findings suggest that a multilevel approach is needed to address these barriers and facilitators. These findings will guide strategies to develop programs that impart knowledge and skills to improve the self-care behaviors of people with prediabetes.

Among the most significant barriers and facilitators mentioned by adults with prediabetes in Iran, we can point to the need for consistent and regular prediabetes screening programs, comprehensive and practical training programs, and prediabetes management through an interdisciplinary team. Empowering healthcare workers, according to the latest evidence, ensures that the training is not repetitive [16, 18, 23].

Improving the quality of interactive communication between adults with prediabetes and doctors, membership in peer groups, improving the skill of setting individual health goals, and designing valid, reliable tools to review the level of self-care behaviors and the control of glycemic indices are among critical things that deserve attention to increase the adherence and involvement of adults in performing self-care behaviors and curb the impact of inhibiting negative emotions.

Considering the time limit in self-care, designing and implementing interactive and native virtual applications is a priority. In addition, awareness about prediabetic conditions, especially among women, should be promoted in the community and the workplace to increase the officials' flexibility [16, 18, 23].

Supplementary Information

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Supplementary Material 1

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Authors' contributions
MZ, AE, and AM supervised this study. All authors designed the study and cooperated in composing, reviewing, and correcting the written version. MZ, AE, and MJ prepared the interview guide. MJ and MR conducted the interviews. MZ, AE, and MJ analyzed the interviews. All authors contributed to the article and approved the submitted version.

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Data availability
The original contributions presented in the study are included in the article/supplementary material; further inquiries can be directed to the corresponding author.

Declarations

Ethics approval and consent to participate
Shahid Beheshti University of Medical Sciences reviewed and approved the studies involving human participants. The patients/participants provided written informed consent to participate in this study.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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