ORIGINAL RESEARCH

# Gaps in MASLD/MASH Education: A Quantitative and Qualitative Survey with Leaders of US Graduate Medical Education Programs

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**Purpose:** Metabolic dysfunction–associated steatotic liver disease (MASLD) and its inflammatory subtype, metabolic dysfunction–associated steatohepatitis (MASH), are associated with cardiometabolic risk factors, including obesity and type 2 diabetes. The prevalence of both conditions is rising rapidly and is underdiagnosed (<5%). We aimed to gather qualitative and quantitative insights from program leaders in US medical education training on their experience with MASH-related training and education.

**Participants and methods:** A cross-sectional study consisting of a quantitative survey and qualitative discussions with individuals in primary care (internal medicine and family medicine) and specialty programs (hepatology, gastroenterology, and endocrinology) were held from February 21 to August 28, 2023. Descriptive statistics were used for data analysis.

**Results:** A total of 190 leaders participated in the online survey and 11 leaders joined the focus groups. Almost all respondents reported that MASLD (96%) and MASH (92%) were included in their program's curricula. However, many believed that little time was devoted to discussing MASH in their program. Most respondents agreed that MASH is extremely underdiagnosed. Program leaders agreed that the interconnectedness of MASH with other cardiometabolic conditions necessitates instruction time on MASH beyond that of its dedicated curriculum time. All participants believed that emergence of regulatory-approved drugs for MASH will drive a decision to increase the time allotted for MASH in the curriculum.

**Conclusion:** Although program leaders agreed that MASH has an important place in medical education curricula, the relative paucity of treatment options reduces its coverage in training, thereby limiting healthcare practitioners' understanding of MASH.

**Plain Language Summary:** Metabolic dysfunction–associated steatotic liver disease (MASLD) and metabolic dysfunction–associated steatohepatitis (MASH) are liver conditions that often appear with obesity and type 2 diabetes. Despite the high prevalence and increasing impact of MASLD and MASH, the majority of affected patients are not diagnosed and present late in the course of disease. These observations suggest limits in awareness. This study aimed to understand how US healthcare providers (HCPs) felt about the level of attention MASLD and MASH receive in medical education training programs. An online survey (N = 190) and focus group discussions (N = 11) were held with people who were familiar with their program's education and training. Most participants said that MASH is often not diagnosed, which can lead to problems; however, it is important to include it in the school's curriculum. Many people said they think MASH is connected to other conditions, and that meant that HCPs were being trained on it indirectly. Once a treatment for MASH is approved, most participants believed MASH will be covered more in their education programs. Even though MASH is thought to have an important place in the training of HCPs, program leaders saw limited treatment options as a barrier to having more focused time spent on it in their educational programs.

**Keywords:** nonalcoholic fatty liver disease, nonalcoholic steatohepatitis, education, medical, curriculum, surveys and questionnaires, focus groups

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#### **Graphical Abstract**



## Introduction

Metabolic dysfunction–associated steatotic liver disease (MASLD) and its inflammatory subtype, metabolic dysfunction– associated steatohepatitis (MASH), are hepatic manifestations of metabolic syndrome.<sup>1–3</sup> In 2023, the nomenclature was updated from nonalcoholic fatty liver disease (NAFLD) and nonalcoholic steatohepatitis (NASH) to MASLD and MASH, respectively. In addition to the nomenclature change, the disease definitions were also updated, and the diagnosis criteria included the presence of at least 1 of 5 cardiometabolic risk factors.<sup>1</sup> MASLD and MASH are associated with cardiometabolic risk factors, including obesity and type 2 diabetes (T2D).<sup>3,4</sup> The prevalence of MASLD/MASH in the United States (US), and globally, is rising rapidly.<sup>5,6</sup> Furthermore, patients with MASH are at an increased risk of cirrhosis, hepatocellular carcinoma, requirement for liver transplant, and mortality.<sup>7,8</sup> Finally, MASH is also the leading cause of liver transplant in women and the elderly.<sup>9,10</sup> Therefore, education surrounding the rising prevalence of MASH and MASLD associated risk factors is important for emerging healthcare providers.

Despite its increasing prevalence, MASH remains largely underdiagnosed.<sup>11</sup> Proprietary data evaluating trial-ready participants with MASLD reported that <2% of patients with MASH are assigned an International Classification of Diseases, 10th Revision, (ICD-10) code for MASH in the US.<sup>12</sup> In another study, although the prevalence of fatty liver disease was 29%, only 1.6% of fatty liver disease cases had ICD codes recorded.<sup>13</sup> According to a recent survey on practice patterns for MASLD, two-thirds of physicians reported that in more than half of the referred patients, the diagnosis of MASLD was either missed or delayed.<sup>14</sup> Furthermore, over 50% of adults with risk factors for MASH go unscreened.<sup>15</sup> Underdiagnosis is likely due to multiple factors, including the silent nature of early stage MASH for most patients, the perceived need for liver biopsy for diagnosis, and the paucity of approved pharmacotherapies for MASH in the US.<sup>16</sup>

Advances in biomarkers and noninvasive tests have improved the feasibility of screening for MASH and advanced liver fibrosis. Recent guidance recommends screening for advanced fibrosis in patients with T2D, medically complicated obesity, and MASLD in the context of moderate alcohol use and among first-degree relatives of patients with cirrhosis due to MASLD/MASH.<sup>17</sup> However, a needs assessment study revealed that US physicians had significant gaps in knowledge regarding screening, diagnosing, and treating patients at high risk for MASH.<sup>2</sup> A recent review highlighting the patient and physician perspectives for MASH/MASLD also reported a need for patient- and provider-centered education to improve disease awareness, diagnosis, and management.<sup>18</sup>

We hypothesized that there might be an educational gap for healthcare professionals treating MASH, which may contribute to insufficient screening, diagnosis, and management of patients with MASH. To achieve our aim, we conducted an online quantitative survey and qualitative discussions with several program leaders in US graduate medical education training to quantify and expand their perspectives on how MASH-specific training is currently offered. This study also aimed to identify gaps between key competencies and current curricula and to uncover barriers and opportunities in current practices for the early identification and treatment of MASH.

Finally, we sought opinions on the recent nomenclature change from NAFLD/NASH to MASLD/MASH, a change that was introduced shortly after the quantitative survey was completed.

## Materials and Methods

## Study Design and Ethical Approval

This cross-sectional study included a quantitative survey and qualitative discussions with program leaders in primary care (internal medicine and family medicine) and specialty programs (hepatology, gastroenterology, and endocrinology) in the US. The quantitative survey was conducted from February 21 to May 24, 2023. Following the quantitative survey, we conducted two qualitative discussions among program leaders, one on August 24, 2023 and one on August 28, 2023. The study protocol was reviewed by the WCG Institutional Review Board and judged to qualify for exempt status due to the minimal risk posed to participants. The study was conducted in accordance with the principles of the Declaration of Helsinki; participant names were not captured by the study or associated with any analytic process. All study participants consented to the research. Their anonymity was preserved, and participants' informed consent included the publication of anonymized responses and direct quotes.

#### Survey Design

Potential participants were recruited by postal mail with a link to access the online survey and were compensated upon completion of the survey. Follow-up reminders were sent by mail, email, and/or telephone. The survey instrument was developed by a market research firm (KJT Group, Inc., Rochester, NY, USA) with input from the program leaders, <u>Appendix 1</u>.

The survey lasted approximately 15 minutes and included yes/no, single-select, multiple-choice, and Likert-scale questions. Topics covered by the survey questions included respondent characteristics, respondent role within the program, program structure and curriculum focus, inclusion of NASH in the curriculum, perceptions of the appropriate-ness and importance of NAFLD/NASH in the curriculum, preparedness for NASH management, awareness of NASH management guidelines, expectations for curriculum evolution, barriers to curriculum modification, and opportunities for additional NASH education.

We conducted the quantitative survey before and the qualitative discussion after the official nomenclature change from NAFLD/NASH to MASLD/MASH. However, we used the terms NAFLD/NASH for most of the qualitative discussions. The MASLD/MASH nomenclature was introduced near the end of each qualitative group session, where we asked each group for their perspectives on the new terms. To ensure full transparency, we report participant responses using the actual terms used (NAFLD/NASH in most cases, MASLD/MASH where appropriate). However, we discuss our findings using the updated nomenclature of MASLD/MASH.

#### **Participants**

A list of US fellowship, residency, and training programs was developed from an online search of programs and used for recruitment. We identified 2599 potential programs and 3,550 potential contacts at these programs. Respondents were categorized as residency directors, medical program directors, deans, or assistant directors; US-based; and knowledge-able about curriculum development at their institution or program. Programs included hepatology, gastroenterology, endocrinology, internal medicine, family medicine residency or fellowship programs, US medical schools, nurse practitioner programs, and physician assistant programs. Only one program leader could participate from each identified institution or program.

## Qualitative Discussion

After completing the online survey, program leaders were asked about their interest in participating in a qualitative discussion. Participating program leaders joined the discussion via a video conference call. They were asked to briefly introduce themselves without mentioning personally identifiable information, such as their full names or the institutions with which they were affiliated. Following introductions, question prompts and interactive polls were used to stimulate discussions among participants. The question prompts and interactive poll questions focused on roles and responsibilities, importance of education and training, time spent on education and training, current and potential coverage in curriculum, and reactions to the new MASLD/MASH nomenclature.

## Statistical Analysis

Descriptive statistical analysis of deidentified quantitative data was conducted with Q Research Software (Displayr, Inc., Delaware, US), and Excel (Microsoft 365, Redmond, WA, USA). Data are presented as mean  $\pm$  standard deviation (SD) or raw numbers and percentages rounded to the nearest whole number. Statistical comparisons were conducted with Q Research Software, and the level of statistical significance (P = 0.05) was calculated using z-test. The qualitative data analysis included summarizing common themes and aggregate sentiments. The complete discussion transcripts are included in <u>Appendices 2</u> and <u>3</u>. Although qualitative polls have a numerical value, due to the small sample size of participants, the qualitative data are grouped according to the following terms: "most" refers to 75% or more of the audience, "many" refers to more than half of the audience, "several" refers to about half of the audience, "some" refers to less than half of the audience. We also use direct quotations from the discussion transcripts to report our results. Participants were assigned participant numbers, and all personal identifying information was redacted from the discussion transcripts.

# Results

## Sample Characteristics

Of 2,599 potential programs identified, 239 individuals responded, of which 190 respondents completed the online survey; 49 did not meet inclusion criteria or refused to consent to the research. Nearly half of the quantitative survey participants (n = 94) were primary care physicians (PCPs). Approximately one-fourth of each program were specialty physicians or advanced practitioners (ie, nurse practitioner or physician assistant; Table 1). Of 190 respondents, 11 participated in the qualitative discussions representing the following specialties: primary care (internal medicine, family medicine, and nurse practitioner) and specialists (endocrinology, gastroenterology, and hepatology; Table 2).

# NAFLD/NASH Screening and Diagnosis

According to 38% of respondents, screening and diagnosis of NASH was covered "to a great extent" in their curricula (Figure 1). The most frequently covered diagnostic methods were ultrasound (88%), liver function tests (87%), liver biopsies (80%), aspartate transaminase to alanine transaminase ratios (78%), and lipid levels (73%; Figure 2). Only 34% of respondents reported covering the Fibrosis-4 (FIB-4) index test for primary risk assessment of patients at risk for MASLD (Figure 2). In the discussion group, most participants believed that MASH is largely unrecognized, leading to diagnosis at a point in which minimal options exist to alter its progression. In the primary care discussions, most respondents agreed that PCPs should play a role in identifying patients at risk for NAFLD/NASH; several primary care providers also indicated that gastroenterologists and hepatologists should be involved in risk identification (Table 3). However, only a couple of respondents said that endocrinologists should play a role. Participants in our specialist group also believed that primary care should play the major role in identifying patients at risk of NAFLD/NASH, screening patients for NAFLD/NASH, and diagnosing patients with NAFLD/NASH. The primary care group believed that hepatologists had a bigger role to play when it came to diagnosis and staging of NASH, but that they were less available in some communities. The specialist group agreed that specialists could be useful for disease staging, depending on the level of detail required for treatment.

Survey Respondent Demographics	PCP <sup>a</sup> (n = 94)	Specialist <sup>b</sup> (n = 41)	NP/PA <sup>c</sup> (n = 49)	Medical School (n = 6)	Total (N = 190)
Role in the program, n (%) <sup>d</sup>					
Program director/chair	87 (93)	31 (76)	34 (69)	3 (50)	155 (82)
Department head/chair	12 (13)	4 (10)	12 (24)	2 (33)	30 (16)
Division head/chief/director	2 (2)	11 (27)	I (2)	( 7)	15 (8)
Director of education	4 (4)	I (2)	5 (10)	( 7)	11 (6)
Curriculum coordinator/chair	3 (3)	0 (0)	2 (4)	( 7)	6 (3)
School of medicine dean	1 (1)	0 (0)	0 (0)	2 (33)	3 (2)
Other	0 (0)	I (2)	0 (0)	0 (0)	1 (1)
Years at current institution, mean (SD)	11.8 (8.5)	13.1 (6.9)	10.5 (7.2)	15.2 (8.0)	11.9 (7.9)
Institution Demographics	PCP (n = 94)	Specialist (n = 41)	NP/PA (n = 49)	Medical School (n = 6)	Total (N = 190)
Program setting, n (%) <sup>d</sup>					
Urban	49 (52)	33 (80)	26 (53)	5 (83)	113 (59)
Suburban	44 (47)	17 (41)	23 (47)	( 7)	85 (45)
Rural	29 (31)	11 (27)	28 (57)	3 (50)	71 (37)
Region, n (%)					
Northeast	22 (23)	14 (34)	12 (24)	( 7)	49 (26)
Midwest	23 (24)	6 (15)	13 (27)	( 7)	43 (23)
West	12 (13)	6 (15)	4 (8)	2 (33)	24 (13)
South	37 (39)	15 (37)	20 (410)	2 (33)	74 (39)
Type of institution, n (%)					
Private	52 (55)	18 (44)	30 (61)	3 (50)	103 (54)
Public	42 (45)	23 (56)	19 (39)	3 (50)	87 (46)
Number of students, mean (SD)	53.2 (85.4)	10.6 (15.8)	100.2 (60.2)	371.4 (203.1)	64.6 (94.9)
Program length, n (%)					
l year	1 (1)	9 (22)	0 (0)	0 (0)	10 (5)
2 years	0 (0)	13 (32)	37 (76)	0 (0)	50 (26)
3 years	90 (96)	19 (46)	10 (20)	0 (0)	119 (63)
4 years	0 (0)	0 (0)	I (2)	6 (100)	7(4)
5 years	3 (3)	0 (0)	I (2)	4 (2)	

Table	l Characteris	tics of Gradua	te Medical	Education	Program Lea	ider Resp	ondents	(N =	190) and	Their Inst	titutions.	Self-Repo	orted
Results	Collected by	online Surve	y in 2023										

**Notes**: <sup>a</sup>PCP programs included internal medicine (n = 47) and family medicine programs (n = 47). <sup>b</sup>Specialist programs included endocrinology (n = 15), gastroenterology (n = 17), and hepatology programs (n = 9). <sup>c</sup>NP/PA programs included nurse practitioner (n = 14) and physician assistant programs (n = 35). <sup>d</sup>Percentages may not add to 100% due to possibility of multiple selections.

 $\label{eq:abbreviations: NP/PA, nurse practitioner/physician assistant; PCP, primary care physician.$ 

Study Respondent Demographics	Primary Care Group <sup>a</sup> (n = 5)	Specialist Group <sup>b</sup> (n = 6)	Total (N = 11)
Role in the program, n (%)			
Program director/chair	4 (80)	5 (83)	9 (82)
Division head/chief/director	I (20)	I (I7)	2 (18)
Years at current institution, mean	14.2	18.8	
Institution Demographics	Primary Care (n = 5)	Specialist (n = 6)	Total (N = 11)
Program setting, n (%) <sup>c</sup>			
Urban	4 (80)	4 (67)	8 (72)
Suburban	3 (60)	3 (50)	6 (54)
Rural	I (20)	I (I7)	2 (18)
Type of institution, n (%)			
Private	3 (60)	I (I7)	4 (36)
Public	2 (40)	5 (83)	7 (64)
Professional time spent teaching, n (%)			
Almost all of my time	I (20)	0 (0)	I (9)
Most of my time	3 (60)	2 (33)	5 (45)
Some of my time	I (20)	4 (67)	5 (45)
Very little of my time	0 (0)	0 (0)	0 (0)
None of my time	0 (0)	0 (0)	0 (0)

Table 2 Characteristics of Graduate Medical Education Program Leader Participants (N = 11) and Their Institutions

**Notes:** <sup>a</sup>The primary care group included internal medicine, family practice, and NP program leaders. <sup>b</sup>The specialist group included hepatology, gastroenterology, and endocrinology program leaders. <sup>c</sup> Responses sum to more than 100% because participants could select more than one program setting. **Abbreviations:** NP, nurse practitioner; PCP, primary care physician.

## Management of NAFLD/NASH and Associated Comorbidities

In the survey, 96% and 81% of respondents reported lifestyle modifications focusing on diet and exercise as part of NASH management, respectively. In qualitative discussions, the primary care group cited mixed feelings about their role in NASH treatment, largely because there was not a clear treatment for NASH at the time of the discussion. The primary care group saw a role for primary care in the management of NASH comorbidities and risk factors but believed staging falls into the hands of gastroenterology or hepatology (Table 4). Primary care providers saw a diminished role for gastroenterologists and hepatologists in the management of comorbidities. While acknowledging specialists' limited time and resources, primary care providers thought an interdisciplinary approach would be ideal. The specialist participants agreed that, considering the current treatment landscape, primary care would play a major role in determining treatment in addition to hepatologists and endocrinologists.

## NASH Education and Training

In the quantitative survey, only 22% (N = 190) of respondents reported that patient education for NASH was covered "to a great extent" in their curricula (Figure 1). This aligns with the qualitative discussions where primary care providers believed that all specialties had a role to play in patient education about NASH. Among specialists,  $\geq$ 50% agreed that all specialties should contribute to patient education about NASH. In the quantitative survey, 96% (n = 183) and 92% (n = 174) of respondents reported that NAFLD and NASH were included in their program's curricula, respectively. When asked on how important it is to include NASH education in their curricula, most



Figure I Coverage of NASH core competencies in graduate medical education curricula.

Note: Percentage of respondents (N = 190) reporting that they cover a topic to a "great extent", "some extent", "very little" or "not at all". Results collected by online survey in 2023.

Abbreviation: NASH, nonalcoholic steatohepatitis.



Figure 2 NASH diagnostics included in graduate medical education curricula.

Note: Percentage of respondents reporting coverage of specific NASH diagnostic tools in their curricula, among respondents who reported covering NASH diagnostic tools in their curricula (n = 187). Results collected by online survey in 2023.

Abbreviations: AST:ALT, aspartate transaminase: alanine transaminase ratio; APRI, aminotransferase-to-platelet ratio index; CAP<sup>™</sup>, controlled attenuation parameter; CT, computed tomography; ELF<sup>™</sup>, Enhanced Liver Fibrosis Test; FIB-4, Fibrosis-4 index; MRE, magnetic resonance elastography; MRI/cT1, magnetic resonance imaging/corrected T1 mapping; MRI-PDFF, magnetic resonance imaging-proton density fat fraction; NAFLD, nonalcoholic fatty liver disease; NASH, nonalcoholic steatohepatitis; VCTE, vibration controlled transient elastography.

respondents (83%) reported that it was very or fairly important to include NASH in their curricula. Similarly, primary care providers and specialists in the qualitative discussions believed that NASH education was important, and one specialist stressed the importance of early identification of NASH (Table 5). However, even with adequate

**Table 3** Representative Quotes From Graduate Medical Education Program Leaders Regarding NASH Screening and Diagnosis.Quotes From Two Group Qualitative Discussions, One Including PCP Program Leaders (n = 5), and One Including Specialist ProgramLeaders (n = 6)

Discussion Prompt	Discussion Group	Representative Quote
Who should play a role in identifying patients at risk for NAFLD/NASH?	Primary care <sup>a</sup>	"If you figure 24% of the population has it, the contact is going to be primarily the primary care docs. Those are the ones that are going to first identify not only the risk factors with triglycerides and obesity, but actually the ones that are going to first notice the abnormal results as well. They need to be on the lookout. I think if you are waiting until the damage is done, it may be a bit too late. Actually, by the time you refer them to [gastroenterologists], probably the damage is already set and you are already in fibrosis".
	Primary care	"Often, people can't get into [gastroenterologists] for quite some time. When we identify an issue, oftentimes, patients can't even get access to specialty. In the meantime, we're left to do our best with what we have".
	Specialist <sup>b</sup>	"The burden really falls on the primary care and the endocrinologists because they are looking for people who are at risk for this disease".
	Specialist	"most of the gastroenterologists are more interested in doing procedures than they are in terms of managing patients, so it seems like more and more nurse practitioners are managing patients for the gastroenterologists".
Who should play a role in screening for NAFLD/NASH?	Primary care	"I would say it has to be primary care again. Again, given the problems of the disease, we get to see them more than anybody else. Granted that periodically, we see these abnormal labs and we send them to the gastroenterologist without even thinking of it being NAFLD/NASH and expect them to make that diagnosis. Primarily, it's really the primary care docs who see these patients and they will do the screen. There are formulas out there to use. It's not that complicated. You do not have to do a FibroScan to make a diagnosis, but you could at least run the initial survey with the four or six questions".
	Primary care	"I think it depends a lot on your practice community. In our community, there are fewer gastroenterologists and they are busy doing endoscopies. Their interest is not so much this population or liver disease because there's not a procedure that they can do on them. We have more endocrinologists who are more interested than gastroenterologists. In our community, in our site, it's fallen upon the endocrinologists to help diagnose and manage. The endocrinologist at our site owns a [FibroScan] scanning device and it's not housed in [gastroenterology]. I think it's probably different in different communities depending on the folks who are available. It's all about staffing".
	Specialist	"With. obesity, if the primary care sent everyone to us that they thought had fatty liver disease, we would be overwhelmed, so [I think] primary care still needs to screen. I think they can screen with a simple FIB-4 test or some other NAFLD scoring system, some blood test, ELF, whatever you want to use, to make the initial screening. If they have significant fibrosis, I think then they need to refer them to us".
Who should play a role in diagnosis and staging of NASH specifically?	Primary care	"when it comes to diagnosis and staging, then that's usually what prompts a referral. Most communities, you won't even have a hepatologist".

#### Table 3 (Continued).

Discussion Prompt	Discussion Group	Representative Quote
	Specialist	"there are a variety of different iterations that you can do for staging of disease severity. The basic ones like clinical prediction scores could be accomplished through the EMR on the primary care level, but if you want to go up with a little bit more granular staging, whether that's transient elastography or even, in some patients, magnetic resonance elastography or even biopsy, those need to be done more at the subspecialty level".

Notes: <sup>a</sup>The primary care group included internal medicine, family practice, and NP program leaders. <sup>b</sup>The specialist group included hepatology, gastroenterology, and endocrinology program leaders.

Abbreviations: ELF, Enhanced Liver Fibrosis; EMR, electromagnetic resonance; FIB-4, Fibrosis-4 index; NAFLD, nonalcoholic fatty liver disease; NASH, nonalcoholic steatohepatitis; NP, nurse practitioner; PCP, primary care physician.

**Table 4** Representative Quotes From Graduate Medical Education Program Leaders Regarding NAFLD/NASH Management. QuotesFrom Two Group Qualitative Discussions, One Including PCP Program Leaders (n = 5) and One Including Specialist Program Leaders (n = 6)

Discussion Prompt	Discussion Group	Representative Quote
Who should play a role in determining treatment for NASH?	Primary care <sup>a</sup>	"It depends on what you think is. the treatment for NASH? The treatment is. challenging. Our endocrinologists feel a lot of it is weight loss and medications that fall within their area. I do not think the exact treatment for NASH is well defined, unfortunately".
	Primary care	". [it depends] where you draw the line in terms of whether a treatment is meant to mitigate risk factors, which we're often doing in primary care regardless, versus a specialized treatment targeted for NASH itself".
	Specialist <sup>b</sup>	"In a disease state where there's no FDA-approved intervention yet, and we are talking about risk factor control, it becomes a little bit of a bandwidth thing. I will recommend to the primary care doctor that we need to work on lipid control and that statins are safe in liver disease, but my ability to implement statin dosing and diabetes management and A1c following is somewhat limited, so I will give advice and send that back to the primary care doctor".
	Specialist	"as mentioned, there is no FDA-approved medication. It's strictly, right now, risk factor modification, and quite a few of the medications that are in the pipeline are already medications that an endocrinologist and a primary care are comfortable with".
Who should play a role in the management of NASH?	Primary care	"staging. and things like that. falls into the hands of gastroenterology or hepatology".
	Specialist	"I think once you rule out any other paths [pathology] for the liver disease, then really it falls in the realm of the primary care and the endocrinologists".

#### Table 4 (Continued).

Discussion Prompt	Discussion Group	Representative Quote
Who should play a role in the management of comorbidities associated with NASH; things like obesity, type 2 diabetes, and hypertension?	Primary care	"there are fewer [gastroenterologists] out there and they will be spending their time [doing other things], rather than talking about weight loss. I would. argue that they do not. know how to counsel about weight loss, nor about management of type 2 diabetes or management of hypertension for that matter, not to insult gastroenterologists".
	Primary care	"This should be a team sport here that involves primary care, but also the hepatologist, maybe even the endocrinologist, and there'll be a dietician. It'll be an interdisciplinary approach".
	Specialist	"When you have patients coming from a couple hours away, you can recommend a statin, put them on a low-dose statin, but you need to tell them they need to follow up with primary care because they will need to check to make sure their LFTs are fine in a month or two months from then, and then recommend to the primary care that you are going to adjust the statin as needed to help manage it. They are not going to drive back three hours to come back for a lab check a month later, and we do not have the space to allow a patient to come back every month to check their cholesterol panel".

Notes: <sup>a</sup>The primary care group included internal medicine, family practice, and NP program leaders. <sup>b</sup>The specialist group included hepatology, gastroenterology, and endocrinology program leaders.

Abbreviations: Alc, glycated hemoglobin; FDA, US Food and Drug Administration; LFTs, liver function tests; NAFLD, nonalcoholic fatty liver disease; NASH, nonalcoholic steatohepatitis; NP, nurse practitioner; PCP, primary care physician.

**Table 5** Representative Quotes From Graduate Medical Education Program Leaders Regarding NASH Education and Training. Quotes From Two Group Qualitative Discussions, One Including PCP Program Leaders (n = 5) and One Including Specialist Program Leaders (n = 6)

Discussion Prompt	Discussion Group	Representative Quote
Who should play a role in patient education about NASH?	Primary care <sup>a</sup>	"I would agree with the team sport idea. It should [be a team sport]. Our ideal is that everyone should [be involved]. Gastroenterologists should have a certified nutritionist, behavioral health [specialist], and motivational interviewers. That's something that we tend to have in primary care or have access to. I certainly think that they should be really good in patient education rather than referring just back to the primary for that".
	Specialist <sup>b</sup>	"We, as the transplant hepatologists, have the knowledge base and the comfort level to talk about disease progression, so, while the endocrinologist and the primary care can talk about risk factor management and control, we also can talk about the whole umbrella of the natural history of disease, from simple steatosis to NASH, to cirrhosis, to decompensation events, et cetera. That's where we can provide more education beyond treatment of associated metabolic comorbidities".

#### Table 5 (Continued).

Discussion Prompt	Discussion Group	Representative Quote
How important it is to include education or training on NASH in your curriculum?	Primary care	"We did a survey of our resident clinic to see how many patients were diagnosed with NAFLD last year and it was one patient. We have, I am sure, hundreds of patients who are walking around with NAFLD, but only one patient was diagnosed and that's because that patient was sent for an ultrasound. It's a shame. We are undertaking a performance improvement project around this. Even though they have been taught to do it, in their clinic, they have not been very proactive about identifying this as a disease among their patients".
	Primary care	" there are a lot of competing topics for our curriculum. I think NASH is one important topic. I am not sure it's more important than lung disease, kidney disease, or infectious disease. I do not know how to judge all these things. I think they are all equally important. NASH is certainly life- threatening. It's all relative".
	Specialist	"Look at the numbers. If 30% of the population has some degree of fat in their liver, you apply that to the US population and that's close to 100 million people. Of those patients, about 20% will develop NASH, or MASH, the progressive form. That's about 20 million people. Over a 5–20 year period, 5–20% of those patients will develop cirrhosis. That turns out to be about 4 million people. Liver transplant is not the answer for NASH cirrhosis. If you were to only list about 1% of patients with NASH cirrhosis for liver transplant, that about doubles the size of the current US transplant wait list. Transplant is not the answer here, so that's why early identification is critically important".
Do you think that, if there was a dedicated treatment to NASH, that there would be a greater likelihood that more time would be dedicated to it in the curriculum?	Primary care	"I agree that if there was a treatment, if you show that you start this early, you could bring [down] morbidity and mortality down the road, then early detection means something versus the cancers and other things we're teaching about".
	Specialist	"A lot of interest in disease is pushed by pharmaceutical companies that have products to sell and they haven't yet got that".
	Specialist	"In the scheme of things, it's relatively recent as well. Smoking and alcohol have been around for centuries, decades, and [MASLD/MASH is] a phenomenon of the last 20 years [in] the more common perception".

## Table 5 (Continued).

Discussion Prompt	Discussion Group	Representative Quote
How important is it that more time is dedicated to the topic of NASH in the curriculum moving forward?	Primary care	"We are still spending so much time talking about endocarditis knowing that in your life you may see 10 cases. We do not spend as much time talking about obesity complications, which are a whole lot more prevalent. We talked about smoking cessation forever because it had a value. We do not have a value on NAFLD yet. at a societal level. If you do not talk about it, there's not going to be importance and vice versa".
	Primary care	"Ultimately, we are talking about behavior change. We have not found as a society any ways to help our patients change their behavior at large. I think they focus on the things that they can do, which is scoping patients and prescribing the limited therapies that we have evidence for".
	Primary care	"financially, it's not very appealing, either. I run obesity medicine, but for the most part, it's not as lucrative as doing a couple of scopes. I could spend my whole day counseling. I could have done two colonoscopies, and I would have gotten more money".
	Specialist	"We are already preaching to the choir here. Our trainees already have a knowledge of the disease state and the severity and that it's a real disease. I think there are probably other areas, like primary care, that may need more time invested into it. By the time our trainees get to where they are, there's a lot of selection bias there and they already know a lot about NASH and they already believe it's a real problem".
To what degree do you think it's probable that more time will be dedicated to the topic of NASH within the next couple of years?	Primary care	"as soon as the novel hep C treatments came out, we spent an inordinate amount of time learning that in primary care. I think if we had something similar [for NASH], we'd love to take ownership over this treatment sphere".
	Primary care	"If there was a medication that was proven in a clinical trial to reverse fatty liver disease and was shown to improve mortality due to fatty liver disease, a lot of flags would be run up the flagpole. It would be fun summer in our didactic conferences, it'd be grand rounds, and it would be shouted to the hinterlands".
Are there any other barriers to devoting more time in your curriculum to NASH, other than what we have already talked about?	Primary care	"I think that the payment model is not such that we care about prevention money up front unless we can prove that it does something if we are going to pay for it. I agree, intensive weight loss clinics would be awesome. I do not think they are very well funded for us".
	Primary care	"riding on the GLP-1 success, we have an intervention that causes a lot of weight loss. That's really a hot topic right now, so there may be some spillover from that as it applies to folks with nonalcoholic fatty liver disease and NASH. Perhaps on the coattails, from a therapeutic intervention, that might get it a little bit more time and space in the curriculum".

#### Table 5 (Continued).

Discussion Prompt	Discussion Group	Representative Quote
	Primary care	I think the worst thing we can do as educators, from a resident standpoint, is bring in [experts], and they talk about the coolest tests and the coolest procedure that they can do and number one, our patients do not have a lot of insurance, so they cannot afford any of this. Then the second thing is if your test is not covered or available in your area.
	Specialist	"Lack of therapeutic regimens, at this point in time. I think, as more drugs come on the market, it will be very different three or four or five years from now than it is at the moment. There are only so many times you can repeat the emphasis on lifestyle modification".
	Specialist	"It's a bit of a zero-sum game here. If you put more emphasis on one thing, you detract from other things. If you look at the internal medicine boards or even the general GI boards done by ACGME, the amount of questions dedicated to NASH is relatively small. That's, in part, because, other than lifestyle modification, there are not a lot of things to talk about or things to do, whereas we are also responsible for teaching about viral hepatitis and alcoholic liver disease and genetic liver diseases and decompensated cirrhosis, et cetera. Then, beyond that, the general GI fellows have all of general GI to learn as well. There's really a finite amount of time in this balance between education and service, doing the colonoscopy, seeing consults, those sorts of things".
Coming out of your programs, how equipped do you think students or trainees are to provide care, treatment, or management of patients with NASH?	Primary care	Yes, we are doing the lecture, it covers in depth all these entities, all these items, but I do not think effectively they are getting what they should. They are not equipped to go out and practice that. I do not think they are. "
	Primary care	I also think that we are massively underfunded to help with behavioral-related conditions. Just think about how poorly we do in diabetes management and obesity management as a country. Those get a lot more attention and a lot more targeted therapeutics. I think this just reflects how powerless we potentially all feel in helping patients navigate these comorbidities. I also think that if you had a quality metric tied to NASH, we'd probably perk up pretty quick".
	Specialist	"Our hepatologists have more time to talk to the fellows about NASH. It used to be just hep B 10 years ago. There wasn't much time for NASH, but with hep B going away, there's much more room for NASH in the clinic".
	Specialist	"Like everyone said, all their experience is really in the clinic for NASH. It really is".

Notes: <sup>a</sup>The primary care group included internal medicine, family practice, and NP program leaders. <sup>b</sup>The specialist group included hepatology, gastroenterology, and endocrinology program leaders.

Abbreviations: ACGME, Accreditation Council for Graduate Medical Education; GI, gastrointestinal; GLP-1, glucagon-like peptide 1; hep, hepatitis; NAFLD, nonalcoholic fatty liver disease; NASH, nonalcoholic steatohepatitis; NP, nurse practitioner; PCP, primary care physician; US, United States.

NASH training, clinical implementation was deemed difficult. Primary care providers mentioned that NASH lacked the urgency of heart disease and cancer and noted the lack of a specific treatment for NASH.

The quantitative survey respondents (N = 190) identified lack of room (time) in the curriculum (n = 100, 53%), lack of access to trained specialists or faculty expertise (n = 61, 32%), lack of treatment available for NASH (n = 58, 31%), lack of faculty interest (n = 51, 27%), and inadequate access to research on NASH (n = 38, 20%) as the top five barriers to integrating NASH education into their curriculum (Figure 3). In the quantitative survey, specialist respondents reported significantly more frequently than primary care providers (54% vs 27%, P < 0.05) that the lack of treatment available for NASH was a barrier to incorporating NASH in their curriculum (Figure 3). During the qualitative discussion, primary care providers agreed that an approved treatment for NASH could make NASH education more meaningful. Currently, more time is devoted to conditions such as cancer, where early detection is coupled with early treatment. Specialists highlighted the lack of dedicated NASH treatments and the difficulty in diagnosing NASH as reasons for the relatively low focus on NASH in their curricula. Primary care providers expressed mixed feelings about dedicating more time to NASH in the curriculum moving forward; those skeptical of spending more time on NASH cited lack of time, competing interests, and lack of specific treatment, whereas those in favor of spending more time on NASH cited the relative importance and prevalence of NASH. Primary care providers also cited the difficulty of enacting lifestyle changes and the lack of financial incentives as reasons more time is not spent on NASH education. Our specialist participants believed that they were already spending enough time, under the current circumstances, on NAFLD/NASH, but believed that primary care programs may need to invest more time into it. This feedback is in line with the quantitative survey results where primary care providers (n = 88) spent, on average, 7.5 hours (SD = 14.0) and specialists (n = 36) spent 22.8 hours (SD = 65.7) on NASH education.

Primary care participants also highlighted how the lack of expert speakers and the lack of certain technologies in their local care environments can hinder inclusion of NAFLD/NASH in curricula; similar findings were seen in the quantitative survey (Figure 3). Specialist participants predicted that more time would be devoted to NASH with the introduction of novel pharmaceuticals for NASH but stressed that there is a finite amount of time to cover many important diseases.

Primary care participants said that, although they generally follow and teach clinical guidelines to trainees, there can be discrepancies between what is advised in guidelines and what is reimbursed by payers, thereby limiting the utility of teaching certain guideline recommendations. Moreover, the NASH clinical guidelines most well known among



Figure 3 Barriers to integrating NASH education in curricula.

**Notes**: Percentage of respondents (N = 190) selecting reason as a "large" or "moderate" barrier. Results collected by online survey in 2023. <sup>a</sup>Percentage significantly differed ( $P \le 0.05$ ) from percentage of PCP program respondents. <sup>b</sup>Percentage significantly differed ( $P \le 0.05$ ) from percentage of specialist program respondents. <sup>c</sup>Percentage significantly differed ( $P \le 0.05$ ) from percentage of NP/PA program respondents. <sup>\*</sup>Indicates extremely small sample size (n<10). **Abbreviations**: NASH, nonalcoholic steatohepatitis; NP/PA, nurse practitioner/physician assistant; PCP, primary care physician.

respondents were from the American Association for the Study of Liver Diseases (AASLD); 48% (n = 92) of respondents were aware of AASLD guidelines for the diagnosis and management of NASH and, of these, 70 respondents (76%) said that AASLD guidelines were included in their curricula. One in five (n = 38, 20%) respondents were not aware of any clinical guidelines for NASH.

According to the survey respondents, major topics covered "to a great extent" in the NASH curricula included patient risk factor and comorbidities associated with NASH (46%), long-term complications and risk associated with the progression of NASH (43%), symptoms and clinical characteristics of NASH (41%), screening and diagnosis of NASH (38%), and lifestyle management of patients with NASH (37%). The topics that were "not at all" covered included clinical trials associated with NASH (28%), current off-label pharmacologic interventions for patients with NASH (23%), and genetic factors associated with NASH (18%; Figure 1). In the qualitative discussions, the primary care participants had mixed feelings about whether certain NASH core competencies were adequately covered in their curricula (Table 5). Participants believed that they covered most key core competencies, but the level of coverage might not be adequate. Despite inadequate coverage of certain competencies, some participants were skeptical that spending more time on them would translate to better outcomes for patients. One primary care provider also mentioned that NAFLD/NASH falls under the umbrella of their obesity topic lectures.

Primary care providers were not confident that their students were adequately prepared to manage NASH but did not specifically fault their curricula or their students. Instead, one primary care provider highlighted how, systemically, the US struggles to help patients with behavior-related conditions such as diabetes and obesity. The specialist group believed that their trainees were, in recent years, better prepared to manage patients with NASH, considering the increased exposure to patients with NASH in the clinical setting. However, the specialists were not universally optimistic about their trainees' preparedness to manage NASH. A similar trend was seen in the quantitative survey, where only 12% of students in the primary care program versus 39% in the specialist program reported preparedness to manage patients with NASH. The specialists predicted that future trainees would struggle to keep abreast of new liver drugs coming to market, and that there would continue to be difficulties with coordinating multidisciplinary care and deciding which provider types would be responsible for each disease state.

## Nomenclature Changes From NAFLD/NASH to MASLD/MASH

Both participant groups were asked about their level of awareness and perceptions of the NAFLD/NASH to MASLD/ MASH nomenclature change that was released two months earlier. The primary care group had mixed feelings about the nomenclature updates (Table 6). They acknowledged the stigma attached to NAFLD, but some were particularly skeptical that the nomenclature update would provide value. One primary care provider described burdensome changes to their NAFLD clinic's signage and website to accommodate the updated nomenclature. Both primary care and specialist participants believed that implementing the changes would take years, from at least 1 year to implement new ICD and electronic medical record codes, specifically, to the many years it could take the wider medical community to adopt the terminology. The specialist group had more positive reactions to the nomenclature updates while sharing many of the same concerns as the primary care group. The specialists predicted that there would be procedural complexities associated with the changes.

## Supplemental Learning Opportunities

In the quantitative survey, most respondents agreed that continuing medical education (CME, 72%) and online resources (72%) would be the most effective opportunities for additional NASH education outside of standard curricula. The discussion groups identified similar supplemental learning opportunities. One participant spoke highly of an online lecture series delivered by a NAFLD expert from the University of Louisville. One participant said that students today are less interested in reading journals and more interested in podcasts and online simulation case studies. Another participant said that they assigned their students monthly *American Family Physician* CME quizzes and noted that NAFLD was covered in a 2020 quiz. One participant said that the American Geriatric Society puts together high-quality, disease-specific slide decks and hoped that the AASLD would consider something similar.

Table 6	Represe	ntative	Quo	otes Fro	om Graduate	e Medical	Educatio	n Progra	m Lea	iders Re	garding	NAFL	D/N	ASH	Nom	enclature
Updates.	Quotes	From	Two	Group	Qualitative	Discussion	is, One	Including	PCP	Program	Leader	rs (n =	= 5)	and	One	Including
Specialist	Program	Leade	rs (n	= 6)												

Discussion Prompt	Discussion Group	Representative Quote
Participants were shown a slide on the recent nomenclature change from NAFLD/NASH to MASLD/MASH and asked about their reaction to the new nomenclature.	Primary care <sup>a</sup>	"I do think that there is definitely some stigma attached both ways, to both groups. One saying, 'You did this to yourself with alcohol'. The other is saying, 'This is fatty liver disease associated with your diet and lifestyle'. I think from both, removing any sort of judgment, particularly because when you start to get into the NASH spectrum, I feel like as a system, we are so much more benevolent to the people who had NASH, potentially, instead of the substance use community, where so much stigma has been for so long. I think realizing that there's overlap. Although, I. hate to just say, 'Here's a new classification system. Learn some more ICD-10 codes and be as specific as you can be'. I do think that there's benefit in that rebrand saying, 'This is a field we're learning more about, that we are refining because of how important the impact is on our system.' Maybe it is a kickstarter to say, 'Guys, we're not doing a great job in supporting these patients'. Let us try to be as accurate as we can be and try to get better as a community''.
	РСР	"They had to take down signs, repaint signs, and redo our website. I asked them, I said, 'What a headache. Why are we doing all this?' They said, 'The nonalcoholic liver disease, maybe there's a bias, introducing a term that is not appealing to the public. Let us call it something that the public will not understand and then that might make it more appealing'".
	Specialist <sup>b</sup>	"Like any change, there is always an initial reluctance to accept it, especially when we have used the nomenclature. for a couple of decades or more, but there are positive things in there. The positive things are, it is acknowledging the disease by what it's associated with, metabolic syndrome, rather than what it's not, non-alcohol, so it does maybe raise the risk factor profile a little bit, which might help. I agree that some people did find the name 'fatty liver' pejorative, but steatotic liver disease is a mouthful. It is a new nomenclature that will take a long time, because of the steatotic part, to catch on as well, so good and bad. In terms of practices, diagnostic codes, ICD codes, are not going to catch up for years, or longer, so it's still going to be called NAFLD and NASH in diagnostic codes, but in the clinic notes, it will be something different. That can be a confusing thing for practices. There are some positives here and some concerns that I have about it, but I think, overall, it's a step in the right direction''.

Notes: <sup>a</sup>The primary care group included internal medicine, family practice, and NP program leaders. <sup>b</sup>The specialist group included hepatology, gastroenterology, and endocrinology program leaders.

Abbreviations: ICD, International Classification of Diseases; ICD-10, International Classification of Diseases, Tenth Revision; NAFLD, nonalcoholic fatty liver disease; NASH, nonalcoholic steatohepatitis; NP, nurse practitioner; PCP, primary care physician.

A specialist respondent said that their trainees had access to general sessions and lectures offered by the Endocrine Society, the American Association of Clinical Endocrinologists, and the American Diabetes Association. The American Board of Obesity Medicine has a CME course that one trainee participated in, but otherwise, interest in the course was

limited among specialist trainees. A variety of gastrointestinal and liver CME courses and conferences were brought up; one participant noted that these "... supplemental opportunities tend to get updated much more rapidly than [their] own curriculums."

### Discussion

In this quantitative survey, we found that most curricula covered MASH to some extent, and most program leaders perceived MASH education as important. Furthermore, the qualitative discussions with primary care and program leaders in specialist medical education highlighted the key role that primary care trainees play in combating the MASLD/MASH epidemic and the challenges that they face. Both groups believed that primary care would play the biggest role in both diagnosing and treating patients with MASLD/MASH. Program leaders in primary care and specialist also agreed that improving MASH education among primary care providers was critical. However, despite this recognition, most curricula lacked coverage of important MASH diagnostic or monitoring tools. FibroScan<sup>®</sup> (vibration-controlled transient elastography) was covered by half of the programs, while the FIB-4 index test (a non-invasive blood test that uses a simple calculation of various parameters) and magnetic resonance elastography (a highly specific imaging technique) were covered by only one-third. These tests are among the most important components of disease recognition and all are recommended in the latest practice guidance from the AASLD and the American Association for Clinical Endocrinology on the clinical assessment and management of MASLD.<sup>17,19</sup> Less than half of program leaders reported including AASLD guidelines in their curricula, suggesting that trainees may not be receiving up-to-date guidance on screening and management of MASH. These findings highlight opportunities to improve MASH education among graduate medical trainees.

Our study identified lack of room (time) as the greatest barrier to expanding MASH education. The average time devoted to MASH education was approximately 9 hours. PCPs were skeptical that more time could be devoted to MASH in their curricula. By comparison, a survey of family medicine residency training professionals found that programs dedicated an average of 25 hours per year to "communication education."<sup>20</sup> A survey of pharmacy school leaders found that an average of 3 out of 155 total credit hours was dedicated to obesity education.<sup>21</sup> Medical knowledge continues to advance rapidly, and devoting more curriculum time to specific diseases is unlikely to be an effective strategy.<sup>22</sup> If expanding time and resources dedicated to MASH education is not an option, then programs should consider where MASH resides in the larger framework of diseases covered in graduate medical education.

Another most frequently cited barrier to expanding MASH education was the lack of an approved treatment for MASH. The impact of the recent approval of resmetirom on MASH education remains to be seen. However, the approval of pharmacologic therapies for MASH is outside the control of medical program leaders, and introducing a MASH-specific therapy may encourage them to further integrate MASH education into their curricula. Program leaders believed that improved education around early detection of MASH had limited utility with the current reliance on behavioral lifestyle changes to treat MASH. Lifestyle changes (including changes to diet and physical activity levels) can be effective in treating chronic diseases such as MASLD/MASH and T2D.<sup>23,24</sup> A high-quality diet, increased physical activity, and college education are associated with a reduced risk of MASLD in the US.<sup>25</sup>

However, lifestyle changes have proven difficult to successfully implement and maintain,<sup>23</sup> and participants in our qualitative discussions suggested that promotion of lifestyle changes lacks the financial incentive associated with medical procedures and pharmaceuticals in the US healthcare system. Instead, participants in this study suggested that curricular time would continue to be devoted to diseases with treatments that offered a clearer value proposition. Fortunately, there are signs that advancements in the MASLD treatment paradigm are arriving soon, with promising advances in drugs targeting reductions in hepatic steatosis, inflammation, and fibrosis, as well as bariatric surgical techniques.<sup>26</sup> In the meantime, leaders of medical training programs can aim to improve MASLD/MASH awareness by sharing supplemental learning materials provided by national medical societies. Almost three-quarters of respondents agreed that CME and online resources would be the most effective opportunities for additional MASH education outside of standard curricula. The AASLD recommends targeted screening of populations at risk for advanced liver disease, including people with T2D, medically complicated obesity, and/or those with significant alcohol use, to identify and manage patients with clinically significant liver fibrosis.<sup>17</sup> Primary risk assessment, using the FIB-4 index, should be performed on patients

suspected to have MASLD. Patients in low-risk categories can be managed in primary care while patients with multiple metabolic risk factors should be assessed with FIB-4 every 1–2 years.<sup>17</sup> Patients with a FIB-4 score  $\geq$ 1.3 should undergo secondary risk assessment (in primary care or specialist care), using additional tools such as vibration-controlled elastography, Enhanced Liver Fibrosis test, and/or magnetic resonance elastography.<sup>17</sup>

More than 70 international medical societies have endorsed the recent nomenclature update from NAFLD/NASH to MASLD/MASH, initiated by a Delphi consensus statement published in June 2023.<sup>1</sup> The reasons for the nomenclature update were twofold: firstly, the "nonalcoholic" language was based on negative diagnostic criteria that did not fully capture the etiology of MASLD, and, secondly, the "fatty liver" language was considered overly stigmatizing.<sup>1</sup> The participants in our qualitative discussion were aware of the nomenclature updates and accurately noted the reasons for the update. However, because we briefly introduced the nomenclature updates for discussion purposes, we could not use participant awareness as a proxy for unaided awareness of the updates. The recent nomenclature updates elicited mixed reactions from the primary care and specialist participants in our study, with specialist participant reactions being slightly more positive. Both groups were worried about transition challenges, including patient confusion, adoption of new diagnostic codes, and slow adoption by the wider medical community. More time is needed to properly evaluate the impacts of the updated MASLD/MASH nomenclature.

## Limitations

Although the quantitative survey included a large sample size (N = 190), the overall response rate was low (9%). There could be differences between the curricula of programs whose leaders responded to our survey and those who did not. Moreover, this survey relied on self-reported responses from participants, which may reflect personal biases and perceptions that may not have wide generalizability. Also, the survey was undertaken prior to the FDA approval of resmetirom; therefore, responses reflect the previous state where there was no FDA-approved medication for the treatment of MASH. Furthermore, the qualitative study included a small sample size (N = 11) of US medical education program leaders, which limits our ability to generalize the findings to leaders of all US medical education programs. However, this limitation is bolstered by quantitative survey, which included a larger sample size (N = 190) and produced key findings that mirror the findings of qualitative discussions.

## Conclusion

In conclusion, the increasing importance of MASLD/MASH education is recognized by the leaders of medical training programs, but curricular time devoted to MASH-specific education is limited by focus on other diseases with clearer treatment options. In the short term, medical training programs should seek to improve MASH-specific education, particularly for primary care providers, through supplemental learning opportunities such as online resources, workshops, CME, and collaboration with national medical societies. In the future, the approval of MASH-specific therapies could represent an impetus to devote more time and resources to MASH-specific education.

# **Data Sharing Statement**

The data that support the findings of this study are available on request from the corresponding author, AMA. The data are not publicly available due to commercial restrictions.

# **Ethics Approval and Informed Consent**

The study protocol was reviewed by the WCG Institutional Review Board and judged to qualify for exempt status due to the minimal risk posed to participants. The study was conducted in accordance with the principles of the Declaration of Helsinki; participant names were not captured by the study or associated with any analytic process. All study participants consented to the research. Their anonymity was preserved, and participants informed consent included the publication of anonymized responses/direct quotes.

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Quantitative data from this study were previously presented as a poster entitled, "A cross-sectional online survey to understand existing NAFLD/NASH curriculum gaps in US primary care provider and specialty training programs" at The Liver Meeting<sup>®</sup> 2023 (Boston, MA), November 10-14, 2023. Qualitative data from this study were presented as a poster entitled, "Barriers to and opportunities for improved MASLD/MASH education: a qualitative discussion with medical training program leaders" at NASH-TAG, Park City, UT, January 4-6, 2024.

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#### References

- 1. Rinella ME, Lazarus JV, Ratziu V, et al. A multi-society Delphi consensus statement on new fatty liver disease nomenclature. *Hepatology*. 2023;78 (6):1966–1986. doi:10.1097/HEP.00000000000520
- 2. Kanwal F, Shubrook JH, Younossi Z, et al. Preparing for the NASH epidemic: a call to action. *Gastroenterology*. 2021;161(3):1030–1042.e8. doi:10.1053/j.gastro.2021.04.074
- 3. Godoy-Matos AF, Silva Júnior WS, Valerio CM. NAFLD as a continuum: from obesity to metabolic syndrome and diabetes. *Diabetol Metabol Syndr.* 2020;12(1):60. doi:10.1186/s13098-020-00570-y
- Quek J, Chan KE, Wong ZY, et al. Global prevalence of non-alcoholic fatty liver disease and non-alcoholic steatohepatitis in the overweight and obese population: a systematic review and meta-analysis. *Lancet Gastroenterol Hepatol.* 2023;8(1):20–30. doi:10.1016/S2468-1253(22)00317-X
- 5. Riazi K, Azhari H, Charette JH, et al. The prevalence and incidence of NAFLD worldwide: a systematic review and meta-analysis. Lancet Gastroenterol Hepatol. 2022;7(9):851-861. doi:10.1016/s2468-1253(22)00165-0
- Younossi ZM, Golabi P, Paik JM, Henry A, Van Dongen C, Henry L. The global epidemiology of nonalcoholic fatty liver disease (NAFLD) and nonalcoholic steatohepatitis (NASH): a systematic review. *Hepatology*. 2023;77(4):1335–1347. doi:10.1097/HEP.00000000000004
- 7. Vitale A, Svegliati-Baroni G, Ortolani A, et al. Epidemiological trends and trajectories of MAFLD-associated hepatocellular carcinoma 2002–2033: the ITA.LI.CA database. *Gut.* 2023;72(1):141–152. doi:10.1136/gutjnl-2021-324915
- Kemmer N, Neff GW, Franco E, et al. Nonalcoholic fatty liver disease epidemic and its implications for liver transplantation. 2013;96(10):860–862. doi:10.1097/01.Tp.0000436723.59879.01
- 9. Noureddin M, Vipani A, Bresee C, et al. NASH leading cause of liver transplant in women: updated analysis of indications for liver transplant and ethnic and gender variances. *Am J Gastroenterol*. 2018;113(11):1649–1659. doi:10.1038/s41395-018-0088-6
- 10. Stepanova M, Kabbara K, Mohess D, et al. Nonalcoholic steatohepatitis is the most common indication for liver transplantation among the elderly: data from the United States Scientific Registry of Transplant Recipients. *Hepatol Commun.* 2022;6(7):1506–1515. doi:10.1002/hep4.1915
- 11. Schattenberg JM, Lazarus JV, Newsome PN, et al. Disease burden and economic impact of diagnosed non-alcoholic steatohepatitis in five European countries in 2018: a cost-of-illness analysis. *Liver Int.* 2021;41(6):1227–1242. doi:10.1111/liv.14825
- 12. DeLegge MH. Recruitment and retention of patients for nonalcoholic steatohepatitis clinical trials. Gastroenterol Clin North Am. 2020;49 (1):123-140. doi:10.1016/j.gtc.2019.09.006
- 13. Karhiaho IP, Kurki SH, Parviainen HI, et al. The hidden epidemic: uncovering incidental fatty liver disease and its metabolic comorbidities by datamining in a hospital data lake a real-world cohort study. *Diabet Res Clin Pract*. 2024;210:111609. doi:10.1016/j.diabres.2024.111609
- 14. Ratziu V, Anstee QM, Wong VW, et al. An international survey on patterns of practice in NAFLD and expectations for therapies-the POP-NEXT project. *Hepatology*. 2022;76(6):1766–1777. doi:10.1002/hep.32500
- Said A, Gagovic V, Malecki K, Givens ML, Nieto FJ. Primary care practitioners survey of non-alcoholic fatty liver disease. Ann Hepatol. 2013;12 (5):758–765. doi:10.1016/S1665-2681(19)31317-1
- 16. Sheka AC, Adeyi O, Thompson J, Hameed B, Crawford PA, Ikramuddin S. Nonalcoholic steatohepatitis: a review. JAMA. 2020;323 (12):1175–1183. doi:10.1001/jama.2020.2298
- 17. Rinella ME, Neuschwander-Tetri BA, Siddiqui MS, et al. AASLD practice guidance on the clinical assessment and management of nonalcoholic fatty liver disease. *Hepatology*. 2023;77(5):1797–1835. doi:10.1097/HEP.0000000000323

- 18. Eskridge W, Cryer DR, Schattenberg JM, et al. Metabolic dysfunction-associated steatotic liver disease and metabolic dysfunction-associated steatohepatitis: the patient and physician perspective. J Clin Med. 2023;12(19):6216. doi:10.3390/jcm12196216
- Cusi K, Isaacs S, Barb D, et al. American Association of Clinical Endocrinology clinical practice guideline for the diagnosis and management of nonalcoholic fatty liver disease in primary care and endocrinology clinical settings: co-sponsored by the American Association for the Study of Liver Diseases (AASLD). *Endocr Pract.* 2022;28(5):528–562. doi:10.1016/j.eprac.2022.03.010
- Jansen KL, Rosenbaum ME. The state of communication education in family medicine residencies. Fam Med. 2016;48(6):445–451. Available from: https://www.stfm.org/FamilyMedicine/Vol48Issue5/Jansen445. Accessed May 01, 2025.
- 21. Phillips E, Traina A, Smolarz BG. A survey of obesity education and training in United States pharmacy schools. Am J Pharm Educ. 2023;87 (8):100109. doi:10.1016/j.ajpe.2023.100109
- 22. Densen P. Challenges and opportunities facing medical education. Trans Am Clin Climatol Assoc. 2011;122:48-58.
- 23. Romero-Gómez M, Zelber-Sagi S, Trenell M. Treatment of NAFLD with diet, physical activity and exercise. J Hepatol. 2017;67(4):829-846. doi:10.1016/j.jhep.2017.05.016
- 24. Knowler WC, Barrett-Connor E, Fowler SE, et al. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *N Engl J Med.* 2002;346(6):393–403. doi:10.1056/NEJMoa012512
- 25. Vilar-Gomez E, Nephew LD, Vuppalanchi R, et al. High-quality diet, physical activity, and college education are associated with low risk of NAFLD among the US population. *Hepatology*. 2022;75(6):1491–1506. doi:10.1002/hep.32207
- 26. Machado MV. MASLD treatment-a shift in the paradigm is imminent. Front Med. 2023;10:1316284. doi:10.3389/fmed.2023.1316284

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