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Challenges and needs in the management of non-alcoholic fatty liver disease from the perspective of gastroenterology and hepatology specialists: a qualitative study

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Abstract

Background Non-alcoholic fatty liver disease (NAFLD) is the most common liver disease worldwide, and it poses a significant threat to public health. There is insufficient documented evidence about the problems and needs of patients and physicians in managing NAFLD. This study aimed to explore the challenges and needs in managing NAFLD from the perspective of gastroenterology and hepatology (GH) specialists.

Methods This qualitative study was conducted from January to September 2023. Fifteen Iranian GH specialists selected by purposive sampling. Data were collected through semi-structured interviews. The interviews were analyzed inductively using the Elo and Kyngas content analysis approach. The criteria proposed by Guba and Lincoln were used to ensure the study's validity.

Results The identified challenges were divided into thirteen main categories (34 subcategories and 117 primary codes), and the identified needs were divided into eight main categories (21 subcategories and 97 primary codes). The main categories of the challenges were chronic nature and time-consuming differential diagnosis, complex treatment process, defects in the patient management process, shortcomings of the healthcare system, the effect of unhealthy eating and cultural and social factors on the diet, incorrect attitude of patients, lack of knowledge and awareness of patients, lack of comprehensive treatment plans based on patients' conditions, defect in knowledge and awareness of physicians, inadequate cooperation of patients, defects in the process of recording and monitoring information and providing feedback, insufficient policies and plans in the prevention of NAFLD, and economic problems. The main categories of needs included developing a comprehensive treatment plan, updating physicians' knowledge and creating standard treatment protocols, changing attitudes and empowering patients, informing and educating patients, establishing multi-specialty clinics for NAFLD treatment, establishing peer support groups and facilitating communication, utilizing digital technology to track patient information and monitor their progress, and supportive, educational, prevention, and management policies in the treatment of NAFLD.

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Conclusions This study showed that managing NAFLD involves physical, psychological, nutritional, sports, economic, and social aspects and requires multidisciplinary clinical approaches, digital technologies, and supportive and educational policies. These findings have important implications that can help patients, physicians, and policymakers design better lifestyle prescriptions to manage NAFLD.

Keywords Nonalcoholic fatty liver disease (NAFLD), Specialists, Challenges, Needs assessment, Content analysis, Qualitative study

Background

Non-alcoholic fatty liver disease (NAFLD) is a chronic liver disease and the most common liver condition worldwide. It is mainly related to an unhealthy diet, inactivity, and overweight. NAFLD prevalence is on the increase, and it is a significant public health concern [1]. It is estimated that 20–30% of the adult population of the world [2, 3] and Iran [4] suffers from this condition, and it is more prevalent among individuals with type 2 diabetes mellitus (T2DM) and severe obesity [5]. NALFD includes a spectrum of liver pathologies from simple steatosis to non-alcoholic steatohepatitis (NASH), advanced fibrosis, cirrhosis, and hepatocellular carcinoma (HCC) [6]. It is essential to treat and manage NAFLD because excessive liver fat is an independent risk factor in developing other conditions like diabetes and cardiovascular diseases [5], making NAFLD a significant health problem worldwide [7]. Moreover, it is expected that, by 2030, NAFLD will be the leading cause of liver disease-related death [8], cirrhosis, and hepatocellular carcinoma, none of which has a definitive treatment [9]. The progression of NAFLD not only imposes a clinical burden on patients but also affects their survival rate and quality of life [10]. It is estimated that annually, 10,000 Iranians suffer from liver failure, and 5000 of them lose their lives [11]. Despite the large number of studies being conducted to treat NAFLD, there is an absence of practical advice to develop services and provide suitable care for this disease [12]. Besides that, until now, no confirmed medication has been introduced to treat this disease. Changes in diet, more physical activity and exercise to lose weight, and lifestyle modification have been the principal therapeutic and management recommendations for this condition [13, 14]. In clinical practice, patients with NASH and NAFLD manage this condition by making and sustaining the necessary lifestyle changes [15]. Studies have demonstrated that lifestyle interventions have a significant clinical impact on reducing liver fat and inflammation in patients with NAFLD [16, 17]. Liver inflammation and fibrosis can be improved or reversed with weight loss of 7–10% [18].

Due to the effectiveness of lifestyle interventions in the management of NAFLD [14], in recent years, various guidelines have been published to manage NAFLD, regardless of disease severity [19–21]. However, there is a gap between the recommended clinical behaviors and the actual care delivery [22], and no defined clinical lifestyle pathway exists [23]. The successful management of NAFLD remains an essential challenge for patients and healthcare providers (HCPs) [22, 24–25]. Modifying lifestyle, losing weight, changing behaviors, and maintaining healthy ones are complicated for NAFLD patients, and there is little information about the barriers they encounter [26, 27]. Therefore, HCPs have a crucial role in this process. In the treatment process, HCPs have the most contact with the patients; they deliver vital information and instructions to help them overcome problems and constantly encourage them to maintain healthy behaviors [28]. Exploring HCPs' experiences via a qualitative approach will provide valuable insights to perceive their challenges and needs more effectively in NAFLD management. Quantitative studies answer many important questions in clinical research, but qualitative methods best address why, how, contexts, and individuals' experiences [29]. In developed countries, few qualitative studies have been conducted on the experiences of patients and HCPs in managing NAFLD [24, 25, 30–33]. For example, Hallsworth et al. [24] showed that environmental context and resources, memory, attention and decision processes, goals, behavioral regulation, skills, and knowledge act as essential barriers/facilitators for diagnosing and managing NAFLD. Mayr et al. [31] stated that improvement in the quality of diet, in-depth knowledge of the dietary pattern, access to patient education, and monitoring resources act as facilitators, but diverse cultural and socioeconomic backgrounds, limited clinician training, and lack of time and resources to support behavior change act as barriers to adopting the Mediterranean diet for management of NAFLD. In China, another study showed [33] that lack of time and energy, lack of awareness of weight, lack of attention to NAFLD, treating food as a reward or compensation, and social entertainment act as barriers, and having basic weight loss knowledge and skills, strong motivation, attention to NAFLD, and positive feedback act as facilitators to the weight management of patients with NAFLD.

Even though NAFLD has become a health challenge in Iran [34], to the best of our knowledge, no qualitative study has been conducted to investigate the perspectives and perceptions of gastroenterology and hepatology (GH) specialists on this subject. The Iranian studies on NAFLD have mainly used the quantitative approach and

focused on subjects such as the prevalence rate [34, 35], identification of the risk factors [36, 37], dietary patterns [38], and educational interventions on NAFLD [39]. GH specialists play an essential role in managing and treating NAFLD, including evaluating the severity and stage of the disease and screening the patients [40]. Eliciting GH specialists' opinions to determine their needs and the focus of intervention is necessary. Moreover, the understanding and attitudes of people in different countries are probably diverse due to the differences in health literacy, cultural values, level of trust in physicians, the healthcare system, and their level of access to healthcare [41]. Due to the few GH specialists in Iran and the large number of patient visits, evaluating their perspectives and experiences helps identify the barriers to and necessities of disease management and develop new therapeutics. Therefore, this study aimed to explore and understand the needs and challenges of NAFLD management from the perspective of GH specialists in Iran.

Methods

Design and settings

This qualitative study was conducted with a conventional content analysis approach from January to September 2023. The content analysis approach is a systematic and rule-based classification and description of textual content by examining words, phrases, latent content, and contexts [42, 43]. The setting of this study was the Adult Gastroenterology and Hepatology (AGH) Research Center of Afzalipour Medical Teaching Hospital, affiliated with Kerman University of Medical Sciences (KUMS), located in Kerman. Kerman is the largest province and metropolis in southeastern Iran, with a population of 800,000. The AGH Research Center is the only research center focusing on this disease in southeast Iran. The city of Kerman has the most gastroenterology and hepatology offices in the province, and they receive patients from a radius of 500 km in southeast Iran. AGH Research Center members include GH specialists, each working either at the Kerman University of Medical Sciences or at offices in Kerman City. The general goals of the AGH Research Center are to conduct basic and applied research focusing on gastrointestinal and liver cancers, functional diseases of the gastrointestinal tract, viral hepatitis, infectious and parasitic diseases causing liver complications, autoimmune diseases, obesity, and related complications (including Fatty liver), and liver diseases caused by toxins and drugs.

Table 1 Demographic characteristics of the specialists

Variables	*N*(%)
Age	
50–55 years	5(33.3)
56–60 years	4(26.7)
61–65 years	5(33.3)
66–70 years	1(6.7)
Gender	
Male	10(66.7)
Female	5(33.3)
Work Experience	
10–15 years	3(20)
16–20 years	5(33.3)
21–25 years	5(33.3)
26 years and more	2(13.3)
Work Experience in Office	
10–15 years	9(60)
16–20 years	5(33.3)
21–25 years	1(6.7)

Participants and sampling

The participants in this study were GH specialists who are members of the AGH Research Center. Almost all of the specialists in Kerman are main or honorary members of the AGH Research Center. This study applied the purposeful sampling method [44] to select the participants. The research team selected participants who met the inclusion criteria, were representative of their peers, and spoke with openness. The sampling continued until data saturation was achieved with a maximum diversity of participants to obtain their rich and diverse perspectives and experiences. The specialists, who were AGH Research Center members, were selected with the following inclusion criteria: 1- specializing in gastroenterology and hepatology, 2- at least ten years of medical experience, and 3- practicing medicine in offices or medical centers in Kerman City. Specialists with different genders, ages, and work experience (years) were recruited. The final selected sample included 15 specialists (Table 1).

Data collection

Data were collected using face-to-face, semi-structured, in-depth interviews using an interview guide (see Additional File 1). This guide included questions prepared by the research team in a research panel with medical informatics specialists (one faculty member and one PhD student), a nurse with a background in community health nursing and experienced in in-depth interviews for qualitative research, and GH specialists (two subspecialists), based on the literature review [9, 20] and the purpose of the study. Three research team members (FS, SS, and AS) have received formal academic training in qualitative research methods. The guide included two categories of questions: main questions and probing qualitative interview questions. Different trigger questions were initially planned and asked to create a comfortable environment and provide quick answers from the participants using qualitative techniques. Then, interview questions sought participants' experiences and perspectives on

the challenges and needs in managing fatty liver disease. After each interview, changes were made in the guide to help conduct the next interview in an optimal manner.

The first researcher (FS), who had the necessary experience and training to conduct qualitative research, completed all the interviews in Persian under the second researcher's supervision (SS). Then, the interviews were translated into English. At the beginning of each interview, verbal and written consent and socio-demographic information were obtained from the interviewees. The questions were asked according to the interview guide. The interviews with specialists were conducted in a quiet room at the AGH Research Center. In cooperation with the head of this center, the first researcher selected a list of eligible specialists who were members of the center, and then the specialists were contacted. The study's objectives were explained to them, they were invited to participate, and the interview date was set. The interviews with the specialists lasted 60 to 90 min. If the specialists required more time, a second interview session was scheduled. All interviews were audio-recorded, and field notes were taken during and after. At the end of each interview session, all recordings for specialists were anonymized using the labels P1 to P15.

Data analysis

The data were analyzed using the conventional content analysis method described by Elo and Kyngas [45]. In conventional content analysis (used inductively), the categories are derived from the text data. This method uses a systematic process, including the three stages of preparation, organization, and reporting results, to describe a specific phenomenon. The three-step analysis process also helps the researcher gain a precise understanding of the participants' experiences [45].

The preparation stage begins with the selection of the unit of analysis. According to Granheim and Lundman [46], the most appropriate unit of analysis is whole interviews or observation protocols that are large enough to be considered as a whole and small enough to be kept in mind as a context for the unit of meaning during the analysis process. According to Colin [47], researchers are guided by the purpose and research question of the study in choosing the content they analyze. Therefore, based on the research purpose, the selected unit of analysis was "Challenges and needs in the management of non-alcoholic fatty liver disease." Following this stage, in the analysis process, the researcher tries to make sense of the data, learn "what is going on," and get a sense of the whole. Therefore, the first author (FS) separately listened to the recorded interviews several times immediately after each and transcribed them verbatim in Microsoft Office Word. Three authors (FS, SS, and AS) reviewed the transcribed text of the interviews several times to understand the data, determine meaning units, and interpret the data independently.

The qualitative data is organized in the organization stage. This process includes open coding, creating categories, and abstraction. In the open coding, the interview's written text is read several times; notes and headings are written in the margins of the text to describe all aspects of the content. Then, the headings are collected from the margins and transferred to coding sheets, and categories are freely generated [45]. In creating categories, the list of categories is grouped under higher-order headings. Data grouping aims to reduce the number of categories by placing them under broader, higher-order categories based on similarities and differences. The researcher reaches a decision, through interpretation, as to which items should be put in the same category [45]. Abstraction means formulating a general description of the research topic by generating categories. Each category is named using content-characteristic words. Subcategories with similar events and incidents are grouped as categories, and similar categories are grouped as main categories. The abstraction process continues as far as is reasonable and possible [45].

Finally, the findings were summarized in the reporting stage, and the researchers extracted the data concepts. The three researchers (FS, SS, and AS) individually did the open coding, category creation, and abstraction. They merged the codes, classified them according to their similarities, and created subcategories independently. The main categories were created by grouping subcategories with similar content. In an iterative process, the subcategories and main categories were created by collapsing similar or dissimilar content, and the researchers developed the coding scheme (code names, code definitions, categories, subcategories, text examples, and coding rules). The researchers met regularly during the analysis to discuss agreements and discrepancies in the assigned codes, categories, and subcategories. Subcategories and categories that differed were discussed until a consensus was reached. Moreover, an external qualitative research expert reviewed and approved the coding process and categories, which led to further modifications. Data coding and analysis were done using MAXQDA10.

Data trustworthiness criteria, such as credibility, transferability, confirmability, and dependability, proposed by Lincoln and Guba [46], were used to ensure the accuracy and reliability of the qualitative data. The study's credibility was provided by long engagement with the participants, the audio recordings, and the transcriptions to ensure the correct representation of the participants' views. A data-rich description of the study settings and process involved is provided to allow readers to judge the relevance of the results to their settings and to allow the transferability of research findings to similar contexts.

We used an audit trail to ensure conformability and dependability, including audio recordings, transcripts, interview guides, data analysis products, purposively selected participants, and field notes. Three research team members encoded the data separately and reached a final agreement through discussion. In addition, participants were provided with a summary of the interviews and results and were asked to give feedback on the findings. Also, this study uses the consolidated criteria for reporting qualitative studies (COREQ) [48]. The COREQ checklist is provided in Additional File 2.

Results

Demographic characteristics of participants

Table 1 shows the demographic characteristics of the participants. The study participants were 15 GH specialists with offices in Kerman City. Ten of these specialists were members of the university's academic faculty. Five participants requested a second interview session. The specialists were ten men and five women aged 50–70 years with work experiences ranging from 10 to 35 years. The primary codes for the identified challenges and needs are presented respectively in Tables 2 and 3, along with some exemplary quotes. The identified challenges were assigned to thirteen main categories, with 34 subcategories and 117 primary codes (Table 4). The identified needs were assigned to eight main categories, including 21 subcategories and 97 primary codes (Table 5).

Challenges in the management of NAFLD

Main category 1: chronic nature and time-consuming differential diagnosis

The GH specialists stated that because NALFD is asymptomatic in the early stages, the patients are unaware of their condition. The symptoms are present only in the advanced stages of the disease, and the patients' late visits to the physician become the most critical problem specialists encounter in treating the disease (Table 2, Sample of Quotes, Row 1). NALFD's connection to metabolic syndrome and other underlying conditions (cardiovascular diseases, diabetes, etc.) makes the physicians consider many parameters to rule out other diseases, making it challenging and time-consuming to diagnose. In addition, the usual means of diagnosis, such as ultrasound and blood tests (liver enzymes), are not enough to diagnose this condition. Also, in some cases, lab results can be normal in the early stages of the disease (Table 2, Sample of Quotes, Row 2).

Main category 2: complex treatment process and weakness of judgment criteria

The GH specialists stated that some underlying conditions, such as mental problems like binge eating, psychosomatic disorders, and the onset of overweight from childhood, make it harder to treat NAFLD and discourage the patients from following the treatment (Table 2, Sample of Quotes, Row 3). The GH specialists pointed out that there is no specific treatment for this disease, except for the patients to change their lifestyles effectively. However, this course of treatment is long-term and challenging for patients, and it is not easy to make them understand the situation. The lack of a standard protocol for treatment makes primary care providers (PCPs), especially general physicians, treat patients arbitrarily. Additionally, the guideline recommendations for treating NAFLD lack the necessary detail and are not adaptable to the characteristics of Iranian society (Table 2, Sample of Quotes, Row 4). According to these specialists, the evaluation of clinical parameters, such as lab results, metabolic profiles, weight, body mass index (BMI), etc., is not sufficient for physicians to determine the situation or for patients to follow the treatment without taking into account other factors, such as dietary situation and the level of physical activity (Table 2, Sample of Quotes, Row 5).

Main category 3: defects in the patient management process

The GH specialists considered the following as problems that have adverse effects on NAFLD treatment: lack of monitoring by the treatment team, lack of continuous communication between the treatment team and the patients and their families, and the absence of a specific and systematic mechanism for follow-up (Table 2, column, Sample of Quotes, Row 6). Also, because of the many patients referring to offices, GH specialists have problems educating and informing them and keeping track of the following appointments (Table 2, Sample of Quotes, Row 7). The treatment of NAFLD requires teamwork and communication among different specialists, which is yet to be achieved in NAFLD treatment. Moreover, no NAFLD-specific medical team is available for patients to refer to if necessary (Table 2, Sample of Quotes, Row 8).

Main category 4: shortcomings of the healthcare system in providing specialized and consulting services

Some patients are not inclined to visit various specialists due to their financial situation, lack of time, and personal reasons. Besides, diagnostic equipment (such as a FibroScan) is not available in all medical centers. Not all cities have GH specialists, so the patients must travel long distances or altogether discontinue their treatment (Table 2, Sample of Quotes, Row 9). The lack of educational and consulting sections specific to treating NAFLD patients is among the problems affecting their treatment (Table 2, Sample of Quotes, Row 10).

Main Category 5: The effect of unhealthy eating and cultural and social factors on the diet of patients.

Table 2 Primary codes and sample of quotes of challenges

Number	Primary codes of challenges	Sample of Quotes*
1	*Being asymptomatic in the early stages of NAFLD *The appearance of symptoms of NAFLD in advanced stages *Being unaware of the disease in patients *Late visits of patients to the physician	*"NAFLD being asymptomatic is one of the most critical problems for us doctors. When this disease becomes symptomatic in patients, it may indicate that patients have complications such as cirrhosis or even cancer" (p12). *"Some patients who come to the office do not have any abnormal findings in their examination, and they are asymptomatic in the early stages of NAFLD. When the disease progresses, then the person becomes symptomatic!" (p1). *"The most important problem that exists in our society right now is that patients with NAFLD are not aware of their disease and come to a stage where the disease may have progressed to a great extent" (p10).
2	*Comorbidities associated with NAFLD *Relationship of NAFLD with Metabolic Syndrome *Examination of many parameters for accurate diagnosis of NAFLD *Inaccuracy of the results of some diagnostic methods *Normal laboratory results in patients	*"If a patient presents with fatty liver reported in his ultrasound and his Liver Function Tests (LFTs) are disturbed, or if he is obese, without further tests, we can essentially assume that the patient has NAFLD. However, from the point of view of medical science, we have to prove it and rule out other possible diseases that complicate the diagnosis process" (p6). *"NAFLD is associated with metabolic diseases, and the symptoms that patients have may be due to other diseases such as heart disease, diabetes, etc" (p5). *"Although NAFLD is a disease with high prevalence and its diagnosis is easy, physicians have to do a lot of investigations to reach an accurate diagnosis of the disease. Patients with NAFLD need to check a metabolic profile and other diseases such as hepatitis B and C, celiac disease, etc. In addition, many parameters such as tests, metabolic status, weight, and body mass of patients should also be checked. Without these data, limitations will be created for physicians to diagnose NAFLD accurately" (p1). *"The results of some conventional methods for diagnosing NAFLD, such as ultrasound, cannot be trusted because determining the grade of the disease (grade 1 or 2 or 3 or…) depends on the experience and interpretation of radiologists and needs to be more accurate" (p14).
3	*Bulimia nervosa and mental disorders *Psychosomatic problems and depression *Childhood obesity and more complex treatment of NAFLD *People's inactivity and increasing the prevalence of NAFLD	*"The most common cause of obesity is bulimia nervosa, and many patients with NAFLD have bulimia nervosa and need to be treated for mental disorders. A psychiatrist should also visit these patients to treat their bulimia nervosa" (p14). *"Many patients with NAFLD have psychosomatic problems or depression. For example, I had a patient whom I advised not to eat dinner as much as possible, but he said that if I didn't eat, I would get a headache or I wouldn't sleep! This shows that these patients have mental and emotional problems, and these problems cause overweight in these patients and worsen their condition" (p1). *"People's lifestyles are no longer the same as before. People were more physically active in the past, but today, due to urbanization and changes in people's lifestyles, people's mobility has decreased significantly compared to the past. Also, many people's jobs require them to sit for hours without the necessary movement and do not have the required movement during work, which has caused obesity and increased the prevalence of NAFLD in society" (p4).
4	*Lack of specific treatment for NAFLD *Absence of standard treatment protocols *The lack of details of guidelines' recommendations *The time-consuming process of treating patients *Slow response of patients to treatment	*"We do not have a specific treatment for NAFLD. The treatment of this disease is based on lifestyle modification, and we must explain to patients that they must change their lifestyle, which is very difficult" (p5). *"Diagnosis and treatment of NAFLD should be based on physicians' treatment protocols. Unfortunately, in offices and other clinics, there are no protocols for physicians (especially general practitioners) to treat patients" (p7). *"Guidelines for managing NAFLD are primarily general, and some recommendations are unsuitable for our society. For example, the guidelines recommend a Mediterranean diet for patients with NAFLD, but these diets are not suitable for the nutritional pattern in Iran" (p9). *"The treatment of NAFLD is time-consuming, and it depends on the patients' follow-up. If the patients adhere to the treatment and follow the diet and exercise, they will be cured faster. However, patients are different, and some may be treated later. Patients should not expect to be cured quickly and know that weight loss is time-consuming" (p11).

Table 2 (continued)

Number	Primary codes of challenges	Sample of Quotes*
5	*Inadequacy of clinical parameters to judge the disease status *Inadequacy of clinical parameters to evaluate adherence to treatment	*"To see if the patient's condition improves after a few months, I usually check the patient's tests, metabolic profile, FBS, HDL, LDL, TG, waist circumference, arm circumference, weight, BMI, and other parameters. The examination partially shows whether the patient's condition is improving! However, judging the condition of patients based on these parameters without considering different parameters such as nutritional status, physical activity level, and mental and emotional status is not accurate" (p3). *"The problem we physicians have is that we do not have a mechanism to determine whether patients have complied with treatment! Our current solution is only to examine clinical parameters such as tests or to verbally ask patients how much they followed their treatment plan" (p8).
6	*Lack of continuous monitoring of patients by the treatment team *Defects in the follow-up mechanism of patients *Lack of continuous communication between the treatment team and patients and their relatives	*"Many patients suffering from NAFLD can improve their condition by implementing lifestyle changes and losing weight. However, it is observed that some patients do not follow their treatment plan diligently or stop following it altogether, assuming that they are cured. Some of these patients may gain weight again, worsening their condition. In my opinion, a lack of continuous monitoring of patients could be a contributing factor in the aggravation of the disease" (p1). *"We have a problem with the follow-up of patients with NAFLD. That is, we do not have a clear and systematic mechanism for following up and monitoring patients. We cannot collect patients' data, and we do not have a solution or tools to monitor patients appropriately during the treatment period" (p13). *"Physicians and patients often have brief face-to-face visits, which can result in a lack of communication. This can lead to patients losing trust in their physicians and seeking alternative treatments from individuals who may not have the necessary expertise. These individuals may claim to treat NAFLD with medicinal plants" (p1).
7	*A large number of visiting patients and overcrowded offices *Lack of time for physicians to educate and inform patients *Inability to manage patients' follow-up visits	*"I am facing a problem in my office due to the high volume of patients and the busy schedule, making it difficult to manage them efficiently. Though I try my best to communicate with patients and provide them with the necessary information and knowledge to treat their disease, I may not be able to spend enough time with some patients" (p9). *"I inform my patients as much as possible about their treatment, which involves exercise, lifestyle modifications, and proper nutrition. I emphasize to my patients that weight loss is necessary for their treatment. However, due to the high number of patients, we have limited time to educate and inform them" (p2). *"I do not have statistics on the percentage of patients returning for follow-up treatment after their initial visit. Some patients do not return after one or two visits" (p11).
8	*Lack of communication and coordination between the required specialties *Absence of specific treatment groups for NAFLD *Absence of a common communication language	*"There is no coordination and effective communication between different specialties in the treatment process of NAFLD. This disease should be investigated from various aspects, and the cooperation of other specialties, such as nutritionists, sports, endocrinologists, radiologists, cardiologists, etc., is needed. These specialties exist, but coordination is required between them to manage and treat NAFLD effectively and permanently" (p8). *"Patients with NAFLD often lack support groups or treatment options. If needed, patients need to be referred to specialists in various fields such as nutrition, digestion, and endocrinology. These patients should be visited by a medical team of experts from different specialties" (p4). *"A major issue in treating NAFLD is the lack of a common language and understanding between physicians, patients, policymakers, and other parties involved in its management. For effective communication, all individuals treating NAFLD must have a mutual understanding of perspectives" (p11).

Table 2 (continued)

Number	Primary codes of challenges	Sample of Quotes*
9	* Absence of specialized centers for NAFLD * The unwillingness of patients to refer to different medical centers * Lack of diagnostic facilities in medical centers * Lack of specialists in other cities	*"There are no specialized centers that provide specialized services such as nutritional and sports consultations, drug treatments, and diagnostic tests such as ultrasound and FibroScan" (p9). *"Some patients do not like to be referred to different physicians, and many do not have the time or financial ability to visit different physicians (p4)". *"Patients with NAFLD often have to perform various diagnostic tests, but diagnostic and laboratory facilities are only available in some medical centers and offices" (p8). *"I usually advise patients who come to the office from far away places to see specialists in their city. However, patients say there are insufficient specialists in their town or no appropriate laboratory and imaging facilities. For example, fibro scanning is not performed in every town, and hepatology specialists do not work in every city" (p6).
10	*Absence of counseling and training departments in medical centers *Absence of face-to-face and virtual counseling and training centers specific to NAFLD *Lack of education to patients during the treatment periods	*"In some medical centers, counseling or education departments have been set up for patients with diseases such as diabetes, high blood pressure, and celiac disease. However, for NAFLD, even despite its high prevalence, there are no such departments" (p14). *"Patients should receive education on a healthy diet. For example, they should be trained to calculate their body's caloric intake. Nutritional counseling should also be provided. Many patients need to be trained to manage their disease, and there are no centers to refer to for advice and training" (p3). *"One of the significant deficiencies in the management of NAFLD is the lack of online counseling sites for patients with NAFLD. These consultations can help patients who do not have the opportunity to see a physician regularly or patients who live in remote areas" (p1).
11	*Eating unhealthy food *Increasing the consumption of fast foods and prepared foods in society *Less consumption of beans, grains, and vegetables	*"In our society, improper diet and excessive consumption of fast foods have become very popular. Preparing healthy foods at home and consuming legumes, grains, and fresh vegetables in Iranian households has decreased" (p6). *"Unfortunately, in society, people have started consuming ready-made and instant foods such as fast foods, which, in addition to having many calories, use low-quality ingredients in their preparation" (p9).
12	*Restriction of some family customs and traditions on diet *Wrong eating habits of patients *Eating at irregular hours	*"Local customs in Iranian households can be one of the obstacles in managing NAFLD. For example, I had a patient from Iranshahr who was very surprised when I told him he should not eat dinner! Eating dinner was a common culture in their family and city! I had patients who raised sheep in their place of residence, and the majority of their meals consisted of red meat. When I told them that they should reduce the consumption of red meat, they were shocked because it was a common food habit for them!" (p7). *"When I ask patients in the office about their diet, they state that they eat irregularly throughout the day and do not follow a regular and structured meal plan. This irregularity in personal life is one factor that aggravates NAFLD" (p1).
13	*Eating non-diet food at work *Eating non-diet food at home *Lack of time for patients to prepare food at home	*"Some patients report having to eat work-provided meals that do not align with their diet due to job restrictions, such as working multiple shifts" (p10). *"Many patients have to eat food prepared at home with other family members. This may make it difficult for them to follow their diet! For example, olive oil cannot be substituted for frying oils" (p3). *"Due to busy work, some patients need more time to prepare food at home and use easily made meals such as fast food. These foods may be prepared from low-quality materials, and their consumption may cause obesity and worsen the severity of the disease in patients" (p11).

Table 2 (continued)

Number	Primary codes of challenges	Sample of Quotes*
14	*Patients' belief that they do not have a disease *Failure to take the disease seriously by patients *Patients' fear of NAFLD in the early stages	*"Sometimes, patients do liver tests, and the results are normal. This creates a false mentality in them that because my test results are somewhat normal, therefore, I do not have NAFLD! However, these tests alone may not indicate the presence or absence of NAFLD if there is a liver disease and the patient's liver enzymes may not be high. This makes patients not consider their illness serious" (p2). *"When patients first come to my office, they are often afraid. My first step is to try to alleviate their fears by explaining that the fat on their liver is also present in other parts of their body, including their heart. I explain that this is somewhat normal and that losing weight is the best treatment. during this conversation, I make them feel at ease. However, sometimes, when patients feel relieved, they may not take their illness as seriously as they should. This is an important issue that needs to be addressed" (p13).
15	*Patients' lack of belief in lifestyle modification as a treatment method *Patients' belief in herbal and traditional treatment methods *Refer to different people to get immediate treatment *Rush to be treated immediately in patients *Patients' belief in taking medicine for treatment	*"Patients usually do not believe that the only effective way to treat their NAFLD is to modify their lifestyle. So, they look for medicine; if they do not find it, they go to traditional medicine specialists or other people to give them medicine! Moreover, these unapproved drugs (mostly herbal drugs) are often not only not helpful but may also be harmful to their liver. In my opinion, this is the biggest challenge for us physicians" (p6). *"Patients often turn to herbal and traditional medicine when dealing with NAFLD. However, this is not the recommended primary treatment for the condition. Despite my advice and emphasis on lifestyle changes for a cure, many patients choose to rely on unapproved medicines and supplements, particularly herbal ones, due to the influence of advertisements. This can be detrimental to their health, as they may fail to follow up on their condition and miss out on crucial treatments" (p14). *"Patients refer to different physicians and are primarily looking for the physician who will give them the answer they like and believe in. They also seek easy and immediate solutions to treat their illness" (p1). *"Patients like to take medicine and believe that if they take it, their fatty liver will be cured, but it is not. We can give medicine to patients in limited cases" (p4).
16	*Patients' lack of belief in treatment follow-up *Decreasing motivation of patients during the treatment period *Patients' lack of persistence during the treatment period	*"I have had many patients who do not follow their treatment after a while. Because patients expect to get an answer from the treatment soon, they turn to other treatment methods after a while. The patients' view of NAFLD is wrong, and they should be aware that the treatment of NAFLD will only be achieved through modifying their lifestyle" (p9). *"Some patients do not return to continue their treatment after a while and need more motivation to diet or exercise. There are several reasons for the decrease in patients' motivation. One reason is related to patients' beliefs that they expect to get well quickly by exercising and dieting. However, this mentality is wrong. The fat built upon the liver has been built up over many years, and it takes time to get rid of it" (p2). *"This disease requires determination and perseverance, which are lacking in patients with NAFLD! Patients must adhere to the main treatment, exercise, and diet, and we, as physicians, must follow up to see whether they have" (p3).

Table 2 (continued)

Number	Primary codes of challenges	Sample of Quotes*
17	*Obtaining false information from non-scientific sources *False commercial advertising and Medical Fraud *Lack of reliable scientific sources about NAFLD *The effect of false advertising on increasing patients' anxiety	*"Patients are terrified of this disease in the beginning, and they often search on the Internet and get information from non-reliable scientific sources, such as the most common cause of liver failure is NAFLD, and this disease eventually causes liver cancer! This information increases the patients' anxiety and makes them look for immediate solutions that do not have a scientific basis; for example, they look for unapproved supplements that do not have a scientific basis" (p9). *"There are many false advertisements about the treatment of NAFLD in society, especially on virtual and social networks. I even observed that they install advertising labels in houses that we cure NAFLD definitively by taking some herbal medicines and supplements! The effectiveness of these supplements has not been proven through scientific methods, and most of them are false advertisements. Unfortunately, some patients are influenced by these advertisements and abandon the primary treatment, which is weight loss and diet. Even many of these supplements may themselves cause poisoning and worsen the condition of patients" (p1). *"Some commercials misinform patients that NAFLD is a simple disease and can be cured by taking a few supplements and medicines! Some other advertisements advertise NAFLD as a dangerous disease to encourage patients to buy their treatment packages by creating fear" (p5).
18	*Patients' lack of awareness of the consequences of not treating NAFLD *Patients' insufficient knowledge about the prevention and treatment of NAFLD *Patients' false information about NAFLD *Little information of patients about healthy eating and proper exercise	*"Patients' awareness of NAFLD and the long-term complications that this disease can have for them is low. Patients have scattered and even incorrect information about NAFLD and its treatment. Some patients also consider NAFLD as a simple disease and do not follow their treatment and do not know that in the future, this disease can progress and even reach the cancerous stage" (p6). *"The most significant problem in managing NAFLD is patients' ignorance. Patients' awareness of NAFLD is very low, and we must provide sufficient knowledge and awareness to them. It is better to provide this knowledge and awareness based on each person's level of education. For example, a patient who is not educated enough and does not understand calories and someone with a high education will have a different understanding of issues" (p15). *"Patients ask many questions about diet and what foods to consume, and they do not have much information about healthy eating and proper exercise for NAFLD treatment" (p13). *"Many patients are unaware of healthy nutrition and do not have much information about healthy and harmful foods" (p13).
19	*Request to obtain specialized information from physicians *Requesting patients to receive treatment plans with more details *Lack of details on physicians' advice to patients	*"Patients ask me for specialized information about proper nutrition and exercise for NAFLD, but my advice to patients is general. We physicians do not have enough knowledge in these fields nor enough time to provide detailed treatment plans to patients" (p11). *"I give patients general advice on nutrition and increasing physical activity. However, many patients ask me for more information on nutrition and exercise. For example, patients ask what kind of oil and how much to use if they will use it! Alternatively, they ask how much and what foods to consume! Our knowledge of these fields is limited, and one of the problems we physicians faces in managing NAFLD is this issue" (p1).

Table 2 (continued)

Number	Primary codes of challenges	Sample of Quotes*
20	*Unstructured treatment plan *Failure to design treatment plans based on patients' conditions *Not considering patients' preferences in the treatment plan	*"The problem with treating NAFLD is that many patients do not follow a regular diet and exercise program. This lack of structure in patients' treatment plans and irregularities in their personal lives hurt their treatment" (p4). *"Many patients ask us for a detailed, flexible treatment plan based on their conditions! For example, the patient said my knee hurts, and I cannot run! Moreover, you ask me what alternative exercise I should do! The knowledge of physicians in these fields is not enough. I see that all patients are not the same, and we cannot give the same treatment plan to all patients!" (p12). *"Patients are different and have their own needs and problems. Their condition and preferences should also be considered when the nutrition and exercise program is designed for them. For example, if a patient does not like certain vegetables, it is important to include other vegetables they enjoy in their diet to some extent. Not considering patients' preferences hinders their treatment adherence" (p2).
21	*Inadequate knowledge in providing nutritional and sports programs *Inadequate knowledge about the care and management of chronic diseases	*"In my office, I give some general recommendations to patients, such as consuming less sugary substances, carbohydrates, and fatty acids and consuming more vegetables, grains, and legumes. I tell them that they should exercise regularly. However, we know little about nutrition and exercise programs and need more time!" (p6). *"We physicians do not know enough about chronic care. NAFLD is a chronic disease, and one of our needs is to get enough information on treating chronic diseases" (p12).
22	*Lack of awareness about NAFLD guidelines *Lack of awareness about Liver Fat Scores (LFSs)	*"Some of our colleagues need to learn more about the new treatment guidelines and protocols for NAFLD to treat NAFLD. Some physicians prescribe treatments for patients that may not be based on scientific evidence" (p10). *" Some general and internal medicine physicians may not be aware of the latest diagnostic and treatment methods for NAFLD, as outlined in the guidelines. As a result, they may prescribe aggressive diagnostic tests like biopsies for their patients, even though the severity of the disease can be estimated using new indicators like the Liver Fat Score. Unfortunately, these physicians are not informed about such indicators." (p1).
23	*Inadequate knowledge of other health care providers *Misjudgment based on radiology grade and liver enzymes	*"It has been observed that some physicians, especially general practitioners, lack the necessary awareness and knowledge to diagnose and treat NAFLD. Unfortunately, some of these physicians prescribe drugs (such as Livorgol tablets or vitamin E) to patients without adequately monitoring their progress. This can create a false sense of security in patients. Physicians need to avoid telling patients that they have a simple fatty liver, as this can lead to patients becoming indifferent towards the follow-up of NAFLD treatment. If left untreated, the disease may progress to cirrhosis over time" (p1). I have had patients who had developed fatty liver disease and stated that they had already seen their general practitioners, and they told the patients that NAFLD was not dangerous! This is due to the lack of awareness of some of these physicians. Failure to manage and pay attention to NAFLD in the early stages will cause the disease to worsen in the future (p5). *"Many physicians have limited knowledge about NAFLD and its diagnosis and treatment. Some may even consider it a simple disease and rely solely on the grade reported by the radiologist to determine its severity. However, the grade alone does not provide a complete picture of NAFLD severity. Additionally, some physicians may diagnose NAFLD based solely on high liver enzymes, even though elevated enzyme levels could be caused by other illnesses like chronic hepatitis C!" (p5).

Table 2 (continued)

Number	Primary codes of challenges	Sample of Quotes*
24	*Long-term use of digital devices *Irregular sleep and wake cycle *Long working hours *Not having enough time for exercise *Not paying attention to sports *Hard to change lifestyle	*"Many patients mention that they spend several hours daily and night using technologies like the Internet, mobile phones, computers, and television for work or entertainment. This often leads to long periods of sitting without much movement, which can cause the development and worsening of NAFLD" (p2). *"I often observe patients who report prolonged use of mobile phones and laptops, particularly at night, leading to insufficient sleep, which can exacerbate NAFLD" (p9). *"When I ask patients about their physical activity level, they say they work many hours a day! Some even have to work two shifts to meet their living expenses, which leaves them with little time to exercise" (p12).
25	*Lack of follow-up visits and treatment *Not continuing treatment after partial recovery *Reducing the importance of follow-up treatment in patients *Non-compliance with the treatment plan	*"Some patients forget about follow-up visits or do not care about following up on their treatment, and some even return when their condition worsens!" (p13). *"In my opinion, patients must be informed about the consequences and complications of not treating NAFLD to take the disease seriously" (p4). *"Patients often abandon their treatment after a short period. While a few patients continue to attend follow-up appointments, most only attend one or two sessions. Once they feel relieved that their condition is not advanced, such as in cases of cancer or cirrhosis, they tend to stop attending further treatment. Unfortunately, this often leads to the worsening of their condition later on" (p1). *"With time, many patients forget or do not take the importance of follow-up treatment and management of NAFLD" (p11). *"Our biggest problem in NAFLD management is patients' non-compliance and adherence to diet and weight loss. Many patients are willing to do all the work and take medicine, but they are not willing to adhere to the main method of NAFLD treatment, which is diet and weight loss!" (p7).
26	*Failure to register patients' information in medical centers *Failure to record disease data during the treatment periods *Failure to register patients' lifestyle profile data *Absence of a registry specific to NAFLD *Absence of electronic health records specific to NAFLD *Failure to use digital health technologies in management NAFLD	*"Due to the large number of patient visits in offices and clinics, there is not enough time to record information on patients, and we do not even have the tools for electronic health records. NAFLD is a chronic disease, and it is necessary to record the complete information of patients" (p1). *"During the treatment period, it is important to record all the data related to the patient's disease to evaluate their condition accurately. However, in reality, this does not always happen. It is common for patients to lose their medical documents, such as test results or ultrasounds. The absence of previous patient data makes monitoring and assessing patients' progress challenging" (p8). *"Patient data such as tests, demographic information, patient history, and treatments should be recorded for patients, but many of these data are not recorded. Even the data related to changes in lifestyle modification, such as nutrition, amount of physical activity, smoking, etc., should also be recorded to determine how much the patients' lifestyles changed and how they followed the treatment" (p3). *"I observed that digital technologies are used to diagnose and treat various diseases. However, I rarely saw these technologies used to manage NAFLD in Iran!" (p12).
27	*Lack of feedback on disease conditions to patients and physicians *Lack of alert to patients and physicians based on disease conditions	*"We do not have a mechanism for giving patients and physicians feedback on the recorded data to make them aware of the disease's condition. Also, if some parameters, such as weight, liver enzymes, etc., increase in patients, we cannot warn them" (p15). *"Some patients who have recovered from NAFLD tend to forget that they are still suffering from the condition and need to continue with their treatment. Unfortunately, we do not have any effective tool or system to provide them with regular reminders or feedback on their condition" (p4). *"Patients should focus on weight loss, modifying their lifestyle, and continuing on this path until recovery and disease control. They should also receive feedback and warnings about their condition, which is not standard practice!" (p7).

Table 2 (continued)

Number	Primary codes of challenges	Sample of Quotes*
28	*Lack of continuous monitoring and evaluation of patient's condition *Absence of monitoring Mechanisms	*"I cannot properly monitor patients. Patients who leave the office are no longer under my supervision, and their information is not properly recorded. Patients should be monitored and receive feedback on their treatment progress" (p10). *"One of the problems we have in treating NAFLD is that patients are not monitored during the treatment period. That means we do not have a tool for this! Patients should be evaluated; for example, we should check to what extent they have followed the diet and whether their physical activity was sufficient! However, we are not capable of such evaluations" (p5). *"One of our problems is not monitoring patients during treatment. We physicians do not have an effective way to monitor patients, and our lack of supervision makes us unable to picture the patient's condition accurately" (p2).
29	*Forgetting the time of appointment *Forgetting the advice of physicians	*"Many patients fail to attend follow-up visits, and some even forget that" (p3). *"Some patients forget their next appointment time. For example, I have had patients who were supposed to return after six months but either returned later or did not return at all" (p1). *"Usually, I give some advice to the patients during the visits and then tell them to return after a few months. However, patients either forget these advices or their importance decreases over time" (p6).
30	*People's lack of awareness and policymakers about NAFLD *People's lack of awareness and policymakers about the importance of preventing NAFLD *Lack of comprehensive planning for NAFLD prevention and community awareness *Limited research in the field of NAFLD	*"People, policymakers, and planners are unaware of the importance of preventing NAFLD. This lack of awareness causes the prevalence of NAFLD in society, and the lack of awareness of policymakers prevents proper planning to prevent and manage this disease in society" (p10). *"Given the high prevalence of NAFLD in our society, it is concerning that both individuals and governments do not place enough importance on prevention. Lack of awareness can lead to significant costs in people's lives and irreparable complications for society and governments" (p1). *"There is a lack of planning for the prevention of NAFLD in society, and policymakers do not realize the importance of NAFLD prevention. Therefore, it is necessary to create comprehensive planning to prevent NAFLD in society. For example, comprehensive studies are deficient at the national level in the field of NAFLD. Only a few studies have been conducted to comprehend the causes of NAFLD in patients in Iran" (p13).
31	*The economic, social, and psychological burden of NAFLD *The economic and human burden of NAFLD on the healthcare system *High cost of treating NAFLD in advanced stages *Liver transplantation in advanced stages	*"Some of the patients must undergo many examinations and tests. If their disease reaches advanced stages, they impose a lot of costs on the economy of society, including the cost of liver transplantation, particular drugs, hospitalization, and disability" (p11). *"The most common cause of liver transplantation is NAFLD, and due to the high and growing prevalence of this disease, if no measures are taken, this disease will have an economic burden and destructive effects on the healthcare system and society shortly" (p4). *"NAFLD has a high prevalence in Iran, and this shows that the economic and social burden of this disease is high for society, and there is no proper planning to prevent NAFLD in the country" (p10).
32	*Not being a priority to treat NAFLD due to financial problems *High cost of referring to other healthcare providers *Increase in inflation and costs of medical services *The effect of economic problems on adherence to treatment	*"Due to the economic and social problems in Iran, many patients with NAFLD do not prioritize the treatment of this disease. Also, patients do not know enough about the consequences of not treating NAFLD" (p9). *"When patients visit the office, I may refer them to different clinics. However, this can be problematic for some patients due to issues with time and cost. Sometimes, it may be challenging for patients to visit multiple physicians and clinics. This can negatively impact their ability to manage their disease and follow up with their treatment properly" (p6). *"The cost of treatment in Iran has increased with inflation and the increase in other services, and many patients cannot afford a physician or another specialist. Additionally, patients must pay out-of-pocket for services such as sessions with nutritionists and sports specialists" (p9).

Table 2 (continued)

Number	Primary codes of challenges	Sample of Quotes*
33	*High cost of diagnostic tests *Non-coverage of NAFLD treatment costs by insurance *High cost of nutritional and sports consultations *High cost of examining comorbidities associated with NAFLD	*"The cost of diagnostic and laboratory tests can be high for patients. However, one necessary test for patients with NAFLD is FibroScan, which is generally not covered by insurance and is expensive for many patients" (p7). *"Many of the medications we prescribe are not covered by insurance, and patients should pay the cost of medicines freely" (p12). *"Patients must routinely perform tests and imaging, such as elastography or FibroScan, which are expensive services. I prescribe these tests for patients based on their financial ability. Insurance must cover these services for patients" (p2). *"Some patients are at risk of cardiovascular diseases and need to be checked for kidney, heart, and other conditions. I may waive these checkups based on the patient's financial ability and unwillingness. For example, elastography can be done for limited patients" (p1).
34	*High cost of healthy food *Cheap and available junk food *Advertisements for fast foods and unhealthy food	*"Patients should follow diets containing vegetables, grains, and legumes, as well as fresh fruits that are not too sweet. However, with the increase in food prices in Iran, it is expensive for patients to follow some of these diets. For example, if we tell patients to eat fresh vegetables and fruits several times a week, not all patients may be able to do it" (p3). *"In our society, the cost of preparing fast food is much lower than the cost of preparing a healthy meal at home. It is possible that the patients follow a special diet for one or two weeks, but in the long term, some patients are not able to continue their diet due to the high food prices and the growing inflation in the food basket of Iranian households" (p4). *"One of the important problems, in my opinion, is that the media often advertises the consumption of fast foods and prepared foods, and even many of these foods are prepared with low-quality ingredients! Over time, these ads affect the minds of people in the community and lead people to consume these foods, which causes NAFLD in many people" (p12).

*NAFLD = Non-Alcoholic Fatty Liver Disease

According to the GH specialists, consuming unhealthy food such as fast food and not eating enough grains, vegetables, and legumes was among other challenges (Table 2, Sample of Quotes, Row 11). Because of some local customs and eating habits in some Iranian households, it is likely that foods that are harmful to the patient or prevent them from following the proper diet are being consumed. In addition, eating at irregular times of the day and the lack of order in personal life adversely affect the patient's diet (Table 2, Sample of Quotes, Row 12). Some patients cannot prepare their meals at home or even have to eat at work due to the requirements of their jobs and limited time, so their diet is likely harmful to their condition (Table 2, Sample of Quotes, Row 13).

Main category 6: incorrect attitude of patients toward NAFLD, its treatment, and follow-up

The patients are afraid right after diagnosis, but with no symptoms and with normal lab results, they do not take the treatment seriously, and gradually, they even begin to doubt having the disease (Table 2, Sample of Quotes, Row 14). Patients believe they can treat the condition immediately with medication. Some do not trust life modification to be the only effective treatment for NAFLD and seek unscientific treatments (Table 2, Sample of Quotes, Row 15). Some patients do not want long-term treatment and lack consistency in following the treatment (Table 2, Sample of Quotes, Row 16).

Main category 7: lack of knowledge and awareness of patients and non-scientific sources of information

The GH specialists maintained that patients' misconceptions about the disease and its treatment, lack of scientific resources available to the patients, false advertising, and medical fraud (advertising herbal drugs and supplements) have a negative effect on the patient's lifestyle modification and their following of the treatment (Table 2, Sample of Quotes, Row 17). Many patients do not have enough awareness about the consequences of not treating NAFLD and the benefits of healthy eating, and proper exercise for NAFLD treatment, and their lack of knowledge negatively affects their treatment process (Table 2, Sample of Quotes, Row 18).

Main category 8: lack of comprehensive treatment plans based on patients' conditions

NAFLD patients want the GH specialist to provide the necessary information about the condition and the treatment, including information on healthy eating and suitable exercises. However, they receive only general advice without detail (Table 2, Sample of Quotes, Row 19). According to the GH specialists, the lack of structure and

Table 3 Primary codes and sample of quotes of needs

Number	Primary codes of Needs	Sample of Quotes*
1	*Investigation of comorbidities associated with NAFLD *Examination of other symptoms in patients *Timely diagnosis of NAFLD in the early stages *Identifying underlying factors of NAFLD *Examining psychological problems in patients *More specialized tests *More specialized medical imaging	*"When examining patients, we do not only examine ultrasound and the level of liver enzymes; other diseases may cause the high level of liver enzymes in patients. Therefore, we need to identify different factors that have led to increased liver enzymes in patients using tests and cooperation with other specialists to reach a definitive diagnosis" (p1). *"Physicians should also pay attention to other symptoms in patients. Some of our colleagues, including general practitioners, must be aware of this issue. Suppose these physicians observe that the patient is obese and his BMI is high, or he has diabetes and his blood lipids increased. In that case, they should consider the possibility that this patient may also have NAFLD and should perform the necessary tests for this patient to reach an accurate diagnosis of the disease" (p13). *"Many patients who visit me with the diagnosis of NAFLD often have other diseases, such as obesity, diabetes, high blood pressure, and more. NAFLD can develop in patients due to various underlying factors. For instance, obesity is one of the leading factors contributing to the development of NAFLD. The lifestyle of such patients is usually the cause of NAFLD. Therefore, identifying and managing these underlying factors are one of the most important measures to treat NAFLD" (p6). *"Some patients suffering from fatty liver disease may experience depression and have bulimia nervosa. These mental health disorders can affect their ability to comply with the recommended treatment plan and may even cause them to abandon treatment altogether. Therefore, including a psychiatric specialist on the treatment team is vital to help manage these patients effectively" (p3). *"Diagnosing NAFLD is seemingly effortless! However, in practice, it is different. Unfortunately, many people think it is possible to diagnose NAFLD with an ultrasound and a blood test. At the same time, its accurate diagnosis requires a complete examination of the patients and various tests to determine that they are not suffering from other diseases" (p8).
2	*Designing tailored treatment plans for each patient *Designing treatment plans structured *Designing education treatment plans *Personal discipline and eating at regular hours *Using guidelines in designing treatment plans	*"Each patient is unique and should receive a personalized exercise and nutritional program. This program must be designed based on their physical and clinical condition and personal preferences. For example, if a patient has arthritis, they may not be able to perform typical sports activities, and the program must be tailored accordingly. On the other hand, if a patient is interested in a specific sport like tennis, this should be considered to ensure they remain motivated. Moreover, the nutritional needs of a 14-year-old boy, a 30-year-old woman, or a 50-year-old man can differ significantly, which is why a customized program is necessary. The program should also consider their socioeconomic status and occupation-related restrictions" (p3). *"Patients need to receive a structured program tailored to their needs. For example, this includes planning out the days of the week so that patients know what foods they should consume and how much physical activity they should do each week. In the design of these programs, the age, gender, and interests of the patients should also be considered. If we physicians are given proper information on designing exercise and nutrition programs that can be implemented for patients, we can provide these programs to patients ourselves" (p9). *"One important need is the discussion of patient education. Patients should receive the necessary education and acquire the ability to manage their disease themselves. Training courses and educational treatment programs should be considered for patients. Additionally, a patient's diet plan should be designed to educate them on what foods to consume and what foods to avoid" (p14). *"One of the basic needs for patients is that they should be given nutritional advice by nutritionists, and nutritional programs based on guidelines should be designed for them" (p5).

Table 3 (continued)

Number	Primary codes of Needs	Sample of Quotes*
3	*Enhance the knowledge of physicians in providing nutritional and sports programs *Enhance the knowledge of physicians regarding the care and management of chronic diseases *Providing nutritional and sports information to physicians in a proper format	*"I give general advice to patients for sports and nutrition programs. However, due to time constraints and inadequate knowledge, I cannot design a complete patient program. Ideally, such a program should be created through the collaboration of experts in sports and nutrition. By empowering physicians with more knowledge about providing nutrition and exercise programs, we can offer more comprehensive advice to our patients" (p2). *"We physicians need more information about chronic care. NAFLD is a chronic disease, and one of the physicians' needs is to get enough information on the treatment and management of chronic diseases" (p12). "If physicians receive more information in a concise and appropriate format on appropriate exercise and nutrition programs for patients with NAFLD, it can help in the treatment and management of NAFLD" (p10).
4	*Enhance the knowledge of other healthcare providers *Holding retraining courses for other healthcare providers	*"Due to the few gastroenterology and hepatology specialists in the cities, patients often seek help from general practitioners or internal physicians . However, these physicians' knowledge and awareness of the methods of diagnosis and treatment of NAFLD should be increased so they can detect the disease early, provide appropriate treatment, and refer patients with more severe conditions to us specialists" (p4). *"One of the most important needs is to increase the knowledge of other providers, such as general practitioners, nutritionists, and sports specialists. Many patients with NAFLD are unaware of their disease, and general practitioners should be able to identify these patients and refer them to specialists. Holding refresher courses in NAFLD management can increase the knowledge of other providers" (p3). *"Since many patients with NAFLD are referred to general physicians, these physicians should receive sufficient training in diagnosing and treating NAFLD. For example, in the field of diagnosis, general practitioners should know that there is a specific process for diagnosing NAFLD. Also, in my opinion, other professionals involved in the management of fatty liver disease, such as nutritionists, sports, endocrinologists, cardiologists, and even radiologists, should receive training in the field of NAFLD in order to help patients more effectively. For example, radiologists should be aware that the grade they inform us is of low value unless they also inform us of other things, such as liver tissue stiffness and the spread of the conflict in their report" (p8).
5	*Localization of guidelines of NAFLD *Examination of lifestyle profile alongside clinical parameters *Designing local treatment protocols *Use of liver fat scores in the treatment protocol	*"Guidelines for the management of NAFLD are mostly general. Therefore, there is a need to localize them in Iran based on the characteristics of Iranian society. For example, nutrition in Iranian society differs from that in other societies! If these guidelines refer to a Mediterranean diet, it is necessary to design this diet based on the dietary pattern in Iran" (p9). *"We physicians mostly use clinical parameters (such as tests, weight, waist circumference, etc.) to determine whether a patient's condition improves. However, these parameters alone are insufficient to evaluate a patient's condition. Information about the patient's lifestyle profile should be considered along with the clinical criteria" (p12). *"Treatment protocols should be designed for general and internal physicians in the field of diagnosis and treatment of NAFLD based on national and international guidelines. These physicians' knowledge about NAFLD should be increased through retraining and training courses" (p6). *"In the past, only liver biopsy or ultrasonography was used to calculate the severity of NAFLD. However, in the last few years, guidelines have been published for calculating the Liver Fat Score (LFS), which can calculate the severity of the disease to a large extent without needing a liver biopsy. One of these indexes is FIB-4, which has become popular recently. Other physicians should be introduced to these guidelines and LFS by conducting retraining courses" (p14).

Table 3 (continued)

Number	Primary codes of Needs	Sample of Quotes*
6	*Changing patients' misconceptions about NAFLD *Changing patients' misconceptions about NAFLD treatment methods *Using the therapeutic role of physicians in changing patients' belief	*"Sometimes, patients do liver tests, and when the results of these tests are normal, a false mentality is created in them that because the results of their tests are normal to some extent, therefore they do not have fatty liver! However, these tests alone do not indicate the presence or absence of NAFLD, and even patients may have a liver disease, but the level of liver enzymes in patients is not very high. This wrong mentality in patients makes them not consider their illness seriously. This wrong mindset of patients should be changed by educating and informing them" (p2). *"Patients like to take medicine, believing that if they take it, their fatty liver will be cured! While this is not the case, we can give medicine to patients in limited cases. For example, if patients have diabetes or blood lipids, we can prescribe drugs. However, many of our patients are neither persons with diabetes nor have blood lipids and have some abdominal obesity. Even some patients are thin and do not need medicine. Patients' mistaken beliefs about drug use must be changed" (p1). *"Most patients listen to us, physicians. For example, suppose we physicians have up-to-date information on exercise and nutrition, and patients receive this information from us physicians instead of others. In that case, patients' compliance with their treatment plan will increase. By providing correct information about NAFLD and its treatment methods to patients, physicians can help change patients' attitudes and wrong information (p3). *"Many patients only want to hear from physicians that their disease is not incurable so that they can calm down! For this reason, patients refer to different physicians and even non-physicians! However, many patients accept the physicians' recommendations, and this way of thinking about the physician's therapeutic role can help change the patients' wrong beliefs. Therefore, physicians should talk more with their patients" (p8).
7	*Improving patients' self-efficacy *Improving patients' motivation during the treatment periods	*"Patients are not patient during the treatment process and must realize that treating NAFLD requires time and continuous effort. Patients should modify their lifestyle and continue proper physical activity and diet regularly. Unfortunately, patients expect a miracle to happen and to get results from the treatment soon! One of the necessary measures for patients is empowering and increasing their motivation in the long term" (p15). *"We must inform patients that modifying their lifestyle is the only way to cure them. Next, patients should be motivated because lifestyle modification is a difficult task. Many patients do not want to do hard work and are looking for more straightforward and immediate treatment!" (p3). *"The only effective treatment for NAFLD is weight loss and a healthy diet. However, losing weight is time-consuming and challenging; many patients may not reach that ideal weight. For example, out of 100 obese patients, 10 may reach the ideal weight! Therefore, many patients may abandon the treatment due to the prolongation of the treatment process and the reduction of their motivation and ability, and it is difficult to convince the patients to continue the treatment. We must increase the awareness of patients and their motivation" (p5). *"Some of my patients have expressed that they lack motivation to exercise. To help these patients, it is important to investigate the factors causing decreased motivation during the treatment period. Patients may also benefit from psychological and motivational counseling to help them identify and solve their problems and ultimately increase their motivation to continue their treatment" (p10).

Table 3 (continued)

Number	Primary codes of Needs	Sample of Quotes*
8	*Teaching appropriate exercises for treating NAFLD to patients *Teaching healthy nutrition to patients *Holding training sessions for patients	*"Patient education is a crucial step in managing Non-Alcoholic Fatty Liver Disease (NAFLD). Physicians' primary challenge while treating their patients are the need for more awareness and knowledge among them. Many patients must know what constitutes fatty foods, even when advised to avoid them. Similarly, they need to have basic knowledge about appropriate physical activities and the types of exercises they should do. Therefore, the first step towards managing NAFLD should be educating patients about nutrition and exercise, enabling them to take control of their disease" (p7). *"It is important to educate patients about their diet, including what types of foods to consume and in what quantities, as well as how much exercise they should be doing and what kinds of exercise are appropriate. Patients should be taught the difference between endurance sports and aerobics. Appropriate exercises at home should also be taught so that people who cannot exercise outside can exercise indoors" (p1). *"Educational-medical universities or medical centers must occasionally hold training meetings or workshops on NAFLD for patients and answer their questions about managing it" (p3). *"Patients should be aware that many of the problems and disorders in their bodies are not related to NAFLD. We need to give them correct information about NAFLD so that they are aware that NAFLD is a significant disease and needs follow-up and treatment" (p1).
9	*Teaching lifestyle modification to Patients *Teaching self-management to patients *Informing patients about their central role in the treatment of NAFLD	*"To effectively treat NAFLD, patients must learn to manage their disease independently. NAFLD is a non-physiological condition that results From patients' lifestyles, which is why I always inform them that medication alone will not suffice and that they must modify their lifestyle. However, changing one's lifestyle can be challenging. Therefore, we must provide patients with the necessary education to help them make the necessary lifestyle changes and manage their condition effectively. They should also be aware that these changes can significantly improve their quality of life" (p14). *"Patients should be aware that they have a key and pivotal role in treating their disease and cannot be treated without their cooperation. They should take diet and exercise seriously and follow their treatment" (p12). *"It is important to prioritize patient education in the management of NAFLD. Patients should be taught about a healthy lifestyle and understand that the treatment for their condition is to practice healthy habits such as eating a balanced diet, exercising regularly, and getting enough rest. In other words, they should know that their lifestyle needs to change. It is essential to understand that patients are the leading therapists in their treatment process and have a leading role in their recovery" (P3).

Table 3 (continued)

Number	Primary codes of Needs	Sample of Quotes*
10	*Making patients aware of NAFLD and its treatment methods *Informing patients about the importance of following the treatment plan *Making patients aware of the importance of treatment follow-up *Informing patients about the consequences of an unhealthy diet *Informing patients about the consequences of inactivity *Informing patients about the consequences of an unhealthy lifestyle *Making available reliable scientific resources about NAFLD	*"In managing NAFLD, we need to give comprehensive information about this disease to patients so that they can understand that the only way to treat it is through obesity treatment, diet, and lifestyle modification. Many of the patients' problems stem from their lack of knowledge. If patients get the necessary knowledge and correct information about NAFLD, they can better manage their disease" (p8). *"As physicians, we often face the challenge of patients' lack of awareness about their health conditions. In the case of NAFLD, we have observed that patients' knowledge about this condition is relatively low. Hence, we need to educate and create awareness among patients. However, we must ensure that the information we provide is tailored to their level of education. For instance, patients with a lower education level may not understand complex concepts like calories, whereas those with a higher education level may better grasp such issues" (p15). *"It is necessary to inform patients that some diseases, including NAFLD, require continuous follow-up for treatment. Patients must find a cognitive change, and we physicians do not have time for that!" (p4). *"Initially, patients are very persistent in knowing how dangerous their disease is and how to treat it. However, unfortunately, after a while, many patients are no longer persistent in treating their disease and may even stop coming back. This is due to the lack of awareness of some patients who, with a little initial recovery, unfortunately, abandon the treatment and even return to the same lifestyle as before!" (p13).
11	*Establishing specialized clinics to provide clinical and paraclinical services *The need for trained colleagues in the NAFLD field *Establishment of advisory and educational service centers	*"In order to effectively manage NAFLD, it is essential to have specialized centers consisting of various professionals such as gastroenterologists, hepatologists, nutritionists, exercise physiologists, and cardiologists. These centers would enable specialists to visit patients with NAFLD as required. For instance, an endocrinologist could see a patient with diabetes, or a psychiatric specialist could visit a patient with bulimia nervosa or depression. The establishment of such centers would lead to a reduction in the costs associated with NAFLD treatment and improve the overall management of the disease" (p11). *"We should set up clinics for NAFLD with the cooperation of different specialties in universities or medical centers in cities. The number of these clinics should be significant, considering the high prevalence of this disease. These clinics should be where people have easy access to them, and they should provide some services in-person to minimize people's attendance" (p8). *"We need to create dedicated clinics for patients with NAFLD so that patients can be registered, followed up, and monitored in these clinics. The necessary consultations can be provided to the patients in a routine manner. The fact that patients go to a centralized place and visit several different specialties will significantly affect the better management of NAFLD" (p15). *"Due to their busyness, patients, especially those from faraway cities, need more time to visit crowded offices, affecting their follow-up treatment. Out-of-office consultations can be helpful for these patients" (p8). *"We must have face-to-face or non-face-to-face centers in cities to answer patients' questions and educate them" (p1).

Table 3 (continued)

Number	Primary codes of Needs	Sample of Quotes*
12	*Team management for NAFLD *Participation of other specialties in the treatment team *Facilitating continuous communication between treatment team members *Creation of clinical, nutritional, and sports treatment groups	*"If patients with NAFLD receive treatment from a multidisciplinary team, including gastroenterologists, nutritionists, endocrinologists, sports physicians, and psychiatrists, their treatment adherence is expected to increase, leading to better disease management" (p7). *"We need teamwork in managing NAFLD. For example, nutrition colleagues in the diet or sports colleagues in the exercise discussion can significantly help. In managing NAFLD, it is necessary to cooperate with a treatment team with different specialties so that when the physician visits the patients, this team provides essential advice to patients" (p2). *"We need the cooperation of sports and nutrition experts to provide sports and nutrition programs based on each patient's condition" (p4). *"The treatment and management of NAFLD requires a multidisciplinary team. The treatment of NAFLD is not in the form that patients refer to we gastroenterology and hepatology specialists, and we do zero to one hundred treatments for them! Causes of NAFLD in patients are different, and patients with NAFLD may also have other diseases, such as diabetes and cardiovascular disease. The treatment of NAFLD is not only drug treatment but also requires team cooperation of other specialties with the treatment team" (p15).
13	*Periodic meetings between patients and the treatment team *Holding face-to-face meetings between patients and the treatment team *Use of telemedicine for communication between the treatment team and patients	*"For patients who do not have enough motivation, monthly meetings should be held with physicians and psychoanalysts to solve the problems of these patients" (p9). *"Periodic meetings should be held between patients and treatment team members to examine patients' problems and questions during NAFLD Treatment" (p12). *"Communication is an important requirement for the treatment of NAFLD. When patients leave the office, they have no contact with the physicians except for the next visit sessions! Establishing communication in groups or virtual meetings can help patients discuss their problems with their physicians. It even allows us physicians to know the condition of the patients" (p8). *"The work of medicine is not static but dynamic! Dynamic means that the patient comes to the physician to talk so that both her physician understands him and he understands her physician. The patient goes to the physician to know the physician's mentality about his illness! The patient wants to know if he has an incurable disease or not! By talking to patients, physicians can free them from anxiety and mental preoccupation caused by their illness! Therefore, communication (face-to-face or virtual communication) between patients and physicians is essential, and it is necessary to hold meetings between the patient and the physician during treatment" (p7).

Table 3 (continued)

Number	Primary codes of Needs	Sample of Quotes*
14	*Informing and involving relatives in the treatment process *Creating a friends network consisting of patients *Family-centered care in the management of NAFLD *Continuous communication of the treatment team with patients and their families	*"One important need for the treatment of NAFLD, besides informing the patients, is telling the patients' families. Families can play an important role in helping patients heal. For example, if the patient is required to follow a special diet, the family can ensure that the patient has access to suitable food at home. Similarly, if the patient is required to exercise, it can be helpful if the other family members join in to increase motivation " (p14). *"Many patients have to eat food prepared at home with other family members, which may make it difficult for them to follow their diet! For example, olive oil cannot be substituted for frying oils. The people around and the patients' families must learn about NAFLD to help the patients carry out their treatment plan" (p3). *"Many patients lose their motivation during the treatment process! One solution to increase motivation is to form groups or meetings consisting of patients with NAFLD to share their experiences. Communicating patients with each other can also improve their motivation. For example, patients can exercise together or share their problems managing their disease" (p1). *"I had many patients who said that after exercising or dieting for a while, they no longer have the motivation to continue the treatment as they did on the first day! One solution to increase the motivation of these patients is family-oriented care through the participation of their families in the treatment process. Patients' families can motivate them to continue treatment with their participation, such as accompanying patients in exercising or dieting" (p3). *"Physicians and patients must maintain constant communication to manage fatty liver disease effectively. When physicians listen to their patients and show that their opinions are important, patients are more likely to stay motivated and continue their treatment. Furthermore, healthcare providers should periodically contact patients to check on their treatment progress and address any concerns they may have. These forms of communication can have a significant positive impact on treatment adherence and follow-up. These communications should also be established with the families to help patients continue treatment" (p7).
15	*Registering patients' information in medical centers *Recording patients' lifestyle profile data *Registration of patients' disease information *Creating electronic health records for Patients *Creating a registry specific to NAFLD	*"Regularly monitoring patients' information, including tests, waist circumference, weight, BMI, FIB4, elastography, FibroScan, nutritional and sports information, lipid profile, and metabolic profile, through an electronic system during the treatment period can be beneficial in managing NAFLD" (p8). *"One important need for managing NAFLD is setting up electronic records to record patient information in offices and medical centers to make patient data available to patients and physicians everywhere" (p13). *"It is important to record information related to lifestyle changes such as physical activity, diet, and tobacco and alcoholic beverage consumption during the treatment period. This helps determine whether the patients have followed their treatment plans and to what extent their lifestyles have changed" (p9). *"Recording patients' information during treatment is one of the most important requirements for better management of NAFLD. Since the treatment process for NAFLD is long, patients must have periodic visits, and their information, including weight, tests, and imaging, should be recorded during each visit. This will help healthcare professionals make correct judgments about the condition of the patients in future visits based on the recorded information" (p10).

Table 3 (continued)

Number	Primary codes of Needs	Sample of Quotes*
16	*Systematic follow-up of patients *Establishing monitoring mechanisms to monitor patients *Persistent monitoring of patients' disease data *Persistent assessment of disease status in patients *Monitoring of treatment team on patients *Monitoring of patient's adherence to the treatment plan	*"We need a mechanism that efficiently follows patients and records their information so that we can monitor their condition in the long term" (p6). *"To monitor patients, weight, periodic tests, nutritional information, diet, and physical activity should be recorded during treatment. By registering this information, we can monitor patients closely" (p2). *"Patients with NAFLD should be under constant supervision, their information recorded, and their disease status monitored" (p10).
17	*Feedback on the disease status to patients and physicians *Sending alerts and incentives to patients based on the disease condition *Feedback on the degree of adherence to the treatment plan to patients and physicians *Reminding patients to perform periodic tests *Reminding patients and physicians of the time of the next visit *Continuous provision of information about NAFLD to patients *Periodic reminder of physicians' recommendations to patients *Providing online expert consultations to patients	*"If we want to treat NAFLD effectively, we need a feedback and warning system for patients. This means that patients' weight, nutrition, physical activity level, tests, and liver enzymes should be recorded and monitored during the treatment period, and feedback and warnings should be given to patients and doctors based on this recorded information. For example, if the patients had little physical activity during treatment or consumed much food, sugar, and carbohydrates, they should be warned" (p3). *"If we can regularly collect patients' data and have a reminder system that reminds patients of the date of their next visits or periodic tests, it can significantly help patients in disease management" (p13). *"For patients to be able to manage their disease, information about NAFLD and their conditions should be given feedback to them from time to time" (p4). *"The successful treatment of NAFLD requires patients to receive timely notifications and encouragement throughout the treatment process. This should involve continuous monitoring of the patient's weight, nutrition, and liver enzymes. For instance, if the patient's weight or test results indicate that the level of liver enzymes is decreasing, they should receive a message to motivate them to continue the treatment regimen. Alternatively, if the patient's condition worsens, they should be alerted immediately. Incentives can include free training sessions, recreational camps with sports, visits, and free consultations on sports and nutrition (p7). *"In my opinion, patients must be reminded as often as possible of the consequences and complications of not treating NAFLD so that follow-up treatment can be taken seriously" (p4). *"It is important to periodically remind patients about upcoming visits, conduct regular tests, and provide updates on their disease status. Even reminding their upcoming appointments with our physicians is helpful. These reminders can be sent through SMS or email" (p3).

Table 3 (continued)

Number	Primary codes of Needs	Sample of Quotes*
18	*Coverage of NAFLD treatment costs by insurance *Financial support of supporting organizations for poor patients *Providing free consultations to poor patients *Providing free healthy food to poor patients	*"In patients with NAFLD, it may be necessary to check other co-morbidities such as cardiovascular diseases, diabetes, blood pressure, etc., which increase the cost of treatment. Therefore, insurance organizations must cover the costs of NAFLD treatment" (p13). *"FibroScan costs at least 400 to 500 thousand tomans, which some patients cannot afford. If insurance or sponsoring organizations cover some of the cost of NAFLD, this can help poor patients" (p4). *"For patients with financial problems, there should be centers that provide them with free consultations or charitable organizations to provide financial assistance to these patients to continue treatment" (p9). *"If patients want to follow a specific diet and consume a particular food, they have to pay for it, which many patients need help with providing. For example, preparing fresh fruits and vegetables, which have an important place in any diet for weight loss due to their lower calories, is expensive for some patients. We must have centers to provide healthy and free food for these patients, and governments and charitable organizations must help these patients" (p10).
19	*Making people aware of NAFLD *Making policymakers aware of the importance of prevention and treatment of NAFLD *Making society aware of the consequences of an unhealthy lifestyle	*"Useful and proper information about NAFLD must be provided through the community media to make people more aware of this disease" (p10). *"The most important thing to do to control NAFLD is to make patients and even people aware of its consequences. People need to know how NAFLD develops and what the consequences will be for them if it is not treated. I believe this information should be continuous and provided through the media, virtual space, and even schools" (p15). *"Policymakers should be aware of the consequences of the spread of NAFLD in society to plan for the prevention and treatment of this disease, which ultimately benefits society, the healthcare system, and even insurance. If the cost of treating a patient with NAFLD is $n, the cost of treating cirrhosis will be $10*n! (p11).

Table 3 (continued)

Number	Primary codes of Needs	Sample of Quotes*
20	*Planning and policy for prevention and treatment of NAFLD *Culturalized healthy eating and exercise in society *Reducing fast food consumption in society *Creating centers to provide healthy food *NAFLD prevention training in teaching resources *Teaching healthy lifestyle in teaching resources *Teaching people about healthy eating habits and regular exercise *Teaching people a healthy lifestyle	*"The Ministry of Health officials must plan and implement effective policies to prevent and treat this disease" (p10). *"Much work should be done to inform people and policymakers in Iran. Families should be educated about the correct way of eating, the importance of physical activity in preventing NAFLD, and the correct treatment methods for NAFLD" (p10). *"We must provide students and their parents with necessary information about NAFLD and its prevention methods in educational centers and schools through educational pamphlets and textbooks. Healthy eating and exercise should be cultivated in society" (p12). *"In our society, healthy eating and exercising have not been cultured, which has become a factor in the creation of NAFLD. Policymakers should plan in this field. Also, in the discussion of nutrition and physical activity, people must be educated so they do not get NAFLD" (p3).
21	*Providing healthy food in the workplace *Dedicating part of working time to exercise *Proper allocation of specialists in other cities *Setting up a referral system in Iran *NAFLD screening in the community *Creation of counseling and educational departments in medical centers *Facilitating communication between individuals involved in the management of NAFLD *Allocation of funds for awareness and prevention of NAFLD *Conducting comprehensive research in the field of NAFLD *Identification of risk factors causing NAFLD in society	*"People in the workplace should also be able to exercise. For example, employees should do simple exercises for 15 to 20 min and not sit still for long hours. These seemingly small actions can also help treat and prevent NAFLD" (p8). *"Many patients do not have enough time to exercise during the day due to their busy schedules. When they come home tired at night, they are not able to exercise, which has a negative effect on the treatment of their disease. Policymakers and the government should plan at the macro level so that people with a lot of work time can also have physical activity in the same work environment. Even simple walking can help treat NAFLD" (p1). *"In many cities, there is a need for more experienced sports and nutrition specialists familiar with chronic diseases and gastroenterology and hepatology specialists who can advise patients. Furthermore, not all patients can travel to big cities to receive these services. To reduce patients' costs, the government must appropriately plan the distribution of specialists in cities" (p1). *"One necessary measure to treat NAFLD is to establish counseling centers in cities. It is even possible to create these centers in educational-therapeutic centers to provide counseling to patients and people" (p8). *"Policymakers in the Ministry of Health should prioritize NAFLD, which is prevalent in society. They should consider allocating a dedicated budget to create awareness, provide financial support, and establish specialized treatment centers for patients with NAFLD and the public. Any measures taken to prevent NAFLD can also prevent other diseases, such as cardiovascular diseases, strokes, high blood pressure, diabetes, and obesity" (p7). *"We should conduct more comprehensive studies, such as cohort studies, on liver diseases in Iran to better identify the risk factors and problems in patients" (p13). *"Early diagnosis of NAFLD is very important, and the Ministry of Health should carry out programs for screening and identifying patients in Society" (p9).

* NAFLD = Non-Alcoholic Fatty Liver Disease

Table 4 Main categories, subcategories, and primary codes of challenges

Main Categories	Subcategories	Primary Codes
1-Chronic nature and time-consuming differential diagnosis	**1.1** Asymptomatic NAFLD*	**1.1.1** Being asymptomatic in the early stages of NAFLD **1.1.2** The appearance of symptoms of NAFLD in advanced stages **1.1.3** Being unaware of the disease in patients **1.1.4** Late visits of patients to the physician
	1.2 Difficult to diagnose NAFLD in the early stages	**1.2.1** Comorbidities associated with NAFLD **1.2.2** Relationship of NAFLD with Metabolic Syndrome **1.2.3** Examination of many parameters for accurate diagnosis of NAFLD **1.2.4** Inaccuracy of the results of some diagnostic methods **1.2.5** Normal laboratory results in patients
2-Complex treatment process and weakness of judgment criteria	**2.1** Underlying factors in patients	**2.1.1** Bulimia nervosa and mental disorders **2.1.2** Psychosomatic problems and depression **2.1.3** Childhood obesity and more complex treatment of NAFLD **2.1.4** People's inactivity and increasing the prevalence of NAFLD
	2.2 Limited and time-consuming treatment options for NAFLD	**2.2.1** Lack of specific treatment for NAFLD **2.2.2** Absence of standard treatment protocols **2.2.3** The lack of details of guidelines' recommendations **2.2.4** The time-consuming process of treating patients **2.2.5** Slow response of patients to treatment
	2.3 Weakness of clinical parameters in determining disease status and adherence to treatment	**2.3.1** Inadequacy of clinical parameters to judge the disease status **2.3.2** Inadequacy of clinical parameters to evaluate adherence to treatment
3-Defects in the patient management process	**3.1** Lack of monitoring and ongoing communication with patients	**3.1.1** Lack of ongoing monitoring of patients by the treatment team **3.1.2** Defects in the follow-up mechanism of patients **3.1.3** Lack of ongoing communication between the treatment team and patients and their relatives
	3.2 Inability to patients' management	**3.2.1** A large number of visiting patients and overcrowded offices **3.2.2** Lack of time for physicians to educate and inform patients **3.2.3** Inability to manage patients' follow-up visits
	3.3 Lack of communication and creating treatment groups for NAFLD	**3.3.1** Lack of communication and coordination between the required specialties **3.3.2** Absence of specific treatment groups for NAFLD **3.3.3** Absence of a common communication language
4-Shortcomings of the healthcare system in providing specialized and consulting services	**4.1** Lack of centers providing specialized and supportive services	**4.1.1** Absence of specialized centers for NAFLD **4.1.2** The unwillingness of patients to refer to different medical centers **4.1.3** Lack of diagnostic facilities in medical centers **4.1.4** Lack of specialists in other cities
	4.2 Lack of counseling and educational service centers	**4.2.1** Absence of counseling and training departments in medical centers **4.2.2** Absence of face-to-face and virtual counseling and training centers specific to NAFLD **4.2.3** Lack of education to patients during the treatment period
5- The effect of unhealthy eating, cultural and social factors on the diet of patients	**5.1** Unhealthy eating of patients	**5.1.1** Eating unhealthy food **5.1.2** Increasing the consumption of fast foods and prepared foods in society **5.1.3** Less consumption of beans, grains, and vegetables
	5.2 Inappropriate nutritional habits and culture in patients	**5.2.1** Restriction of some family customs and traditions on diet **5.2.2** Wrong eating habits of patients **5.2.3** Eating at irregular hours
	5.3 The effect of occupational and family restrictions on the diet of patients	**5.3.1** Eating non-diet food at work **5.3.2** Eating non-diet food at home **5.3.3** Lack of time for patients to prepare food at home
6-Incorrect attitude of patients toward NAFLD, its treatment and follow-up	**6.1** Misconceptions of patients to NAFLD	**6.1.1** Patients' belief that they do not have a disease **6.1.2** Failure to take the disease seriously by patients **6.1.3** Patients' fear of NAFLD in the early stages
	6.2 Misconceptions of patients to NAFLD treatment methods	**6.2.1** Patients' lack of belief in lifestyle modification as a treatment method **6.2.2** Patients' belief in herbal and traditional treatment methods **6.2.3** Refer to different people to get immediate treatment **6.2.4** Rush to be treated immediately in patients **6.2.5** Patients' belief in taking medicine for treatment
	6.3 Misconceptions of patients toward adherence to treatment and follow-up	**6.3.1** Patients' lack of belief in treatment follow-up **6.3.2** Decreasing motivation of patients during the treatment period **6.3.3** Patients' lack of persistence during the treatment period

Table 4 (continued)

Main Categories	Subcategories	Primary Codes
7- Lack of knowledge and awareness of patients and non-scientific sources of information	**7.1** Medical fraud and non-scientific sources in the treatment of NAFLD	**7.1.1** Obtaining false information from non-scientific sources **7.1.2** False commercial advertising and Medical Fraud **7.1.3** Lack of reliable scientific sources about NAFLD **7.1.4** The effect of false advertising on increasing patients' anxiety
	7.2 Lack of knowledge and awareness of patients about NAFLD	**7.2.1** Patients' lack of awareness of the consequences of not treating NAFLD **7.2.2** Patients' insufficient knowledge about the prevention and treatment of NAFLD **7.2.3** Patients' false information about NAFLD **7.2.4** Little information of patients about healthy eating and proper exercise
8- Lack of comprehensive treatment plans based on patients' conditions	**8.1** Lack of details and inadequacy of physicians' advice	**8.1.1** Request to obtain specialized information from physicians **8.1.2** Requesting patients to receive treatment plans with more details **8.1.3** Lack of details on physicians' advice to patients
	8.2 Unstructured and non-personalization of treatment plans	**8.2.1** Unstructured treatment plan **8.2.2** Failure to design treatment plans based on patients' conditions **8.2.3** Not considering patients' preferences in the treatment plan
9- Defect of knowledge and awareness of physicians	**9.1** Inadequate knowledge in providing treatment plans and chronic care	**9.1.1** Inadequate knowledge in providing nutritional and sports programs **9.1.2** Inadequate knowledge about the care and management of chronic diseases
	9.2 lack of awareness about guidelines and Liver Fat Scores non-invasive methods for diagnosis of NAFLD	**9.2.1** Lack of awareness about NAFLD guidelines **9.2.2** Lack of awareness about Liver Fat Scores (LFSs)
	9.3 Inadequate knowledge in diagnosis and management of NAFLD	**9.3.1** Inadequate knowledge of other healthcare providers **9.3.2** Misjudgment based on radiology grade and liver enzymes
10- Inappropriate cooperation of patients in adherence to treatment	**10.1** Inappropriate lifestyle and inactivity of patients	**10.1.1** Long-term use of digital devices **10.1.2** Irregular sleep and wake cycle **10.1.3** Long working hours **10.1.4** Not having enough time for exercise **10.1.5** Not paying attention to sports **10.1.6** Hard to change lifestyle
	10.2 Not adherence to treatment and follow-up	**10.2.1** Lack of follow-up visits and treatment **10.2.2** Not continuing treatment after partial recovery **10.2.3** Reducing the importance of follow-up treatment in patients **10.2.4** Non-compliance with the treatment plan
11- Defects in the process of recording, monitoring and information feedback	**11.1** Failure to record disease data and lifestyle changes	**11.1.1** Failure to register patients' information in medical centers **11.1.2** Failure to record disease data during the treatment period **11.1.3** Failure to register patients' lifestyle profile data **11.1.4** Absence of a registry specific to NAFLD **11.1.5** Absence of electronic health records specific to NAFLD **11.1.6** Failure to use digital technologies in management NAFLD
	11.2 Lack of feedback and alerts based on disease data	**11.2.1** Lack of feedback on disease conditions to patients and physicians **11.2.2** Lack of alert to patients and physicians based on disease conditions
	11.3 Lack of a mechanism to monitor disease data and keep track of patients	**11.3.1** Lack of continuous monitoring and evaluation of patient's condition **11.3.2** Absence of monitoring Mechanisms
	11.4 Lack of a mechanism to remind information and inform the patients	**11.4.1** Forgetting the time of appointment **11.4.2** Forgetting the advice of physicians
12- Insufficient policy-making and planning in the prevention and management of NAFLD	**12.1** Insufficient policy-making in public awareness and prevention of NAFLD	**12.1.1** Lack of awareness of people and policymakers about NAFLD **12.1.2** Lack of awareness of people and policymakers about the importance of preventing NAFLD **12.1.3** Lack of comprehensive planning for NAFLD prevention and community awareness **12.1.4** Limited research in the field of NAFLD
	12.2 The adverse effects of NAFLD prevalence on the healthcare system and society	**12.2.1** Not being a priority to treat NAFLD due to financial problems **12.2.2** High cost of referring to other healthcare providers **12.2.3** Increase in inflation and costs of medical services **12.2.4** The effect of economic problems on adherence to treatment

Table 4 (continued)

Main Categories	Subcategories	Primary Codes
13- Economic problems and the high cost of specialized services and healthy nutrition	**13.1** Failure to follow treatment due to economic problems	**13.1.1** Not being a priority to treat NAFLD due to financial problems **13.1.2** High cost of referring to other healthcare providers **13.1.3** Increase in inflation and costs of medical services **13.1.4** The effect of economic problems on adherence to treatment
	13.2 The high cost and inadequate insurance coverage of specialized service	**13.2.1** High cost of diagnostic tests **13.2.2** Non-coverage of NAFLD treatment costs by insurance **13.2.3** High cost of nutritional and sports consultations **13.2.4** High cost of examining comorbidities associated with NAFLD
	13.3 The high cost of preparing healthy food and promoting unhealthy food in society	**13.3.1** High cost of healthy food **13.3.2** Cheap and available junk food **13.3.3** Advertisements for fast foods and unhealthy food

* NAFLD = Non-Alcoholic Fatty Liver Disease

personalization of treatment plans based on factors such as age, gender, physical problems, job requirements, and patient preferences were other problems (Table 2, Sample of Quotes, Row 20).

Main category 9: defect in knowledge and awareness of physicians

Physicians do not possess the adequate knowledge to provide patients with the necessary nutrition and exercise plans. They fail to answer the patients' questions about these matters, especially as this disease is chronic in nature. Many physicians lack adequate knowledge about the management of chronic diseases (Table 2, Sample of Quotes, Row 21). The GH specialists stated that many of their colleagues (especially general physicians and internists) do not have adequate knowledge about the treatment guidelines and protocols; they may use unscientific methods to diagnose and employ arbitrary ways and unconfirmed medications to treat this disease. Moreover, they lack knowledge about the new noninvasive methods, such as liver fat scores (LFSs), to diagnose NAFLD and evaluate disease severity without performing invasive tests like liver biopsy (Table 2, Sample of Quotes, Row 22). Considering general physicians' lack of knowledge, they may make wrong judgments about the diagnosis and severity of the disease in patients based only on laboratory parameters, such as liver enzymes, and radiology reports (Table 2, Sample of Quotes, Row 23).

Main category 10: inadequate Cooperation of patients in adherence to treatment

According to the GH specialists, patients do not consider exercising to be very important. Long working hours, lack of enough physical activity, and disruption in the sleep cycle are among the factors that have a negative effect on the management of NAFLD. Changing their lifestyle is difficult for patients; only a few have long-term consistency in their diet and exercise (Table 2, Sample of Quotes, Row 24). Moreover, some patients do not continue their treatment and even miss their subsequent visits to the physician. They do not have patience for the results of their treatment and gradually lose interest in it (Table 2, Sample of Quotes, Row 25).

Main category 11: defects in the process of recording and monitoring information and providing feedback

The GH specialists considered the absence of systematic patient data collection using electronic health records (EHRs) and local and national registries problematic in managing NAFLD. These data include lab results, patient history, scans, and lifestyle profiles. They also stated that not using digital health technologies (DHTs) such as educational websites, self-management mobile applications, and telemedicine is a critical defect in managing this disease (Table 2, Sample of Quotes, Row 26). Another challenge was the absence of a mechanism through which the physicians and patients would be provided with disease status feedback so that they could become aware of the changes in essential data such as weight, liver enzyme levels, and the level of physical activity. Therefore, they do not receive any warning, for example in case of weight gain or an increase in liver enzymes (Table 2, Sample of Quotes, Row 27). Also, the absence of any monitoring mechanism for the patient's status after their visit to the physician was mentioned (Table 2, Sample of Quotes, Row 28). Patients often forget essential information, such as the significance of follow-up and NAFLD treatment, their upcoming visit schedules, and their physician's recommendations during treatment. Currently, there is a lack of a mechanism to remind and inform patients of such necessary information (Table 2, Sample of Quotes, Row 29).

Main category 12: insufficient policy-making and planning for prevention and management of NAFLD

According to the GH specialists, there is a lack of awareness among people and policymakers about NAFLD and the importance of its prevention in society. Consequently,

Table 5 Main categories, subcategories, and primary codes of needs

Main Categories	Subcategories	Primary Codes
1- Developing a comprehensive treatment plan	**1.1** Comprehensive examination of patients and timely diagnosis	**1.1.1** Investigation of comorbidities associated with NAFLD*
		1.1.2 Examination of other symptoms in patients
		1.1.3 Timely diagnosis of NAFLD in the early stages
		1.1.4 Identifying underlying factors of NAFLD
		1.1.5 Examining psychological problems in patients
		1.1.6 More specialized tests
		1.1.7 More specialized medical imaging
	1.2 Designing structured and customized treatment plans for patients	**1.2.1** Designing tailored treatment plans for each patient
		1.2.2 Designing treatment plans structured
		1.2.3 Designing education treatment plans
		1.2.4 Personal discipline and eating at regular hours
		1.2.5 Using guidelines in designing treatment plans
2- Updating physicians' knowledge and creating standard treatment protocols	**2.1** Improving physicians' knowledge of developing treatment plans and managing chronic diseases	**2.1.1** Enhance the knowledge of physicians in providing nutritional and sports programs
		2.1.2 Enhance the knowledge of physicians regarding the care and management of chronic diseases
		2.1.3 Providing nutritional and sports information to physicians in a proper format
	2.2 Improve the knowledge and awareness of other healthcare providers	**2.2.1** Enhance the knowledge of other healthcare providers
		2.2.2 Holding retraining courses for other healthcare providers
	2.3 Designing standard treatment protocols based on guidelines	**2.3.1** Localization of guidelines of NAFLD
		2.3.2 Examination of lifestyle profile alongside clinical parameters
		2.3.3 Designing local treatment protocols
		2.3.4 Use of noninvasive methods in the treatment protocol
3- Changing attitudes and empowering patients	**3.1** Changing patients' attitudes towards NAFLD and its treatment methods	**3.1.1** Changing patients' misconceptions about NAFLD
		3.1.2 Changing patients' misconceptions about NAFLD treatment methods
		3.1.3 Using the therapeutic role of physicians in changing patients' belief
	3.2 Increasing self-efficacy and motivation of patients	**3.2.1** Improving patients' self-efficacy
		3.2.2 Improving patients' motivation during the treatment period
4- Informing and educating patients about various aspects of NAFLD management	**4.1** Teaching healthy nutrition and appropriate exercises to patients	**4.1.1** Teaching appropriate exercises for treating NAFLD to patients
		4.1.2 Teaching healthy nutrition to patients
		4.1.3 Holding training sessions for patients
	4.2 Teaching lifestyle modification and self-management to patients	**4.2.1** Teaching lifestyle modification to patients
		4.2.2 Teaching self-management to patients
		4.2.3 Informing patients about their central role in the treatment of NAFLD
	4.3 Informing and providing information to patients about NAFLD, its treatment	**4.3.1** Making patients aware of NAFLD and its treatment methods
		4.3.2 Informing patients about the importance of following the treatment plan
		4.3.3 Making patients aware of the importance of treatment follow-up
		4.3.4 Informing patients about the consequences of an unhealthy diet
		4.3.5 Informing patients about the consequences of inactivity
		4.3.6 Informing patients about the consequences of an unhealthy lifestyle
		4.3.7 Making available reliable scientific resources about NAFLD
5- Establishing multispecialty clinics for NAFLD with different treatment groups	**5.1** Establishing specialized clinics to provide medical, educational, and consulting services	**5.1.1** Establishing specialized clinics to provide clinical and paraclinical services
		5.1.2 The need for trained colleagues in the NAFLD field
		5.1.3 Establishment of advisory and educational service centers
	5.2 Cooperation and ongoing communication of different specialties in the treatment team	**5.2.1** Interdisciplinary team for NAFLD
		5.2.2 Participation of other specialties in the treatment team
		5.2.3 Facilitating continuous communication between treatment team members
		5.2.4 Creation of clinical, nutritional, and sports treatment groups
6- Establishing peer support groups and facilitating communication	**6.1** Facilitating communication between the treatment team and patients	**6.1.1** Periodic meetings between patients and the treatment team
		6.1.2 Holding face-to-face meetings between patients and the treatment team
	6.2 Involving relatives and friends of patients in the treatment of NAFLD	**6.2.1** Informing and involving relatives in the treatment process
		6.2.2 Creating a friends network consisting of patients
		6.2.3 Family-centered care in the management of NAFLD
		6.2.4 Continuous communication of the treatment team with patients and their families

Table 5 (continued)

Main Categories	Subcategories	Primary Codes
7- Utilizing digital technology to track patient information, monitor their progress, and provide feedback	**7.1** Design a patient information registration system	**7.1.1** Registering patients' information in medical centers **7.1.2** Recording patients' lifestyle profile data **7.1.3** Registration of patients' disease information **7.1.4** Creating electronic health records for patients **7.1.5** Creating a registry specific to NAFLD
	7.2 Design a monitoring and follow-up system	**7.2.1** Systematic follow-up of patients **7.2.2** Establishing monitoring mechanisms to monitor patients **7.2.3** Persistent monitoring of patients' disease data **7.2.4** Persistent assessment of disease status in patients **7.2.5** Monitoring of treatment team on patients **7.2.6** Monitoring of patient's adherence to the treatment plan
	7.3 Design a notification and information feedback system	**7.3.1** Feedback on the disease status to patients and physicians **7.3.2** Sending alerts and incentives to patients based on the disease condition **7.3.3** Feedback on the degree of adherence to the treatment plan to patients and physicians **7.3.4** Reminding patients to perform periodic tests **7.3.5** Reminding patients and physicians of the time of the next visit **7.3.6** Continuous provision of information about NAFLD to patients **7.3.7** Periodic reminder of physicians' recommendations to patients **7.3.8** Providing online expert consultations to patients **7.3.9** Use of telemedicine for communication between the treatment team and patients
8- Supportive, educational, prevention, and management policy-making in the treatment of NAFLD	**8.1** Covering the costs of treating patients by insurance and sponsoring centers	**8.1.1** Coverage of NAFLD treatment costs by insurance **8.1.2** Financial support of supporting organizations for poor patients **8.1.3** Providing free consultations to poor patients **8.1.4** Providing free healthy food to poor patients
	8.2 Raising awareness people and policymakers about NAFLD	**8.2.1** Making people aware of NAFLD **8.2.2** Making policymakers aware of the importance of prevention and treatment of NAFLD **8.2.3** Making society aware of the Consequences of an unhealthy lifestyle
	8.3 Teaching and planning for the prevention of NAFLD in the community	**8.3.1** Planning and policy for prevention and treatment of NAFLD **8.3.2** Culturalized healthy eating and exercise in society **8.3.3** Reducing fast food consumption in society **8.3.4** Creating centers to provide healthy food **8.3.5** NAFLD prevention training in teaching resources **8.3.6** Teaching healthy lifestyle in teaching resources **8.3.7** Teaching people about healthy eating habits and regular exercise **8.3.8** Teaching people a healthy lifestyle
	8.4 Policy-making to facilitate the management and treatment of NAFLD in the community	**8.4.1** Providing healthy food in the workplace **8.4.2** Dedicating part of working time to exercise **8.4.3** Proper allocation of specialists in other cities **8.4.4** Setting up a referral system in Iran **8.4.5** NAFLD screening in the community **8.4.6** Creation of counseling and educational departments in medical centers **8.4.7** Facilitating communication between individuals involved in the management of NAFLD **8.4.8** Allocation of funds for awareness and prevention of NAFLD **8.4.9** Conducting comprehensive research in the field of NAFLD **8.4.10** Identification of risk factors causing NAFLD in society

* NAFLD = Non-Alcoholic Fatty Liver Disease

the absence of any plan by the government and officials adds to the existing challenges in treating this disease (Table 2, Sample of Quotes, Row 30). The prevalence of this disease among people imposes social, financial, and mental burdens (such as the medical costs of treatment and liver transplants in advanced cases) on society and the government. Also, this burden could devastate the healthcare system and its ability to deal with a surge in the prevalence of this disease in the future (Table 2, Sample of Quotes, Row 31).

Main category 13: economic problems and the high cost of specialized services and healthy nutrition

According to the GH specialists, the patient's financial problems due to inflation and increased medical costs render them unable to seek treatment from HCPs and have adverse effects on their treatment (Table 2, Sample of Quotes, Row 32). In the treatment process, the patients must have lab tests and various consultations (nutrition, exercise, and psychology), which are costly and sometimes not covered by insurance companies (Table 2, Sample of quotes, Row 33). The increase in food,

vegetable, and fruit prices has rendered many patients unable to afford healthy food. The low cost and availability of convenience food, such as fast food, and the vast number of advertisements for these foods affect people's and patients' diets (Table 2, Sample of Quotes, Row 34).

Needs in the management of NAFLD

Main category 1: developing a comprehensive treatment plan

For NAFLD to be treated more quickly, it must be diagnosed early, and other comorbid conditions should be controlled as well. Also, physicians (incredibly general physicians) must pay attention to the underlying conditions, mental disorders, and other symptoms because carrying out several tests like ultrasound or liver enzyme levels is not sufficient to diagnose NAFLD and its severity. It may be necessary for some cases to have more specific lab tests and specialized imaging like FibroScan (Table 3, Sample of Quotes, Row 1). The treatment plan should be specific to patients' physical and clinical conditions and preferences. It also has to be organized, structured, informed, and education-based so that the patient can be educated about what they can do to manage their condition (Table 3, Sample of Quotes, Row 2).

Main category 2: updating physician knowledge and creating standard treatment protocols

CH specialists and other physicians must increase their knowledge of providing dietary and physical plans to care for and manage chronic diseases. They are willing to receive such information in a concise and suitable format (Table 3, Sample of Quotes, Row 3). As many patients with this condition visit general physicians and internists, these professionals must increase their knowledge and awareness of the diagnosis and treatment of this disease. According to GH specialists, NAFLD knowledge and awareness must be increased via retraining and educational courses for other HCPs, such as radiologists, nutritionists, and exercise physiologists, who play a role in the treatment process (Table 3, Sample of Quotes, Row 4). Also, they stated that the guidelines have to be explicitly localized to the attributes of Iranian society, and some standard treatment protocols need to be designed for PCPs so that they can provide care according to these protocols. Physicians must become familiar with noninvasive methods such as liver fat score (LFS) to determine the severity of the disease (Table 3, Sample of Quotes, Row 5).

Main category 3: changing attitudes and empowering patients

GH specialists stated that patients must change their misconceptions about NAFLD and its treatments. Considering the patients' trust in the medical role of physicians, it would be helpful if the physicians talked to them to change their misconceptions (informing them that NAFLD is dangerous and they must follow the treatment) (Table 3, Sample of Quotes, Row 6). In addition, the patients must be informed that lifestyle modification and weight loss are lengthy processes, and they should be provided with essential consultations to increase motivation and self-efficacy in following the course of treatment so they can believe in their ability to manage their condition (Table 3, Sample of Quotes, Row 7).

Main category 4: informing and educating patients about various aspects of NAFLD management

The GH specialists stated that patients must be educated about the exercises, diet, and lifestyle suited for avoiding and treating NAFLD through educational sessions and workshops (Table 3, Sample of Quotes, Row 8). They must be educated about self-management and the modification of their lifestyles to comprehend their crucial roles in their treatment (Table 3, Sample of Quotes, Row 9). Besides that, the GH specialists emphasized the importance of informing the patients of the consequences of not treating NAFLD, unhealthy diet and lifestyle, and physical inactivity. The other identified needs included providing access to scientific and reliable resources, the correct information about NAFLD, its treatment methods, and the necessity of following treatment protocols (Table 3, Sample of Quotes, Row 10).

Main category 5: establishing multi-specialty clinics with different treatment groups for NAFLD

According to the GH specialists, it is necessary to establish multi-specialty clinics for NAFLD in which the clinical and para-clinical services (like special labs and imaging), consulting services (like dietary and physical consultation), and educational services (in-person or online) are provided in a centralized manner. Also, it is necessary to have staff who are educated in NAFLD (such as general physicians and nurses) available to answer any questions the patients have (Table 3, Sample of Quotes, Row 11). The GH specialists also mentioned team cooperation and the presence of different professionals (such as nutritionists, sports physiologists, and psychiatrists) on the treatment team. They emphasized the need to facilitate communication between treatment team members and create clinical, nutritional, and sports groups specific to NAFLD for patients (Table 3, Sample of Quotes, Row 12).

Main category 6: establishing peer support groups and facilitating communication

The GH specialists maintained that it is necessary to hold periodic meetings between the patients and the medical team members to address possible problems

and motivate them to follow the treatment (Table 3, Sample of Quotes, Row 13). Also, they consider it necessary for the relatives of the patients to participate in the treatment process. In other words, family-based care is needed to treat this condition, so it is essential to educate and inform family members and keep contact between the medical team and family members. Establishing a friends network helps patients share their experiences and continue their treatment as a group (Table 3, Sample of Quotes, Row 14).

Main category 7: utilizing digital technology to track patient information, monitor their progress, and provide feedback

GH specialists stated that keeping a record of the patient's information, such as demographic information, lab results, imaging, dietary and exercise information, lifestyle profile, etc., using tools like EHRs and registers is required for better treatment of NAFLD (Table 3, Sample of Quotes, Row 15). They also recommended a systematic follow-up and monitoring mechanism (in the form of a system) to analyze and monitor patients' data (lab, dietary situation, and physical activity level) throughout treatment (Table 3, Sample of Quotes, Row 16). It was recommended that an informing system be established to constantly generate information about NAFLD and disease conditions for patients through alerts and incentives. Patients must be notified of essential information, such as following appointments, periodic lab tests, and physician advice (Table 3, Sample of Quotes, Row 17).

Main category 8: supportive, educational, prevention, and management policy-making in the treatment of NAFLD

The GH specialists recommended insurance coverage for the necessary services, consultations, diagnostic tests, and medications for NAFLD treatment. Considering the importance of healthy eating in the treatment, they suggested that the relief organizations provide healthy food for those patients who cannot afford it (Table 3, Sample of Quotes, Row 18). They said informing the people about this condition and its consequences is necessary. Also, they maintained that it is necessary to inform healthcare policymakers and officials of the importance of the prevention and control of NAFLD in society (Table 3, Sample of Quotes, Row 19). The specialists stated that prevention could be achieved through culturalization of healthy eating, exercising, reducing the consumption of fast food and their advertisements, and establishing centers to present people with healthy eating choices, and teaching healthy lifestyles and healthy eating from an early age. Prevention education can also be a part of school curricula (Table 3, sample of Quotes, Row 20). They pointed out that policies to assign part of work time to exercise, provide healthy food in the workplace, establish a referral system, allocate specialists fairly in different cities, and establish consulting and education units in medical centers are necessary to facilitate the management and treatment of NAFLD. They stated that it is necessary to allocate a specific budget to inform, prevent, screen, and research NAFLD in Iran (Table 3, Sample of Quotes, Row 21).

Discussion

The findings of this study showed that according to the GH specialists, various challenges exist in the management of NAFLD, such as difficult diagnosis in the early stages, the complicated treatment process, inefficient management process, shortages in the healthcare system, diet and unhealthy eating habits, patients' misconceptions, lack of knowledge and awareness among patients and physicians, non-personalization and incomprehensiveness of treatment plans, lack of cooperation by patients, defective record process, faulty monitoring and feedback system, financial problems, and lack of the suitable policy-making and planning. The identified needs included comprehensive and customized treatment plans, bringing physicians up to date, establishing standard treatment protocols, changing the patients' attitude and empowering them, establishing multi-specialty clinics, creating support groups, facilitating communication and coordination, using DHTs in managing the disease, and supportive, educational, and management policy-making.

The findings showed that because it is asymptomatic and unknown to patients and considering its normal lab results and connection to metabolic syndrome and other comorbidities, it is difficult for the physician to diagnose NAFLD. Different studies have mentioned the connection of NAFLD to metabolic syndrome [4, 49–50] and also to other comorbidities [51, 52]. They have also shown that the results of some diagnostic procedures like ultrasound are not valid in diagnosing steatosis [53, 54], and liver function tests (LFTs) may not be elevated in blood tests; therefore, the diagnosis should not be solely based on these tests [55]. A definite diagnosis that is not based on strict criteria might lead to overdiagnosis and its associated harms [56–58]. Considering these challenges, the needs identified in this study included the comprehensive evaluation of the patient, timely diagnosis, attention to other symptoms, and a multidisciplinary team. Various studies mentioned the necessity of the early detection of NAFLD to prevent the disease from progressing to NASH [59, 60] and employing a multidisciplinary approach to manage this condition [61–63]. Therefore, it is necessary to have a team whose members include a hepatologist, a dietitian, an endocrinologist, an exercise physiologist, a clinical psychologist, and a cardiologist.

An increase in the knowledge of HCPs (especially general physicians) in providing patients with diet and

exercise plans and NAFLD guidelines is necessary to address the identified challenges in this study. The HCPs' diagnosis of this condition should not be based solely on radiology reports and liver enzymes. In line with our study, various studies have shown significant gaps in physicians' knowledge regarding diagnosing and managing NAFLD, especially among PCPs such as general physicians [63–66]. Given these challenges, this study identifies the need to offer retraining courses, educational courses, and workshops and provide information in the correct format to increase knowledge and awareness among HCPs. In this regard, the studies mentioned the importance of increasing the knowledge of HCPs through the availability of diagnostic tools and guidelines [24, 67]. Kanwal et al. [63] also showed that more than 80% of physicians requested more education in diagnosing and managing NAFLD/NASH. Additionally, the GH specialists emphasized the importance of educating and informing other involved professionals (exercise physiologist and dietitian) in managing NAFLD, which points to the significance of a multidisciplinary approach in managing this condition. The studies maintained that educating all professionals in the treatment team is necessary to facilitate a consistent approach [24, 31]. Our findings showed that the guideline instructions are too general, and the absence of a standard protocol and the existing local guidelines make the treatment process challenging. On this subject, many studies have mentioned the absence of required details in the guidelines [22, 68–69], the unsuitable design of NAFLD screening or management guidelines [70], the discordance between the published guides and clinical practice [22, 24], and inconsistencies in PCP diagnostic methods [24]. Therefore, in this study, designing local guidelines and standard treatment protocols is identified as a necessity. Studies have pointed to the significance of local guidelines in diagnosing and assessing this condition and the timely referral of patients to secondary care (24,70(. The GH specialists also maintained that the physicians (especially general physicians) must become familiar with noninvasive methods as alternatives to invasive ones (e.g., liver biopsies) due to the complications of the latter [71]. Using noninvasive methods such as fatty liver index (FLI), hepatic steatosis index (HSI), lipid accumulation product (LAP), liver fat scores (LFS), hepatorenal ultrasound index (HRI), regular abdominal ultrasound (AUS), fibrosis-4 index (FIB-4) could help physicians diagnose this condition [72, 73]. Employing these tools is recommended for diagnosing and evaluating NAFLD, so in case the PCPs cannot establish an exact diagnosis, they can refer the patients to a secondary care expert.

Other identified challenges in this study were the inadequate knowledge and awareness among the patients, the public, and policymakers about the prevention and treatment of this condition and the consequences if it is left untreated. Besides that, the GH specialists mentioned the absence of suitable information resources for the patients and the negative effect of false advertising and medical fraud on the patients' desire to follow up on their treatment. Aligned with our results, various studies have reported a low level of NAFLD awareness among people, patients [74, 75], and policymakers [76]. A study conducted in Iran [77] showed a low level of awareness of fatty liver prevention behaviors among people due to the absence of information sources. Contradictory dietary information can affect patients' weight loss and diet plans, and it is a barrier to changing patient behavior [78, 79]. Considering these challenges, informing policymakers and people, providing access to reliable scientific sources about NAFLD, educating healthy eating and suitable exercises, and training colleagues were identified as needs. The studies identified education as a safeguard against NAFLD [80, 81] and a facilitating tool for patients' treatment plans [82, 83]. In addition, training colleagues in NAFLD (including general physicians and nurses) can play a positive role in educating the patients and addressing their questions. Also, various studies have mentioned the positive effect of collaboration among other health staff, such as nurses, on managing this condition in patients [84, 85].

Among other identified challenges are unhealthy lifestyle, noncompliance with the treatment plan, lack of treatment follow-up, lack of consistent communication between the treatment team and the patient, lack of self-efficacy and motivation, and the patients' long working hours. Consistent with our results, other studies mentioned noncompliance with disease management advice, lack of suitable physical activity [24, 86], lack of communication with and support by the treating physician [22, 24, 26], lack of motivation [33], and time and job limitations [27, 87]. Based on these challenges, the identified needs in this study included teaching lifestyle modification and self-management to the patients, informing patients of their crucial role in NAFLD management, increasing their motivation and empowering them, offering periodical meetings, and facilitating communication between patients and the treatment team. On this subject, the educational intervention of Sharifi et al. [39] in Iran showed that the perceived susceptibility, motivation, self-efficacy, and preventive behaviors in NAFLD patients increased. Also, providing the patients with adequate information about the effectiveness of lifestyle modification in treating NAFLD was able to increase their compliance and self-efficacy [88]. One way to overcome time limitations is to exercise at home. The benefits of home-based exercise programs have been confirmed in chronic liver diseases [89]. Another tool by which the motivation and self-efficacy of the patients could increase is

motivational interviews, whose effectiveness in chronic conditions like diabetes and cardiovascular diseases has been demonstrated by various studies [90, 91]. However, many physicians are not familiar with these methods [92]. Therefore, educating physicians and establishing centers to conduct motivational interviews with patients will help the patients in this respect. Another identified need in our study was the need to establish support networks among patients, and studies have illustrated the benefits of these networks in maintaining motivation among other patients in addition to empowering them and answering their questions [78, 93–94]. Moreover, patients must have coping strategies and communication with the physicians to remain compliant with the treatment plan and overcome possible problems [30]. Thus, it is recommended that the treatment team conduct periodical interviews to more effectively evaluate the patient's problems, levels of NAFLD self-management, and personalized factors.

Other challenges to treatment include too general physician advice and unstructured and impersonalized treatment plans. Consistent with our results, Jang et al. [25] showed that the physicians' advice being too general and uninformed is one of the significant problems for NAFLD patients. Designing structured and personalized treatment plans was identified as a need. Physical exercise interventions must be tailored to the individual patient's needs and customized according to the patient's preferences, physical activity, and comorbidities. A structured treatment plan must contain precise guidance and information, including the optimum frequency, intensity, and duration of the exercise or safe intake of carbohydrates.

Other identified challenges included misconceptions, incorrect notions and habits, and the belief in herbs and medicinal plants. Although Iranians use herbs to treat some common conditions [95, 96], no study has been conducted to investigate the effect of medicinal plants and natural products on reducing liver enzyme levels in NAFLD patients. The patients' misconceptions could be the result of their lack of awareness and knowledge of this condition, the asymptomatic nature of this disease, and the absence of any treatment specific to NAFLD. Significant behavior changes are required to modify lifestyle [97]. Due to the complexity of patients' notions, habits, and behaviors, employing theories or patterns of behavior change is recommended to develop healthy behaviors in lifestyle interventions. For example, the protection motivation theory (PMT) can be used to understand and foresee the health intentions and behaviors that protect the individual against hazardous events [98]. The capability, opportunity, motivation, and behavior (COM-B) model is a theory of behavior change whose factors can be used to develop healthy habits in people [99]. The advantage of this model is its capability to provide a valuable framework for explaining enabling factors of behavior change and a basis for behavioral interventions [30]. Another behavior change model is the health action process approach (HAPA), which is widely used in various behavior change cases, including changes in diet [100] and physical activity [101]. HAPA is essential in improving risk perception, action self-efficacy, and outcome expectations management, using volitional self-regulation strategies (including action plans, coping strategies, and self-efficacy maintenance) to establish and maintain the behavior.

Other identified challenges included financial problems, constant exposure to advertisements, and easy access to unhealthy food. Iran has a low-income, high-inflation economy [102], and the inflation has made many patients unable to visit consultants and HCPs, do periodical lab tests, and access healthy food, so they consume unhealthy and convenience food such as fast food. A recent study showed that in Iran, NAFLD is related to social inequality and socioeconomic status among the Iranian population [37]. Consistent with our results, various studies also have shown that the high cost of food is a barrier to maintaining diet and lifestyle modification [78, 103]. However, Haigh et al. [26] showed that contrary to our findings, costs are not a barrier to maintaining a healthy diet, which may be due to the difference between the economic conditions in Iran and developed countries. Evidence suggests that low-income households are more vulnerable to food insecurity, unhealthy diets, and chronic diseases like NAFLD [104]. Moreover, aligned with our results, studies have shown that a food environment full of advertising and marketing can affect people's healthy eating habits [105, 106]. In keeping with these challenges, the following needs were identified in this study: the cost coverage of the tests, including laboratory tests, imaging, and consultations by insurance companies and relief organizations, free food for poor patients, the establishment of centers to present healthy food, and planning to reduce supply and consumption of fast foods in society. Some actions are necessary to regulate the advertising market and the marketing of unhealthy foods and beverages. Some countries have undertaken the "United Nations Decade of Action on Nutrition 2016–2025" policy, which includes reducing taxes on fresh foods and providing low-income families with cash transfers to buy fresh produce [107]. These plans can be implemented for low-income NALFD patients in Iran.

Our study identified the local culture and customs as barriers to NAFLD management. The results of a study in Iran [38] also showed that a firm commitment to ordinary and traditional dietary patterns increases the chance of developing this condition. To overcome this challenge, the involvement of the patient's family was identified as a need. Additionally, reducing participation in

social gatherings, eating at home more often, and choosing the food smartly at parties are recommended. Also, the conducted studies maintained that since NAFLD is a lifestyle disease, the patient's family members should understand its harm [33], and their participation as care partners positively affects managing this condition [25]. Asian countries like Iran have family-centered cultures; therefore, the family plays a vital role in a patient's self-management behavior [108, 109]. Thus, any treatment must consider family members' roles and provide plans to educate and inform them about their roles.

The absence of centers that provide specialized consultation, support, and education services, the lack of medical teams specific to the treatment of NAFLD, and the shortage of specialists were among other identified problems. On this subject, a study in Iran [77] showed that people in most cities are at risk of developing this condition, and due to the shortage of specialists and informed sources, the awareness of preventive behaviors among people needs to be improved. Limited access to health care could be a factor in the prevalence of chronic conditions [110]. Studies have shown that physicians lack the time, training, and tools to address lifestyle modification problems such as exercise programming. Instead, they advocate a multidisciplinary approach, which is unavailable in most settings [22, 26]. Considering these challenges, establishing multidisciplinary clinics specific to treating NAFLD was identified as a need to provide consultation (to evaluate the barriers to lifestyle modification and to provide a personalized plan), education (lifestyle and healthy eating skills, physical and self-management exercises, and coping mechanisms against stressful factors), and clinical and para-clinical services. Several studies have illustrated the benefits of establishing multidisciplinary secondary care clinics, such as reducing cardio-hypometabolic risk, BMI, transaminase levels, and costs [111, 112].

The defect in recording, monitoring, and obtaining feedback and the absence of DHTs in managing NAFLD were identified as other challenges. The patient's information is not registered and recorded in medical centers during the treatment, and tools such as NAFLD-specific registries and EHRs do not exist to record data. Our findings also showed that physicians have problems managing patients and their future referrals during visits. After the visit, they have problems monitoring and following up with the patients, and there is no communication from one visit to the next. Regarding these challenges, the use of DHTs to record their data, monitor and observe them, obtain their feedback, and inform them was identified as a need. The GH specialists maintained that using DHTs in the comprehensive management of NAFLD is crucial. This suggests the growing significance of using these technologies among physicians and people in Iran. In this regard, a national survey in Iran [113] showed that Iranians have been using digital technologies like the Internet for health-related purposes for more than a decade. Various studies have shown the benefits and advantages of using DHTs in any setting [114] for the prevention, treatment, and management of other chronic diseases [114, 115], lifestyle modification of NAFLD patients (like long-term weight loss), the improvement of biomarkers related to liver health [116], and the patients' motivations and commitment to the treatment plans [117]. Other studies have mentioned other forms of DTHs, such as remote intervention, voice reminders, gamification for awareness enhancement, gift rewards, financial rewards, role model incentives, and motivation [118, 119]. The primary treatment for NAFLD patients includes physical activity and diet, so real-time data registration is necessary to evaluate the disease's progression or improvement [120]. Data registration and comprehensive data monitoring via DHTs provide a chance to achieve tailored feedback and timely adjustment of the interventions [114]. Previous studies have illustrated that DHTs can track physical activity [121] and dietary parameters [122]. Due to the complicated nature of NAFLD management, it is recommended that software be designed with various modules, including diet guidance, exercise management, medication reminders, sleep management, psychological guidance, counseling services, education, and the real-time assessment of the patient's situation. Also, registering data, like weight, waist circumference, skeletal muscle weight, percentage of body mass, diet, exercise, etc., via wearable devices, intelligent apps, measurement tools, and patients' self-reporting in the EHRs could help physicians monitor and track the health situation and personalized treatment plans of the patients. Recording patients' data during their daily activity in the EHR could help HCPs monitor patients' activities and provide them with regular, timely, informed, and personalized feedback. Through a unified intra-hospital and extra-hospital data registration system, patients can access data on their condition in any setting after registering their personal information into the EHR, which could save time and medical costs. Few studies have used all the capabilities of DHTs, and their practice in treating NAFLD is in the exploratory stage [114]. Some studies have investigated remote lifestyle interventions, including diet, exercise, and health education on web-based and mobile-phone-based platforms, which were beneficial preliminary steps to aid physicians and patients in the treatment of NAFLD [123–126]. However, enjoying the benefits of DHTs has its limitations, such as product design, personalization of guidance, professionalism of the intervention content, applicability of service targets, patient compliance, the accuracy of data recording, and cost issues [114]. Future studies must find a way to overcome these challenges and

investigate the effectiveness of DHTs' extensive capabilities in managing NAFLD.

This study identified the absence of policies for education, informing, screening, prevention, providing specialized services for the patients, implementing a referral system, and sufficient research about NAFLD as a challenge/need. A survey showed that among 102 countries, none has a written strategy to fight this condition, and one-third of the countries scored zero in the policy preparedness index [127]. The economic effect of NAFLD increases with the condition's progression, and it is estimated that more cases will increase the costs [128]. NASH's heavy financial and clinical burden demands effective treatment options and policy-making for its prevention and treatment. The screening of NAFLD is still controversial, and there needs to be a consensus about the most effective screening strategy [129]. Usually, the guidelines do not recommend screening for NAFLD, and the United States Preventive Services Task Force (USPSTF) does not have any particular guidelines for NAFLD screening [21]. However, screening is necessary due to the high number of NAFLD patients [2]. The guidelines of the American Association for the Study of Liver Diseases (AASLD) recommend that noninvasive biomarkers such as NAFLD fibrosis score (NFS) or fibrosis-4 index (FIB-4) could be used in the screening of these patients. Nevertheless, further studies are necessary to determine the practicality of these tools.

Our study identified that some challenges in managing NAFLD in Iran stem from issues in the healthcare system, including a shortage of specialists, inadequate insurance coverage, and incomplete implementation of the referral system. In this regard, the study by Khangah et al. [130] showed that the Iranian healthcare system has shortcomings and problems compared to different countries, including the referral system, type of payment method, and ownership of service providers. Comparing the Iranian healthcare system [131–133] with other leading countries (see the list below) [134–142] reveals that in most of them, the private sector provides primary care services; at the same time, the government has a regulatory and commanding role. Compared to Iran, the government provides primary care services. This could explain why many patients have to travel long distances from their cities to health centers concentrated in large urban areas to see GH specialists. In addition, these countries offer public coverage at both the primary and secondary care levels. In contrast, in Iran, this coverage is more prominent at the primary but not secondary healthcare level. Our results also showed that the government and insurance do not cover the costs of NAFLD treatment in Iran. However, in many developed countries such as the United Kingdom [140] and Canada [142], almost all costs are covered by the government and insurance. Also, in these countries, special care is provided through a referral system, and the gatekeeper role is defined for physicians. However, in Iran, the referral system has not been fully implemented; there is no limitation for access to specialists without a referral from a family physician, and many of the patients choose their services, both for provider and location, by the way, they want. The lack of a referral system in Iran could explain our findings, including crowded private offices and public clinics and a lack of time for physicians to talk to patients. The government provides most healthcare services to patients in Iran, while non-governmental organizations play a smaller role in providing these services. This problem in the Iranian healthcare system might be solved by privatization and centralization. The literature review revealed that all countries face similar challenges in their healthcare systems, even with major differences in health service financing, organization, and delivery. These challenges include ensuring fair public access to healthcare, improving service quality, enhancing patient outcomes, reducing public expenses, boosting performance, fostering accountability within the healthcare system, encouraging greater public involvement in decision-making, and lowering obstacles between health and social care [130, 143]. Iran's healthcare system functions amid swiftly evolving social, economic, and technological factors, resulting in various challenges and tensions [130]. The healthcare system is complex and demands a thorough exploration of various historical, political, social, economic, and cultural factors [143], which this article cannot cover in detail. Therefore, it is recommended that future studies focus on the challenges within the healthcare system and how these challenges impact the management of NAFLD in Iran and other countries.

Strengths and limitations

To the best of our knowledge, this study, conducted via a qualitative approach and in-depth interviews, was the first in Iran to investigate GH specialists' perspectives and experiences on NAFLD management. The findings may facilitate further quantitative studies on the facilitators and barriers to managing NAFLD. Given the limited number of these specialists in Iran and the necessity for the majority of patients to seek their care, the findings of this study offer valuable insights into the specialists' views on the challenges encountered by patients and physicians in the management of NAFLD and their needs for future treatment options. Some key findings of the study, significant for policymakers and planners, have been infrequently addressed in similar research. These included the defects in the patient management process, weakness in the criteria, the use of DHTs in the management of this condition, the change in the patients' attitude and patient empowerment, shortages in the healthcare system, and

the need to make educational, supportive, and management policies in the society. Considering the AGH Research Center announcements, most of the participating individuals in this study had prior knowledge of the study and were prepared. Because of the suitable setting of the interviews, some interviews continued for as long as 90 min, and a second interview was scheduled for some specialists to elicit more information. The GH specialists in this study had at least ten years of experience in medicine and the management of NAFLD.

The study had several limitations. First, this study was conducted with a relatively small number of GH specialists. Since qualitative studies are specific to a limited number of participants and a particular environment, the findings cannot be generalized to other settings. Qualitative research typically involves small sample sizes and serves as a reliable scientific method for gaining insights into individuals' experiences regarding a specific topic. However, to ensure a broader range of perspectives, we performed a purposeful sampling and identified some experienced specialists whose offices are located in various areas of the city. Secondly, the perspectives of other HCPs involved in managing NAFLD, such as the internists and general physicians, endocrinologists, cardiologists, psychiatrists, nutritionists and dieticians, and exercise physiologists, were not investigated. Exploring the perspectives of other HCPs can provide a more comprehensive approach to the care of patients with NAFLD, addressing not only hepatic complications but also the metabolic, nutritional, and psychological aspects of the disease. However, considering that the referral system is not entirely in place yet, the patients consult directly with the GH specialists; therefore, investigating the specialists' perspectives might lead to a clearer picture of the challenges and needs in managing NAFLD in Iran. Our research team recommends that future studies investigate the perspectives of other HCPs who are involved more in managing NAFLD. Third, due to the cultural, social, and economic gaps and differences among healthcare systems, the generalization of this study's findings should be done with caution. However, since the contributing factors to this condition and the management challenges that involve the physicians and the patients may be similar in different societies, this study's findings can be used to compare various societies. Also, to perceive the gap between patients and physicians and expand suitable interventions to improve patients' health, future studies may investigate the difference in the patients' and physicians' perspectives on managing NAFLD.

Implications

Without approved therapies for NAFLD, this study provides preliminary insights that may guide policymakers, planners, and stakeholders involved in managing NAFLD to address challenges and needs and develop interventions and strategies. Based on our findings, a multidisciplinary approach is crucial in managing this condition; therefore, policymakers should plan to establish NAFLD-specific medical teams and facilitate communication among various specialties. Moreover, the patients and the treatment team need to communicate with each other; DHTs like telemedicine can help with this. Policymakers should plan to establish special clinics for NAFLD in different cities to provide education, counseling, and special services for the patients, suitably distribute physicians, and implement the referral system. It should be a priority for them to design standard treatment protocols, especially for the PCPs, to standardize the diagnosis and treatment of NAFLD. Due to the cultural, social, economic, and dietary differences between Iran and other countries, it is necessary to design local guidelines according to these features. For example, the Mediterranean diet, recommended by international guidelines, should be redesigned based on the Iranian dietary pattern. Educational products should be designed to increase knowledge and awareness among patients, the public, and physicians. Public campaigns, traditional media, social media, and collaborative approaches can increase patient and public awareness. The interventions and education of healthy lifestyles can begin early in families and continue in schools. The media, social media, and the Internet can also be beneficial sources for generating health information and helping raise public awareness of NAFLD. There should be increased knowledge and awareness among healthcare professionals via formal medical curricula, continuing their education with the cooperation of other disciplines, and providing workshops and conferences. It is recommended that dietary plans be delivered via videos so that the patients can better realize which ingredients should be used. Due to the possible effects of food insecurity on NAFLD management, screening for food insecurity via validated screening tools is recommended. Patients' lack of time was identified as an essential barrier; therefore, it is recommended that policymakers and governments annually assign some days to public exercise days and dedicate some of the people's working hours to physical activity.

Conclusions

To design new and suitable interventions or to appropriate the existing ones for NAFLD management, first, it is necessary to perceive the issues that physicians and patients have. The current study investigated the challenges that patients and physicians face in Iran for the first time from the point of view of GH specialists. The findings showed that the following had adverse effects on the prevention and management of NAFLD: differential diagnosis, the complicatedness of the treatment

and management process, shortages and defects in the healthcare and medical system, patients' misconceptions and poor self-efficacy, problems of the social, cultural and economic factors, defects in recording, monitoring, patient data feedback, and the absence of systematic policy-making and planning. The following act as facilitators of the management of NAFLD and were identified to be helpful to the policymakers and planners in facing challenges as the focus of interventions: designing comprehensive and personalized treatment plans, elevating the physician's and patients' level of knowledge and awareness, designing standard treatment protocols, changing patients' attitude and empowering them, establishing multi-specialty NAFLD clinics, using DHTs to record and monitor patient data, and supportive, educational and preventive policy-making for the management of NAFLD. Fighting NAFLD with a multifaceted approach could have better results that require collaboration among governments, healthcare institutions, families, and individuals. Future studies could investigate the effects of these findings on successful lifestyle interventions in the management of NAFLD and achieve an optimum design for medical interventions.

Abbreviations

NAFLD	Non-alcoholic fatty liver disease
NASH	Non-alcoholic steatohepatitis
GH	Gastroenterology and hepatology
T2DM	Type 2 diabetes mellitus
HCC	Hepatocellular carcinoma
HCPs	Healthcare providers
PCPs	Primary care providers
AGH	Adult gastroenterology and hepatology
KUMS	Kerman University of Medical Sciences
COREQ	Consolidated criteria for reporting qualitative studies
BMI	Body mass index
LFS	Liver fat score
FLI	Fatty liver index
LFTs	Liver function tests
EHR	Electronic health record
DHTs	Digital health technologies
HSI	Hepatic steatosis index
LAP	Lipid accumulation product
HRI	Hepatorenal ultrasound index
AUS	Regular abdominal ultrasound
FIB-4	Fibrosis-4 Index
PMT	Protection motivation theory
COM-B	Capability, opportunity, motivation, and behavior
HAPA	Health action process approach
USPSTF	United States Preventive Services Task Force
AASLD	Association for the Study of Liver Diseases
NFS	NAFLD fibrosis score

Supplementary Information

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Supplementary Material 1

Supplementary Material 2

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Author contributions
FS, SS, SSh, MJ, and AS contributed to conceiving and designing the research. FS, SS, and AS collected, analyzed, and interpreted the data. FS, SS, and AS contributed equally to writing and revising the manuscript. All five authors read and approved the final manuscript.

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Data availability
The datasets used and/or analyzed during the current study are available from the corresponding author upon a reasonable request.

Declarations

Ethics approval and consent to participate
All procedures performed in studies involving human participants were in accordance with the ethical standards of the Institutional and/or National Research Committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study. The study was approved by the Ethics Committee of Kerman University of Medical Sciences (code: IR.KMU.REC.1401.536).

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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