Metabolic dysfunction-associated steatotic liver disease in primary care: an international Delphi consensus

Gong Feng, Shouping Gong*, Frank Tacke*, Luca Valenti, Mark Muthiah, Koki Kato, Zhaoxiang Yu, Giovanni Targher, Christopher D Byrne, Mohamed Farouk Allam, Wah Kheong Chan, Yusuf Yilmaz, Jingjing Ren, Juan Pablo Arab, Giada Sebastiani, Jacob George, Seung Up Kim, Yang Zhao, Aung Hlaing Bwa, Khalid A Alswat, Weiru Zhang, Helen M Parretti, Laura Elizabeth Moreno, Sombat Treeprasertsuk, Ajay Duseja, Martin Bach Jensen, Mei Feng, Catherine Wendy Spearman, Bernardo Meza-Torres, Syifa Mustika, Nahum Méndez-Sánchez, Boon How Chew, Marlen Ivón Castellanos Fernández, Man Mi, Nicholas Kyalo Muendo, Thomas Yuen Tung Lam, Aimei Dong, Jay H Shubrook, Xiaotong Gao, Marium Ahmed, Qiang Gao, Won Kim, Helena Cortez-Pinto, Yuen Ching Chan, Katarzyna Nessler, Ponsiano Ocama, Moien A B Khan, Marinos Pericleous, Dimitrios A Koutoukidis, Jin Chai, Shlomo Vinker†, Ming-Hua Zheng†, for the GPS-MASLD Alliance‡*

Metabolic dysfunction-associated steatotic liver disease (MASLD) is the most common chronic liver disease worldwide, with general practitioners and family doctors (collectively referred to as GPs) playing a key role in its management. However, numerous challenges persist in primary care settings. We aimed to develop consensus statements and recommendations to support MASLD management in primary care through an international collaboration of multidisciplinary experts. Experts were selected on the basis of clinical and academic expertise, publication record, involvement in guideline or consensus work, and geographical representation. 51 experts from 30 countries across six continents participated in round 1, and 49 experts from 29 countries participated in round 2. The expert panel included hepatologists or gastroenterologists, GPs, endocrinologists, cardiologists, and experts from other relevant disciplines. Agreement rose from 1271 (73·3%) of 1734 in round 1 to 1119 (87·8%) of 1274 in round 2, yielding 26 consensus statements across six domains: use of screening and non-invasive diagnostic tools; referral pathways for individuals at risk of advanced fibrosis; treatment goals emphasising weight reduction, dietary modifications, physical activity, and metabolic risk control; structured follow-up based on dynamic changes in clinical and fibrosis indicators, with assessment of extrahepatic complications; the role of GPs in patient education, lifestyle interventions, and coordination of multidisciplinary care; and training frameworks and system-level support to enhance primary care capacity. This expert consensus provides a systematic guide for managing MASLD in primary care, emphasising the key role of GPs in early screening, patient education, and behavioural interventions. It also offers a practical management framework for primary care worldwide and provides essential guidance for future research and policy development.

Introduction

Metabolic dysfunction-associated steatotic liver disease (MASLD), formerly termed non-alcoholic fatty liver disease or metabolic dysfunction-associated fatty liver disease, is a chronic liver disease closely associated with common cardiometabolic risk factors.[1,2] With the rising global prevalence of metabolic diseases, such as obesity and type 2 diabetes, the incidence of MASLD has increased considerably, making it the most common chronic liver disease worldwide.[2] Therefore, early screening and management of MASLD are crucial. MASLD can progress from isolated steatosis to metabolic dysfunction-associated steatohepatitis (MASH) or fibrotic MASH, also known as at-risk MASH, which is associated with a higher risk of long-term liver-related events such as hepatic decompensation, hepatocellular carcinoma, and liver-related death.[3] Additionally, MASLD is strongly associated with an increased risk of important extrahepatic outcomes, including cardiovascular disease, type 2 diabetes, chronic kidney disease, extrahepatic cancers (especially non-liver gastrointestinal cancers), and severe infections.[4]

Primary care plays a crucial role in managing MASLD, serving as the initial point of contact for patients and individuals at risk of MASLD.[5] The main tasks of primary care include ruling out advanced liver fibrosis and addressing metabolic risk factors of MASLD, such as obesity, type 2 diabetes, atherogenic dyslipidaemia, and hypertension.[6] Additionally, primary care can help to reduce the development of MASLD and the risk of disease progression through case-finding or screening, early diagnosis, behavioural interventions, and patient education. As a result, primary care should be a cornerstone of MASLD management.[6] Empowering primary care in the management of MASLD is essential for reducing the disease burden and improving patients' quality of life. However, MASLD has historically not been considered a priority in primary care.[7] For general practitioners and family doctors (collectively referred to as GPs) to assume a larger role in the identification and management of MASLD, providing support to improve awareness, knowledge, and confidence is essential.[7]

This Delphi consensus, developed through an international, multidisciplinary collaboration of experts, proposes a strategy for managing MASLD in primary care settings, grounded in clinical evidence and best practices. We aimed to bridge gaps in current clinical practice and promote the early identification, intervention, and management of MASLD, particularly in primary care settings, to achieve broader public health benefits.

Lancet Prim Care 2026; 2: 100205

Published Online September 2, 2026
https://doi.org/10.1016/j.lanprc.2026.100205

*Contributed equally
†Senior authors
‡All members of the GPS-MASLD Alliance are named authors

Institute of General Practice (G Feng MD, Prof M Mi MSc), **Research Institute of Rural Medicine in Shaanxi Province** (Prof S Gong MD), **and School of General Practice** (Prof Z Yu MD), **Xi'an Medical University, Xi'an, China; Department of Infectious Diseases, The First Affiliated Hospital of Xi'an Jiaotong University, Xi'an, China** (G Feng); **Department of Hepatology and Gastroenterology, Charité–Universitätsmedizin Berlin, Berlin, Germany** (Prof F Tacke MD); **Precision Medicine Lab, Biological Resource Center and Department of Transfusion Medicine, Fondazione IRCCS Ca' Granda Ospedale Maggiore Policlinico, Milan, Italy** (Prof L Valenti); **Department of Pathophysiology and Transplantation, Università degli Studi di Milano, Milan, Italy** (Prof L Valenti); **Yong Loo Lin School of Medicine** (Prof M Muthiah PhD) **and Duke–NUS Medical School** (Prof Y Zhao PhD), **National University of Singapore, Singapore; Division of Gastroenterology and Hepatology, Department of Medicine, National University Hospital, Singapore** (Prof M Muthiah); **National University Centre for Organ Transplantation, National University Health System,**

Singapore (Prof M Muthiah); **Madoka Family Clinic, Fukuoka, Japan** (K Kato MD); **Academic & Research Centre, Hokkaido Centre for Family Medicine, Hokkaido, Japan** (K Kato); **Department of Medicine, University of Verona, Verona, Italy** (Prof G Targher MD); **Metabolic Diseases Research Unit, IRCCS Ospedale Sacro Cuore Don Calabria Hospital, Negrar di Valpolicella, Italy** (Prof G Targher); **Southampton National Institute for Health and Care Research Biomedical Research Centre, University Hospital Southampton NHS Foundation Trust and University of Southampton, Southampton General Hospital, Southampton, UK** (Prof C D Byrne PhD); **Department of Family Medicine, Faculty of Medicine, Ain Shams University, Cairo, Egypt** (M F Allam PhD); **Gastroenterology and Hepatology Unit, Department of Medicine, Faculty of Medicine, University of Malaya, Kuala Lumpur, Malaysia** (Prof W K Chan PhD); **Department of Gastroenterology, School of Medicine, Recep Tayyip Erdoğan University, Rize, Türkiye** (Prof Y Yilmaz MD); **Department of General Practice, First Affiliated Hospital, School of Medicine, Zhejiang University, Hangzhou, China** (Prof J Ren MD); **Stravitz-Sanyal Institute for Liver Disease and Metabolic Health, Division of Gastroenterology, Hepatology, and Nutrition, Department of Internal Medicine, Virginia Commonwealth University School of Medicine, Richmond, VA, USA** (Prof J P Arab); **Division of Gastroenterology and Hepatology, Chronic Viral Illness Service, Royal Victoria Hospital, McGill University Health Centre, Montreal, QC, Canada** (Prof G Sebastiani MD); **Storr Liver Centre, Westmead Institute for Medical Research, Westmead Hospital and University of Sydney, Sydney, NSW, Australia** (Prof J George MD); **Yonsei Liver Center, Severance Hospital, Seoul, South Korea** (Prof S U Kim); **Department of Internal Medicine, Yonsei University College of Medicine, Seoul, South Korea**

Methods

Study design

This study was conducted within the General Practice–Specialty Collaboration for Metabolic Dysfunction-Associated Steatotic Liver Disease (GPS-MASLD) Alliance, a multidisciplinary collaboration established to advance consensus and research on the management of MASLD in primary care. A list of GPS-MASLD Alliance collaborators is provided in the appendix (pp 2–5).

The Delphi method is a communication approach to achieving expert consensus through a structured process (appendix p 6). We used a modified Delphi method to achieve expert consensus on the multidisciplinary management of MASLD in primary care through two rounds of online surveys. Experts were selected on the basis of clinical and academic expertise, publication record, involvement in guideline or consensus work, and geographical representation. To ensure the professionalism and regional representativeness of the expert panel, we selected active researchers from six continents (ie, Asia, Europe, North America, South America, Africa, and Oceania) with experience in primary care, expertise in MASLD, or both. Eligible experts were identified by the Steering Committee and invited individually by email; those who replied to the email invitation and expressed interest in participation were included. 51 experts from 30 countries across six continents participated in round 1, and 49 experts from 29 countries participated in round 2. The expert panel included hepatologists or gastroenterologists, GPs, endocrinologists, cardiologists, and experts from other relevant disciplines. We informed experts of our objectives via email and provided a secure link to the first-round and second-round Delphi questionnaires via Google Forms.

This Delphi consensus consisted of a first-round survey and second-round survey. To clarify the strength of the evidence supporting the final consensus statements, we referred to the Oxford Centre for Evidence-Based Medicine's evidence grading system and drew on the approach used in a 2026 international expert consensus statement,[8] adopting a simplified four-level evidence grading system: level 1 (randomised evidence), level 2 (non-randomised, prospective, clinical evidence, including prospective, single-arm studies and non-randomised trials), level 3 (retrospective, observational evidence), and level 4 (expert consensus and indirect evidence or extrapolation).[8] When multiple types of evidence are present, the grading is based on the highest level of direct evidence supporting the statement.[8] None of the experts who participated in the Delphi survey, online feedback review, or web-based draft statement review received any financial or non-financial compensation, remuneration, gifts, travel support, or other incentives related to this study.

Consensus process

All Delphi activities were conducted online, including two online survey rounds; an online feedback review during April 2025, to review round 1 feedback and proposed revisions for round 2; and a subsequent web-based review of draft statements (appendix p 6).

In the first phase, we conducted a structured narrative synthesis of evidence on MASLD and primary care from database inception, to Dec 31, 2024 (panel). The retrieved evidence, along with relevant guideline recommendations and clinically important themes, informed the development of the first-round questionnaire. This questionnaire encompassed six domains and 34 draft statements. Participants rated each statement on a four-point scale (ie, agree, somewhat agree, somewhat disagree, or disagree) to encourage directional judgements and prevent overuse of neutral responses.[9–11] Each question domain included a free-text comment section. Comments collected in the first round were used to revise item wording, merge overlapping items, remove duplicates, and provide additional supporting evidence before the second round.[9–11] The first-round survey ran for 12 weeks, starting on Jan 6, 2025, and ending on March 30, 2025.

The second-round survey was completed between May 18, 2025, and June 22, 2025. In the second round, experts primarily re-evaluated the revised questionnaires, focusing on controversial items identified in the refined results of the first-round survey. When consensus was not achieved in the first round (ie, <80% agreement), voting was conducted in the second round after presenting the available evidence. The first round was designed to capture experts' initial independent judgements on draft statements, whereas the second round allowed reconsideration of controversial items after the available supporting evidence was presented. The consensus level for each statement was indicated on a grading scale: U for universal (100%) agreement, A for 85–99% agreement, B for 70–84% agreement, and C for 60–69% agreement.[11] The final consensus level was ascertained by the proportion of experts who selected agree. The combined proportion of experts who selected agree or somewhat agree served as a supplementary descriptive measure indicating the overall direction of expert support and was not used to ascertain the consensus level. The final statements were decided upon by the Consensus Steering Committee members (GF, GT, CDB, JC, and M-HZ).

Results

In the first round of the survey, we received 51 responses from GPs, hepatologists or gastroenterologists, endocrinologists, cardiologists, and experts from other relevant disciplines across 30 countries (appendix pp 7–9). In the second round, we obtained 49 responses across 29 countries. The overall response rate was 51 (100%) of 51 respondents in round 1 and 49 (96%) of 51 respondents in round 2. Among the 51 respondents in round 1, 22 (43%) were hepatologists or gastroenterologists, 19 (37%) were GPs, six (11%) were experts from other relevant disciplines, three (6%) were endocrinologists, and one (2%) was a cardiologist. Among the 49 respondents in round 2, 21 (43%)

Panel: **Search strategy and selection criteria**

No formal systematic literature search was conducted for this manuscript, as the work was designed as an international Delphi consensus rather than a systematic review. The evidence base was developed through a structured narrative synthesis informed by the expertise of the Consensus Steering Committee (GF, GT, CDB, JC, and M-HZ), relevant international guidelines, consensus statements, and key studies in the field. The evidence considered included clinical practice guidelines and consensus statements on metabolic dysfunction-associated steatotic liver disease, non-alcoholic fatty liver disease, and metabolic dysfunction-associated fatty liver disease; randomised controlled trials; cohort studies; diagnostic accuracy studies; meta-analyses; and key observational studies relevant to primary care, non-invasive fibrosis assessment, referral pathways, lifestyle interventions, follow-up, multidisciplinary care, and health-system support. Formal inclusion and exclusion criteria, duplicate-screening procedures, and risk-of-bias assessment were not applied. Priority was given to the most recent international guidelines, high-quality evidence syntheses, large cohort studies, randomised clinical trials, and studies directly relevant to primary care. The initial evidence base was developed through a structured narrative synthesis of relevant English-language literature available between database inception and Dec 31, 2024, with targeted updates incorporated when relevant new international guidelines, consensus statements, or key studies were published during manuscript drafting and revision. Draft statements were reviewed iteratively by the steering committee, with a focus on evaluating their clinical relevance, clarity, and suitability for primary care implementation. This process was primarily used to support the content validity of Delphi questionnaires. We acknowledge that this type of structured narrative evidence synthesis could introduce bias, and that the availability of evidence varies across different domains.

were hepatologists or gastroenterologists, 18 (37%) were GPs, six (12%) were experts from other relevant disciplines, three (6%) were endocrinologists, and one (2%) was a cardiologist (appendix pp 7–9).

Across the two rounds of the Delphi survey, the average percentage of agree responses rose from 1271 (73·3%) of 1734 in the first round to 1119 (87·8%) of 1274 in the second round. The rate of responses indicating agree or somewhat agree increased from 1664 (96·0%) of 1734 in the first round to 1248 (98·0%) of 1274 in the second round (figure 1). Detailed consensus rates are provided in the appendix (pp 10–25). For example, the highest level of agreement (47 [96%] of 49 respondents) was observed for the statement that GPs play a key role in raising awareness among individuals at high risk of developing MASLD and promoting lifestyle modifications to prevent MASLD (appendix p 24), reflecting strong agreement within this international expert panel on the pivotal role of primary care in disease prevention and management. Overall, 20 (77%) of 26 statements received an A rating and six (23%) of 26 statements received a B rating (table). The 26 statements related to primary care and MASLD were grouped into six domains: use of screening and non-invasive diagnostic tools; referral pathways for individuals at risk of advanced fibrosis; treatment goals emphasising weight reduction, dietary modifications, physical activity, and metabolic risk control; structured follow-up based on dynamic changes in clinical and fibrosis indicators, with assessment of extra-hepatic complications; the role of GPs in patient education, lifestyle interventions, and coordination of multi-disciplinary care; and training frameworks and system-level support to enhance primary care capacity (table; figure 2). A primary care-centred practical workflow focused on a Fibrosis-4 (FIB-4) Index-based MASLD assessment and follow-up, derived from the consensus statements, is reported in figure 3. Evidence levels supporting the final consensus statements endorsed in round 2 of the Delphi process are provided in the appendix (pp 26–32).

Use of screening and non-invasive diagnostic tools in primary care

MASLD is a common chronic liver disease in primary care settings, but its diagnosis and reporting remain insufficient, and efforts should be enhanced in prevention and screening (grade A; appendix pp 33–34). In primary care settings, GPs should screen for MASLD along with liver fibrosis in the following groups: individuals with type 2 diabetes; individuals with abdominal obesity and at least one additional metabolic risk factor; individuals presenting with abnormal liver function test results (grade B; appendix pp 35–37).

In primary care settings, FIB-4 should be recommended as the initial screening tool for assessing the risk of advanced fibrosis in people with MASLD. For individuals with a FIB-4 score of 1·3 or more, or 2·0 or more for those older than 65 years, further assessment or referral for more comprehensive risk stratification is advised (grade A; appendix pp 38–39). Wherever feasible, liver stiffness measurement (LSM) by vibration-controlled transient elastography (VCTE) or serum enhanced liver fibrosis (ELF) testing are recommended for further stratification of liver fibrosis risk (grade B; appendix pp 40–41).

Convenient non-invasive diagnostic tools (eg, FIB-4) should be integrated into laboratory reports or electronic health systems in primary care, allowing for automated calculation upon request in specific clinical scenarios. This integration would enable GPs to assess the probability of liver fibrosis, thereby enhancing screening efficiency (grade A). Although the FIB-4 index can be obtained through laboratory reporting systems or electronic health records in some primary care settings, variation in laboratory methods may hinder the standardised interpretation of FIB-4 results.[12] The FIB-4 index is widely available, low-cost,

(Prof S U Kim); **The George Institute for Global Health, University of New South Wales Sydney, Sydney, NSW, Australia** (Prof Y Zhao); **School of Health Management, Binzhou Medical University, Yantai, China** (Prof Y Zhao); **Yangon GI and Liver Centre, Yangon, Myanmar** (A H Bwa MBBS); **Liver Disease Research Center, Department of Medicine, College of Medicine, King Saud University, Riyadh, Saudi Arabia** (Prof K A Alswat MD); **Department of General Practice, Xiangya Hospital, Central South University, Changsha, China** (Prof W Zhang MD); **Norwich Medical School, University of East Anglia, Norwich, UK** (H M Parretti PhD); **Department of Family and Preventive Medicine, University of Utah, Salt Lake City, UT, USA** (L E Moreno MD); **Division of Gastroenterology, Department of Medicine, Faculty of Medicine, Chulalongkorn University and King Chulalongkorn Memorial Hospital, Thai Red Cross Society, Bangkok, Thailand** (Prof S Treeprasertsuk MD); **Department of Hepatology, Post Graduate Institute of Medical Education and Research, Chandigarh, India** (Prof A Duseja MD); **Center for General Practice at Aalborg University, Aalborg, Denmark** (Prof M B Jensen PhD); **Department of General Practice, Shanxi Bethune Hospital, Taiyuan, China** (Prof M Feng MD); **Division of Hepatology, Department of Medicine, Faculty of Health Sciences, University of Cape Town and Groote Schuur Hospital, Cape Town, South Africa** (Prof C W Spearman PhD); **Nuffield Department of Primary Health Care Sciences, University of Oxford, Oxford, UK** (B Meza-Torres PhD, D A Koutoukidis PhD); **Division of Gastroenterohepatology, Department of Internal Medicine, Faculty of Medicine, Universitas Brawijaya, Malang, Indonesia** (S Mustika MD); **Faculty of Medicine, National Autonomous University of Mexico, Mexico City, Mexico** (Prof N Méndez-Sánchez MD); **Liver Research Unit, Medica Sur Clinic and Foundation, Mexico**

City, Mexico (Prof N Méndez-Sánchez); Department of Family Medicine, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Serdang, Malaysia (Prof B H Chew PhD); Department of Researches, National Institute of Gastroenterology, Havana, Cuba (Prof M I Castellanos Fernández); Department of Family Medicine, Community Health & Epidemiology, Kenyatta University, Nairobi, Kenya (N K Muendo MMed); The Nethersole School of Nursing (T Y T Lam PhD) and The Jockey Club School of Public Health and Primary Care (Y C Chan MBBS), Faculty of Medicine, The Chinese University of Hong Kong, Hong Kong Special Administrative Region, China; Department of General Practice, Peking University First Hospital, Beijing, China (Prof A Dong MD); Department of Clinical Sciences and Community Health, College of Osteopathic Medicine, Touro University California, Vallejo, CA, USA (Prof J H Shubrook MD); Department of General Practice, The First Affiliated Hospital of China Medical University, Shenyang, China (X Gao MD); Department of Family Medicine, Liaquat National Hospital and Medical College, Karachi, Pakistan (M Ahmed MBBS); Department of Geriatrics, The Second Affiliated Hospital of Harbin Medical University, Harbin, China (Q Gao MD); Department of Internal Medicine, Seoul National University College of Medicine, Seoul, Korea (Prof W Kim MD); Division of Gastroenterology and Hepatology, Department of Internal Medicine, Seoul Metropolitan Government Boramae Medical Center, Seoul, Korea (Prof W Kim); Unidade Local de Saúde de Santa Maria, Lisbon, Portugal (Prof H Cortez-Pinto); Clínica Universitária de Gastrenterologia, Faculdade de Medicina, Universidade de Lisboa, Lisbon, Portugal (Prof H Cortez-Pinto); The Chinese University of Hong Kong Medical Centre, Hong Kong Special Administrative Region, China (Y C Chan); Department of Family Medicine, Jagiellonian University Medical College,

and easy to calculate, and guidelines recommend it as the first screening option to help rule out advanced liver fibrosis.[13,14] Therefore, convenient, non-invasive tools such as the FIB-4 index should be incorporated into laboratory reports or electronic health systems to enable GPs to assess the likelihood of advanced liver fibrosis, improving screening efficiency.

GPs play a crucial role in the early detection and management of MASLD. However, owing to the complexity of interpreting non-invasive diagnostic tools for assessing disease severity, providing additional support to enhance their ability to effectively use these tools in clinical practice is important (grade A). In a previous qualitative study using semistructured interviews, 25 GPs were purposively sampled across five primary care research sites in the UK.[7] Although participants reported ordering liver function tests daily, they had low confidence in interpreting the results.[7] In a previous cross-sectional survey of primary care clinicians in Brisbane and southeast Queensland, Australia, Patel and colleagues found a substantial underestimation of MASLD prevalence, with approximately 50% of respondents estimating it to be 10% or less, a figure significantly lower than the actual rates.[15] Additionally, familiarity with non-invasive fibrosis biomarkers was low, with 64 (63%) of 102 respondents expressing uncertainty regarding the clinical applications of the FIB-4 scores and 65 (64%) of 102 respondents expressing uncertainty about ELF scores.[15] In a Canadian survey, Sebastiani and colleagues found that 51 (58%) of 88 primary care physicians were only somewhat familiar or unfamiliar with MASLD, and 47 (53%) of 88 primary care physicians estimated the prevalence of MASLD in Canada to be 15% or less.[16]

Referral pathways for individuals at risk of advanced fibrosis

Individuals with MASLD and a FIB-4 score of 1·3 or more, or 2·0 or more for those older than 65 years, can have LSM first and be referred to a hepatologist depending on the LSM value (grade B). Previous research has shown that a FIB-4 score of less than 1·3, or of less than 2·0 for individuals aged 65 years or older, helps to rule out advanced liver fibrosis in individuals with MASLD, with a negative predictive value of 90% or more.[17,18] Consequently, the FIB-4 index is a valuable and cost-effective initial screening tool for assessing advanced fibrosis in primary care settings. Individuals with FIB-4 scores of less than 1·3 generally do not require further invasive or advanced diagnostic evaluations.[19] In line with these findings, the 2024 European Association for the Study of the Liver Clinical Practice Guidelines recommended periodic re-evaluation of the FIB-4 index every 1–3 years in individuals with MASLD and a FIB-4 score of less than 1·3, to monitor disease progression.[14] Conversely, individuals with MASLD and a FIB-4 score of 1·3 or more, or 2·0 or more for those older than 65 years, could have advanced or indeterminate liver fibrosis that requires further evaluation. In such cases, individuals with MASLD can undergo VCTE-measured LSM first, when available, and be referred to a hepatologist on the basis of the results. Using these accurate diagnostic tools helps to identify individuals with MASLD who require further evaluation, thereby reducing unnecessary workload for hepatologists and ensuring appropriate patient triage. Although VCTE-measured LSM remains the preferred second-line test, serum ELF testing can be considered when VCTE is unavailable or impractical, depending on local access, laboratory capacity, and cost.[14]

Individuals with MASLD and a FIB-4 index of more than 2·67, LSM of 8 kPa or more, or both, despite lifestyle changes, should be referred to a specialist for further diagnosis and evaluation (grade A). An individual patient data meta-analysis showed that individuals with MASLD and a FIB-4 score of more than 2·67 have an increased risk of advanced liver fibrosis;[20] studies have reported a positive predictive value of 60–80% for the FIB-4 index.[17,20] These individuals can be directly referred to hepatology specialists without additional risk stratification in primary care to assess for advanced fibrosis or cirrhosis.[19,21] In a multicentre cohort study in France, Sweden, and Spain, Boursier and colleagues found that a stepwise algorithm combining the FIB-4 index with VCTE performed well in stratifying risk of future long-term liver-related events.[22] Yip and colleagues showed that a non-invasive, two-step approach of FIB-4 followed by LSM was effective in classifying individuals into different risk categories for long-term liver-related events.[23] When LSM is less than 8·0 kPa, advanced liver fibrosis can be excluded in most cases, and the incidence of liver-related events is low.[22,24,25] In a study involving 1073 individuals with biopsy-proven MASLD from ten European liver centres, in which liver biopsy and LSM measurements were performed within 6 months, an LSM cutoff of less than 8 kPa had a sensitivity of 93% for excluding advanced liver fibrosis.[26] Individuals with a FIB-4 score of more than 1·3 but LSM of less than 8·0 kPa can be followed up in primary care settings.[21] Most scientific guidelines recommend VCTE-measured LSM as the leading disease-monitoring tool because it effectively predicts future risk of long-term liver-related outcomes.[14,21] Conversely, individuals with MASLD and VCTE-measured LSM of 8·0 kPa or more should be referred to hepatology specialists for further examination.[21] Although point shear-wave elastography or other ultrasound-based methods can also be used for initial risk stratification of liver fibrosis, they are not as widely validated as VCTE-measured LSM.

Individuals with MASLD and a FIB-4 index of more than 2·67, ELF of 9·8 or more, or both, despite lifestyle changes, should be referred to a specialist for further diagnosis and evaluation (grade A). In a prospective cohort study of referral pathways for people with MASLD in the UK, Srivastava and colleagues used a two-step testing strategy (ie, FIB-4 testing followed by ELF testing for individuals with indeterminate FIB-4 results).[27] Practices exposed to the pathway had 332% higher odds of detecting advanced fibrosis or cirrhosis and 77% lower odds of unnecessary referrals than practices not exposed to the pathway.[27] In a

prospective, single-centre screening study in Denmark, Kjaergaard and colleagues found that the sequential use of FIB-4 and ELF testing with an ELF cutoff of 9·8 or more minimised ineffective referrals and reduced costs, making it a promising referral strategy.[28] Therefore, ELF testing is a supported choice for secondary risk assessment after FIB-4 scoring, especially when VCTE is unavailable.[27,28]

Treatment goals and lifestyle interventions

The primary treatment goal for people with MASLD in primary care is to reduce steatohepatitis and fibrosis, manage metabolic syndrome, prevent disease progression and complications, and improve the individual's quality of life (grade A). GPs should provide lifestyle recommendations for individuals with MASLD, including healthy eating, exercise management, and behavioural interventions. The goal should be a weight reduction of at least 5% to reduce liver fat, 7–10% to resolve liver inflammation, and 10% or more to improve fibrosis in adults with MASLD and overweight. However, weight loss targets could vary depending on several factors, including the level of obesity, MASH stage, age, and sarcopenia (grade B; appendix pp 42–43).

Dietary adjustments should focus on reducing the intake of saturated fats, starches, and added sugars while increasing the consumption of whole grains and vegetables (grade A; appendix p 44). Individuals should be encouraged to consume plant-based proteins, fish, and low-fat dairy products, opting for lean, unprocessed meats and reduced intake of red and processed meats (grade A). Huang and colleagues conducted a meta-analysis of ten observational studies involving 3624 people with liver cancer across Asia, Europe, and North America.[29] They showed that higher fish intake was associated with a significantly lower risk of liver cancer.[29] In a systematic review and dose–response meta-analysis of ten observational studies, Zhou and colleagues found that total red meat intake (odds ratio [OR] 1·27, 95% CI 1·07–1·50), processed red meat (OR 1·20, 95% CI 1·04–1·37), and unprocessed red meat (OR 1·28, 95% CI 1·05–1·55) were significantly associated with a higher risk of MASLD.[30] Furthermore, for each additional 25 g of processed red meat consumed daily, the risk of MASLD increased (OR 1·11, 95% CI 1·01–1·22).[30]

A Mediterranean-style diet or other healthy dietary patterns with appropriate macronutrient composition, including adjustments in carbohydrate or fat intake as needed, are recommended to improve MASLD and reduce associated risks (grade A; appendix pp 45–46). For adults with MASLD, 150 min or more per week of moderate-intensity aerobic activity or 75 min or more per week of vigorous-intensity aerobic activity is recommended after cardiovascular risk assessment, tailored to individual tolerance and preference (grade A; appendix pp 47–48).

Structured follow-up based on dynamic changes and assessment

Follow-up indicators for individuals with MASLD should include monitoring lifestyle and weight changes, regularly assessing blood biochemical markers, and evaluating the severity of fatty liver, fibrosis, and extrahepatic complications such as cardiovascular disease (grade A). The 2024 European Association for the Study of the Liver–European Association for the Study of Diabetes–European Association for the Study of Obesity Clinical Practice Guidelines recommend laboratory tests and physical examinations to assess relevant comorbidities at the time of initial MASLD diagnosis and at regular follow-up visits.[14] The 2024 Chinese MASLD management guidelines suggest that follow-up for individuals with MASLD should include monitoring lifestyle and weight changes, regular assessment of biochemical biomarkers, evaluation of liver steatosis and fibrosis, and screening for liver complications such as cirrhosis.[31] These recommendations aim to facilitate comprehensive assessments, enabling early detection and intervention for liver-related complications.[31,32] In the management of adult MASLD, repeat FIB-4 testing should follow a pathway-based schedule rather than being performed arbitrarily. Individuals with low-risk FIB-4 results (ie, FIB-4 <1·3) could be reassessed every 1–3 years.[14] More frequent reassessment every 1–2 years is recommended for those with type 2 diabetes, prediabetes, or two or more metabolic risk factors, whereas reassessment of FIB-4 every 2–3 years could be considered for those without type 2 diabetes or prediabetes and with fewer than two metabolic risk factors.[33] For those with FIB-4 scores of 1·3–2·67, a second-step, non-invasive fibrosis assessment should be prioritised. If second-tier testing cannot be completed promptly because of resource or access limitations, then the FIB-4 index should be repeated within 1 year after lifestyle interventions and optimisation of comorbidity management (figure 3).

Increases in FIB-4 scores or LSMs during follow-up suggest a higher risk of liver disease progression and liver-related clinical events (grade B; appendix pp 49–50). During follow-up, efforts should be made to enhance individuals' self-management skills, including educating them about changes in their condition, the importance of follow-up, and how to monitor their health indicators (grade A; appendix p 51). For individuals showing signs of liver fibrosis progression, such as increased liver stiffness on elastography, clinical manifestations of portal hypertension, or an increased risk of liver-related complications during follow-up, referring them promptly to a higher-level hospital for more detailed evaluation and treatment is recommended (grade A).

The progression of liver fibrosis or LSM is closely associated with long-term adverse liver-related outcomes in individuals with MASLD. Development of portal hypertension or other liver complications indicates further deterioration of the condition. Therefore, this group should be referred to a higher-level hospital during follow-up. An increase in LSM of 5 kPa or more, or 20% or more from baseline, was associated with an elevated risk of progression to cirrhosis in individuals with F3 fibrosis.[34] Gawrieh and colleagues showed that longitudinal changes in

Krakow, Poland (K Nessler MD); **Makerere University College of Health Sciences, School of Medicine, Kampala, Uganda** (Prof P Ocama PhD); **Health and Wellness Research Group, Department of Family Medicine, College of Medicine and Health Sciences, United Arab Emirates University, Al Ain, United Arab Emirates** (M A B Khan MD); **Primary Care, NHS North West London, London, UK** (M A B Khan); **Department of Gastroenterology & Hepatology, Royal Surrey NHS Foundation Trust, Guildford, UK** (M Pericleous PhD); **Department of Gastroenterology** (Prof J Chai MD), **Institute of Digestive Diseases of the Chinese People's Liberation Army** (Prof J Chai), **and Cholestatic Liver Diseases Center and MASLD Medical Research Center** (Prof J Chai), **the First Affiliated Hospital of Third Military Medical University, Chongqing, China; Department of Family Medicine, Gray Faculty of Medical & Health Sciences, Tel Aviv University, Tel Aviv, Israel** (Prof S Vinker MD); **MAFLD Research Center, Department of Hepatology, the First Affiliated Hospital of Wenzhou Medical University, Wenzhou, China** (Prof M-H Zheng MD); **Key Laboratory of Diagnosis and Treatment for the Development of Chronic Liver Disease in Zhejiang Province, Wenzhou, China** (Prof M-H Zheng)

Correspondence to:
Prof Ming-Hua Zheng, MAFLD Research Center, Department of Hepatology, the First Affiliated Hospital of Wenzhou Medical University, Wenzhou 325000, China
zhengmh@wmu.edu.cn

See **Online** for appendix

For the **first-round survey** see https://forms.gle/8x313TVAJBvUWhJQ7

For the **second-round survey** see https://forms.gle/rh7dw1gZ6w7fnAjM8

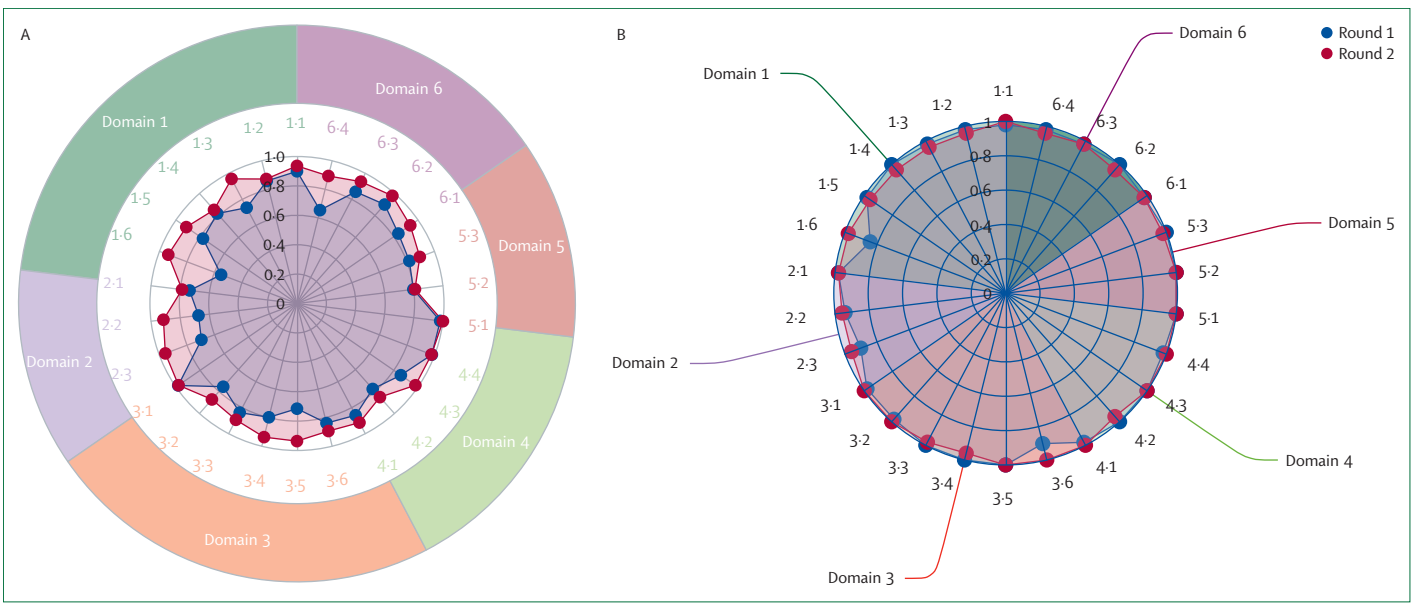


Figure 1: **Delphi agreement**
Agree responses (A) and combined agree or somewhat agree responses (B). Round 1 items were matched to final statements by content. Domain 1 is the use of screening and non-invasive diagnostic tools; domain 2 is referral pathways for individuals at risk of advanced fibrosis; domain 3 is treatment goals emphasising weight reduction, dietary modifications, physical activity, and metabolic risk control; domain 4 is structured follow-up based on dynamic changes in clinical and fibrosis indicators, with assessment of extrahepatic complications; domain 5 is the role of GPs in patient education, lifestyle interventions, and coordination of multidisciplinary care; and domain 6 is training frameworks and system-level support to enhance primary care capacity. GPs=general practitioners and family doctors.

VCTE-measured LSM were bidirectionally associated with the risk of long-term liver-related events, supporting the role of liver stiffness progression as a non-invasive surrogate for long-term liver-related events in individuals with MASLD.[35]

Role of GPs in patient education, lifestyle interventions, and coordination of care

Regarding prevention, GPs can help to raise awareness among individuals at high risk of developing MASLD and educate and motivate them and their families to adjust their lifestyle habits to reduce risk (grade A; appendix p 52). In lifestyle interventions, GPs should take a leading role, and advocate a multidisciplinary team approach to management (grade B; appendix pp 53–54). When managing individuals with MASLD and their comorbidities, such as type 2 diabetes or cardiovascular disease, GPs should take a lead in patient management and consult specialists promptly when dealing with complex cases or treatment challenges (grade A; appendix p 55).

Training frameworks and system-level support to enhance primary care capacity

Implementation of competency-based MASLD training programmes for GPs should be prioritised in regions with resources available, with phased expansion guided by health-equity frameworks. Core curricula should emphasise non-invasive diagnostic tools, evidence-based lifestyle protocols, and screening for complications (grade A; appendix pp 56–57).

Training content should be aligned with the latest guidelines and evidence to ensure that GPs are equipped with up-to-date clinical knowledge and skills (grade A). Applying guidelines helps to increase GPs' confidence in their diagnostic abilities.[7] When guidelines are integrated into daily clinical practice through computer-based reminder systems or clear flowcharts, GPs perceive that these guidelines have a greater effect on boosting their confidence.[7]

Referral and teleconsultation mechanisms should be established between primary care facilities and higher-level hospitals, allowing for timely expert support and improving the diagnostic and treatment capabilities of primary care institutions (grade A; appendix pp 58–59). Wherever local policies permit and the use of artificial intelligence (AI) tools is acceptable, GPs should receive training in relevant AI knowledge to effectively use these tools and improve their work efficiency (grade A; appendix pp 60–61).

Discussion

Our international Delphi consensus highlights practical strategies for effective MASLD management in primary care settings and recommends non-invasive diagnostic tools that considerably streamline workflows. These tools enable GPs to quickly identify individuals at high risk of advanced fibrosis, implement early interventions, and improve patient outcomes. Moreover, research emphasises the benefits of behavioural interventions, particularly the Mediterranean-style diet, physical activity, and weight loss, providing GPs with actionable treatment strategies. Our consensus also supports improving the management capacity of GPs through systematic training and technical support.

	Statement number	Consensus statement	Agreement in round 2 (n=49)	Grade
Use of screening and non-invasive diagnostic tools	1·1	MASLD is a common chronic liver disease in primary care settings, but its diagnosis and reporting remain insufficient, and efforts should be enhanced in prevention and screening.	44 (90%)	A
	1·2	In primary care settings, GPs should screen for MASLD and liver fibrosis in the following groups: individuals with type 2 diabetes; individuals with abdominal obesity and at least one additional metabolic risk factor; and individuals presenting with abnormal liver function test results.	41 (84%)	B
	1·3	In primary care settings, FIB-4 should be recommended as the initial screening tool for assessing the risk of advanced fibrosis in people with MASLD. For individuals with a FIB-4 score of 1·3 or more, or 2·0 or more for those older than 65 years, further assessment or referral for more comprehensive risk stratification is advised.	45 (92%)	A
	1·4	Wherever feasible, LSM by vibration-controlled transient elastography or serum ELF testing is recommended for further stratification of liver-fibrosis risk.	40 (82%)	B
	1·5	Convenient non-invasive diagnostic tools, such as FIB-4, should be integrated into laboratory reports or electronic health systems in primary care, allowing automated calculation upon request in specific clinical scenarios. This integration would enable GPs to assess the probability of liver fibrosis and enhance screening efficiency.	43 (88%)	A
	1·6	GPs play a crucial role in the early detection and management of MASLD. However, because interpreting non-invasive diagnostic tools for assessing disease severity can be complex, additional support is important to enhance their ability to use these tools effectively in clinical practice.	44 (90%)	A
Referral pathways for individuals at risk of advanced fibrosis	2·1	Individuals with MASLD and a FIB-4 score of 1·3 or more, or 2·0 or more for those older than 65 years, can have LSM first and be referred to a hepatologist depending on the LSM value.	37 (76%)	B
	2·2	Individuals with MASLD and a FIB-4 score of more than 2·67, LSM of 8 kPa or more, or both, despite lifestyle changes, should be referred to a specialist for further diagnosis and evaluation.	43 (88%)	A
	2·3	Individuals with MASLD and a FIB-4 score of more than 2·67, ELF 9·8 or more, or both, despite lifestyle changes, should be referred to a specialist for further diagnosis and evaluation.	45 (92%)	A
Treatment goals emphasising weight reduction, dietary modifications, physical activity, and metabolic risk control	3·1	The primary treatment goal for MASLD in primary care is to reduce steatohepatitis and fibrosis, manage metabolic syndrome, prevent disease progression and complications, and improve the quality of life.	46 (94%)	A
	3·2	GPs should provide lifestyle recommendations for individuals with MASLD, including healthy eating, exercise management, and behavioural interventions. The goal should be a weight reduction of at least 5% to reduce liver fat, 7–10% to resolve liver inflammation, and 10% or more to improve fibrosis in adults with MASLD and overweight. Weight loss targets can vary according to factors such as degree of obesity, MASH stage, age, and sarcopenia.	41 (84%)	B
	3·3	Dietary adjustments should focus on reducing intake of saturated fats, starches, and added sugars while increasing consumption of whole grains and vegetables.	42 (86%)	A
	3·4	Individuals should be encouraged to consume plant-based proteins, fish, and low-fat dairy products; choose lean, unprocessed meats; and reduce intake of red and processed meats.	44 (90%)	A
	3·5	A Mediterranean-style diet or other healthy dietary patterns with appropriate macronutrient composition, including adjustments in carbohydrate or fat intake as needed, are recommended to improve MASLD and reduce associated risks.	44 (90%)	A
	3·6	For adults with MASLD, 150 min or more per week of moderate-intensity aerobic activity or 75 min or more per week of vigorous-intensity aerobic activity is recommended after cardiovascular risk assessment, tailored to individual tolerance and preference.	42 (86%)	A
Structured follow-up based on dynamic changes in clinical and fibrosis indicators, with assessment of extrahepatic complications	4·1	Follow-up indicators for individuals with MASLD should include monitoring lifestyle and weight changes, regularly assessing blood biochemical markers, and evaluating the severity of fatty liver, fibrosis, and extrahepatic complications such as cardiovascular disease.	43 (88%)	A
	4·2	Increases in FIB-4 scores or LSM during follow-up suggest a higher risk of liver disease progression and liver-related clinical events.	40 (82%)	B
	4·3	During follow-up, efforts should be made to enhance individuals' self-management skills, including educating them about changes in their condition, the importance of follow-up, and how to monitor their health indicators.	46 (94%)	A
	4·4	For individuals showing signs of liver-fibrosis progression, such as increased liver stiffness on elastography, clinical manifestations of portal hypertension, or increased risk of liver-related complications during follow-up, prompt referral to a higher-level hospital or specialist centre for more detailed evaluation and treatment is recommended.	46 (94%)	A

(Table continues on next page)

	Statement number	Consensus statement	Agreement in round 2 (n=49)	Grade
(Continued from previous page)				
Role of GPs in patient education, lifestyle interventions, and coordination of multidisciplinary care	5·1	Regarding prevention, GPs can help to raise awareness among individuals at high risk of developing MASLD and educate and motivate them and their families to adjust lifestyle habits to reduce the risk.	47 (96%)	A
	5·2	In lifestyle interventions, GPs should take a leading role and advocate a multidisciplinary team approach to management.	38 (78%)	B
	5·3	When managing individuals with MASLD and comorbidities, such as type 2 diabetes and cardiovascular disease, GPs should take a lead in patient management and consult specialists promptly when dealing with complex cases or treatment challenges.	42 (86%)	A
Training frameworks and system-level support to enhance primary care capacity	6·1	Implementation of competency-based MASLD training programmes for GPs should be prioritised in resource-available regions, with phased expansion guided by health equity frameworks. Core curricula should emphasise non-invasive diagnostic tools, evidence-based lifestyle protocols, and screening for complications.	44 (90%)	A
	6·2	Training content should be aligned with the latest guidelines and evidence to ensure that GPs are equipped with up-to-date clinical knowledge and skills.	46 (94%)	A
	6·3	Referral and teleconsultation mechanisms between primary care facilities and higher-level hospitals or specialist centres are encouraged to allow timely expert support and improve the diagnostic and treatment capabilities of primary care institutions.	44 (90%)	A
	6·4	Wherever local policies permit and the use of AI tools is acceptable, GPs should receive training in relevant AI knowledge to use these tools effectively and improve work efficiency.	42 (86%)	A

Agreement is the proportion of participants selecting agree in round 2, reported as n (%). Grade definitions: U=universal agreement (100%). A=85–99% agreement. B=70–84% agreement. C=60–69% agreement. Other healthy dietary patterns refers to dietary approaches other than a Mediterranean-style diet that share similar healthy nutritional principles and can be adapted to local dietary cultures and individual metabolic needs, such as DASH-style, plant-forward, or balanced energy-restricted dietary patterns. AI=artificial intelligence. DASH=Dietary Approaches to Stop Hypertension. ELF=enhanced liver fibrosis. FIB-4 index=Fibrosis-4 Index. GPs= general practitioners and family doctors. LSM=liver stiffness measurement. MASH=metabolic dysfunction-associated steatohepatitis. MASLD=metabolic dysfunction-associated steatotic liver disease.

Table: **Consensus statements on MASLD in primary care**

The major strengths of this work include its international scope and multidisciplinary expert collaboration, which ensured participation by experts from diverse regions and fields, resulting in a consensus on MASLD management with broad geographical representation. Through the Delphi method, expert opinions were extensively collected from six continents, supporting the professionalism and scientific rigour of the consensus. Additionally, the work recognises the unique advantages of general practitioners in managing MASLD, emphasising the pivotal role of primary care in early screening, disease management, and patient education.

This consensus can serve as a supplement to and extension of previously published guidelines and consensus statements on MASLD. Previous documents have provided important clinical practice recommendations on the use of the FIB-4 index as the initial non-invasive diagnostic tool, second-line testing with LSM or ELF, lifestyle interventions, and long-term follow-up;[13,14] our recommendations are generally consistent with these clinical practice principles. The unique contribution of this consensus is its clear focus on primary care implementation. Specifically, we further define the crucial role of GPs in MASLD prevention, patient education, lifestyle interventions, management of metabolic comorbidities, and coordination of multidisciplinary care. We also establish a consensus domain of training and support for GPs, including competency-oriented MASLD training, referral and teleconsultation mechanisms, and reasonable use of digital or AI-assisted tools when available. These aspects are crucial for effectively translating disease-specific recommendations for MASLD into the daily work processes of primary care providers across different health-care systems.

Substantial disparities in the feasibility of MASLD management pathways exist across health-care systems. In low-income and middle-income countries, imaging, digital systems, and specialised hepatology might not be easy to access. In resource-constrained primary care settings, a basic essential care package should prioritise interventions that can be delivered through routine clinical assessment and low-cost laboratory tests. These interventions include identifying individuals at high risk of MASLD, especially those with type 2 diabetes, abdominal obesity with other metabolic risk factors, or abnormal serum liver enzymes; assessing alcohol use and other common causes of fatty liver disease on the basis of clinical presentation; calculating the FIB-4 index; providing structured advice on weight management, diet, physical activity, alcohol reduction, and control of type 2 diabetes, hypertension, and dyslipidaemia; and arranging referrals or remote consultations for people with high FIB-4 scores, suspected cirrhosis, chronically elevated serum liver enzymes, increased cardiovascular risk, or progressive clinical conditions. When LSM or ELF testing is unavailable, a repeat FIB-4 assessment after lifestyle modification and intensified management of cardiometabolic comorbidities can be a low-cost interim strategy, especially for individuals with indeterminate FIB-4 results. Follow-up protocols should also be tailored to local resource availability. Regular monitoring of bodyweight, blood pressure, lifestyle factors, medication

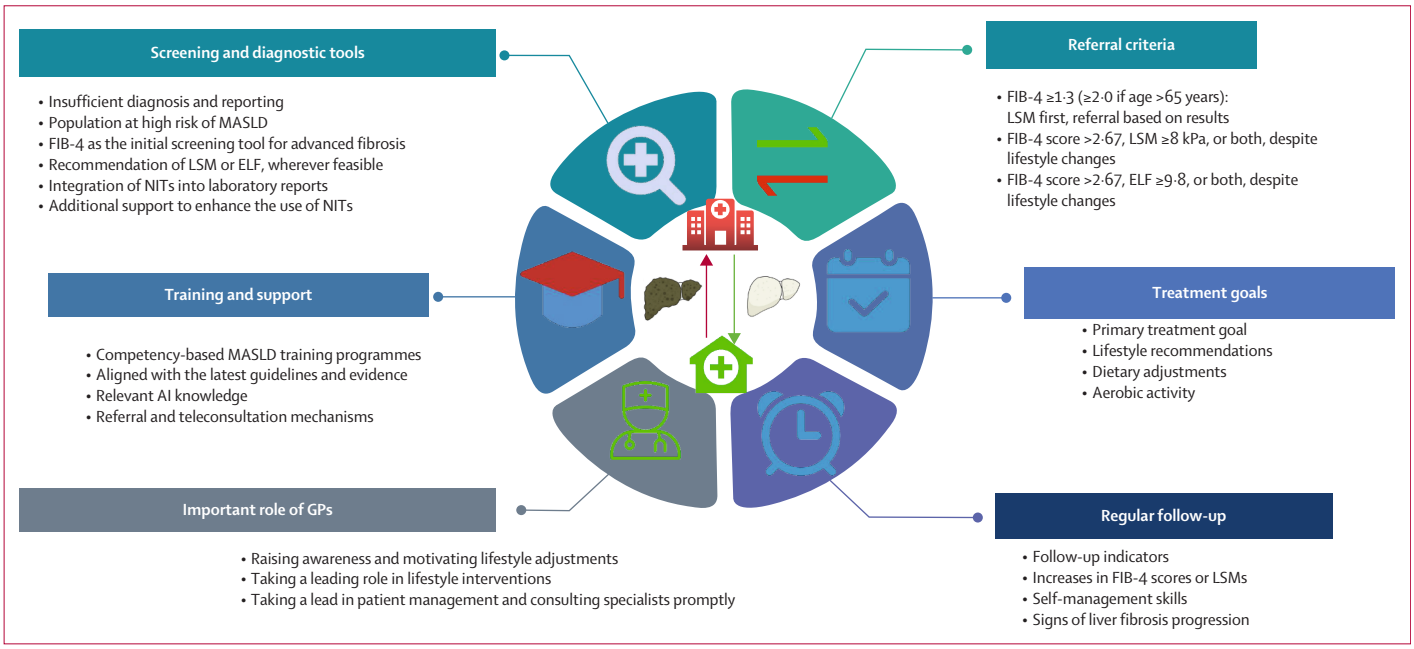


Figure 2: **Overview of consensus domains for management of MASLD in primary care**
AI=artificial intelligence. ELF=enhanced liver fibrosis. FIB-4 index=Fibrosis-4 Index. GPs=general practitioners and family doctors. LSM=liver stiffness measurement. MASLD=metabolic dysfunction-associated steatotic liver disease. NITs=non-invasive tests.

adherence, liver and renal function tests, blood glucose, and blood lipids, alongside repeated FIB-4 testing, form a practical framework for long-term MASLD management.

The FIB-4 index plays an important role as a triage tool in primary care. As a low-cost, first-line triage tool, the FIB-4 index can help to identify individuals at low risk of advanced fibrosis who can receive ongoing management and regular re-evaluation at primary care facilities. LSM or ELF tests are recommended for individuals with indeterminate or high FIB-4 results. When LSM or ELF testing are unavailable, a repeat FIB-4 assessment after lifestyle intervention and intensified management of cardiometabolic risk factors is a practical, low-cost alternative strategy. However, cost-effectiveness analyses on pathways for identifying MASLD-related fibrosis in primary care remain scarce, and these pathways are influenced by target populations, testing costs, drug-treatment costs, equipment availability, referral capacity, and health-care payment systems. Therefore, implementation strategies should be tailored to local resources, infrastructures, referral capabilities, and cost-effectiveness. In addition, primary care assessment of MASLD should be integrated into existing follow-up processes for chronic diseases. Because MASLD often coexists with type 2 diabetes, obesity, and cardiovascular disease, case-finding focused on risk of liver fibrosis can be embedded in routine follow-ups for these conditions. In chronic disease management, individuals with type 2 diabetes, individuals with obesity and at least one cardiometabolic risk factor, and individuals with cardiometabolic disease should be prioritised for assessment.

Initial FIB-4 assessment should be performed when individuals at risk of MASLD are first identified in primary care or during routine chronic disease review when age, aspartate aminotransferase, alanine aminotransferase, and platelet count are available. Follow-up frequency should be based on risk stratification. Individuals with MASLD and low FIB-4 scores can usually continue to receive lifestyle interventions and cardiometabolic risk-factor management in primary care, and the FIB-4 index should be re-evaluated every 1–3 years. For individuals with type 2 diabetes, multiple metabolic risk factors, or deteriorating cardiometabolic status, a shorter follow-up interval can be considered. Those with FIB-4 scores of 1·3–2·67 should undergo further LSM or ELF testing; if these second-line non-invasive tests are not accessible, the FIB-4 index can usually be re-evaluated within 1 year after lifestyle intervention and optimisation of cardiometabolic risk factors. Individuals with MASLD who have high FIB-4 scores and those with VCTE-measured LSM of 8 kPa or more should seek advice or consultation from liver disease specialists; if second-line tests are unavailable, they should be referred promptly.

Because metabolic risk factors and alcohol exposure often coexist in clinical practice, managing metabolic and alcohol-associated liver disease (MetALD) is also important in primary care. Although this consensus focuses on MASLD, GPs should assess daily alcohol consumption when evaluating individuals suspected of having MASLD and recognise that alcohol exposure can influence the risk and severity of MetALD, referral decisions, and management priorities. The recommendations in this consensus are primarily applicable to MASLD and should not be directly extrapolated to MetALD without fully considering alcohol intake, risk of liver fibrosis, and local referral pathways. For those suspected of having MetALD, primary

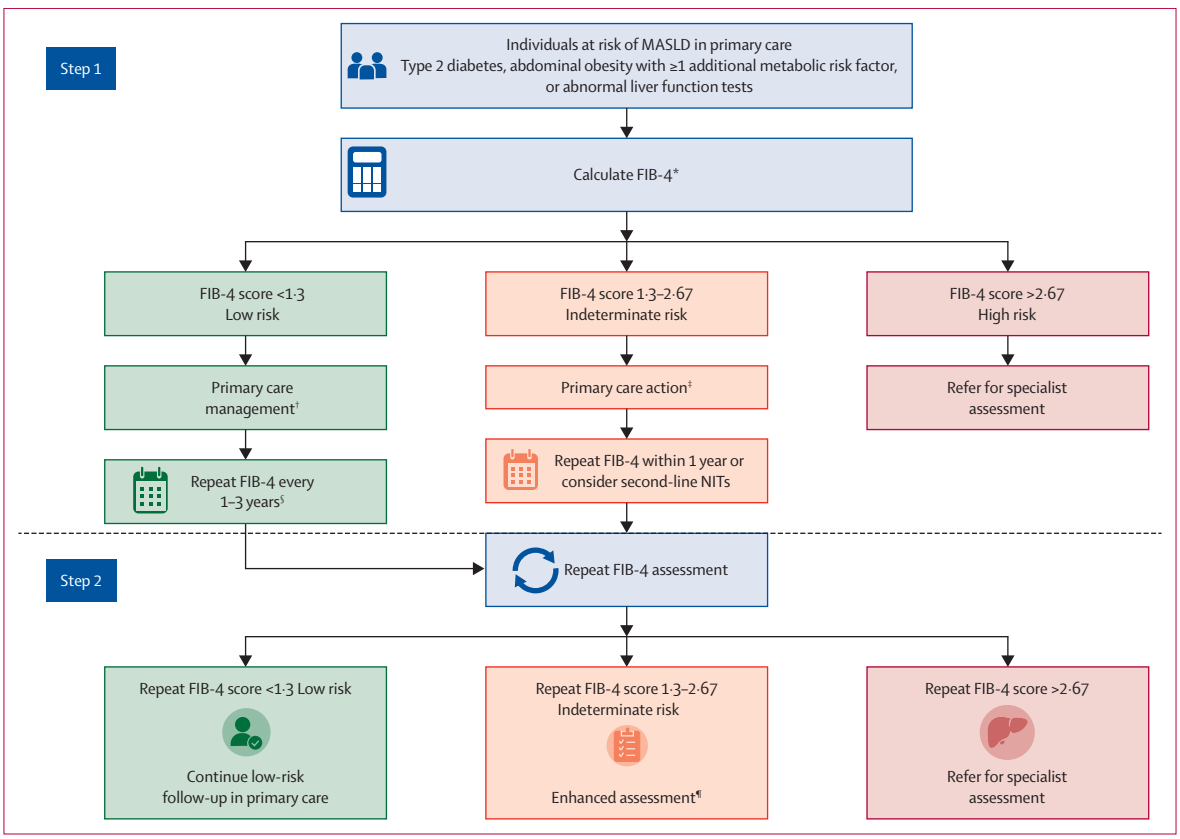


Figure 3: **Primary care-centred practical workflow for assessment and follow-up of MASLD, based on the FIB-4 index**
FIB-4 index=Fibrosis-4 Index. MASLD=metabolic dysfunction-associated steatotic liver disease. NITs=non-invasive tests. *For adults older than 65 years, use FIB-4 of 2·0 or more, rather than 1·3 or more, to trigger further assessment. †Examples include lifestyle interventions, optimisation of cardiometabolic risk factors, and patient education. ‡Examples include intensifying lifestyle and cardiometabolic risk-factor management and reviewing liver biochemistry and clinical status, or considering second-line NITs. §Shorter intervals, such as every 1–2 years, could be considered for individuals with type 2 diabetes, prediabetes, or two or more metabolic risk factors. ¶Examples include second-line NITs wherever available, or specialist advice or referral according to clinical context and local resources.

care management should include counselling on reducing or avoiding alcohol consumption on the basis of specific circumstances, managing cardiometabolic risk factors, and using accessible non-invasive tools for liver fibrosis risk stratification.

Our work has some important limitations. First, although the evidence-based consensus provides a theoretical basis for managing MASLD, there is a paucity of long-term clinical trials to validate the real-world effectiveness of these recommendations. Second, despite the broad geographical representation of the expert panel, disparities in health-care resources and capabilities across regions, especially in low-income countries or resource-constrained settings, could hinder the practical application of the consensus. Third, we did not address pharmacotherapy for MASH. Although the US Food and Drug Administration has approved resmetirom (80 mg or 100 mg per day orally) and subcutaneous semaglutide (2·4 mg per week) for adults with non-cirrhotic MASH and moderate-to-severe fibrosis, implementing these new pharmacotherapies in primary care remains challenging. Key barriers include difficulty accurately identifying eligible individuals, high drug costs, limited access, insufficient awareness of MASLD among GPs, and inadequate resources and protocols for monitoring treatment efficacy and safety. Fourth, MetALD was not addressed as an independent voting domain in our Delphi process, and further consensus research targeting MetALD in primary care settings is warranted. Finally, the Delphi process had inherent methodological limitations. We did not conduct formal cognitive interviews or psychometric validation of the questionnaire, as its purpose was to elicit expert judgements and reach consensus rather than to serve as a measurement scale. Furthermore, the four-level mandatory selection scale does not include neutral, uncertain, or unable to determine options, which could restrict participants' ability to express uncertainty, especially when some items fall outside their primary professional fields. Free-text comments and two rounds of revision have alleviated these limitations to some extent, but future Delphi research should consider conducting cognitive pretests and including options for uncertainty. Owing to the small sample size of each subgroup, comparing response differences between GPs and specialists across items could yield unstable estimates and misleading conclusions. Therefore, we did not conduct this comparison. If future

research incorporates larger-scale expert groups, subgroup analyses by professional background, geographical region, and resource environment can be prespecified to further assess consensus consistency across groups.

Conclusions

For this international Delphi consensus, experts from multiple countries developed and endorsed a series of statements on the management of MASLD in primary care. This consensus highlights the crucial role of GPs in early detection, lifestyle interventions, and patient education. It also provides evidence-based recommendations for specialist referral using non-invasive diagnostic tools and emphasises the importance of lifestyle modifications, including diet and physical activity, in the management of MASLD. These statements can serve as the basis for developing primary care guidelines for MASLD and inform future research directions.

Contributors

GF and M-HZ contributed to the study design. GF, SG, FT, LV, MMu, KK, GT, CDB, MFA, WKC, YY, JR, JPA, GS, JG, SUK, YZ, AHB, KAA, WZ, HMP, LEM, ST, ADu, MBJ, MF, CWS, BMT, SM, NM-S, BHC, MICF, MMi, NKM, TYTL, ADo, JHS, XG, MA, QG, WK, HC-P, YCC, KN, PO, MABK, MP, DAK, SV, and M-HZ participated in the Delphi expert consultation and voting process. ZY, SG, FT, GT, CDB, JC, and SV suggested substantial revisions to the manuscript. GF and M-HZ drafted the initial version of the manuscript. GF and M-HZ had access to the underlying Delphi survey data and verified the data. All authors reviewed the manuscript and approved the final submission.

Declaration of interests

FT's lab has received research grants (institutional funding) from AstraZeneca, MSD, Gilead, and Agomab Therapeutics. FT has received honoraria for consulting or lectures from Gilead, AbbVie, Dr Falk Pharma, AstraZeneca, Boehringer Ingelheim, Madrigal Pharmaceuticals, MSD, GSK, Ipsen, Pfizer, Novartis, Novo Nordisk, and Sanofi. LV receives speaking fees from Viatris, Novo Nordisk, and GSK and consulting fees from Novo Nordisk, Pfizer, Boehringer Ingelheim, Resalis Therapeutics, and Almac Group. WKC is a consultant or advisory board member for Abbott, Ipsen, Zuellig Pharma, Roche, AbbVie, Boehringer Ingelheim, and Novo Nordisk; is a speaker for Novo Nordisk, Abbott, Echosens, Roche, Viatris, and Hisky Medical; and has received research grants from Abbott and Roche. YY is a consultant for Zydus Lifesciences and adviser for Novo Nordisk. CDB has received grant support from Echosens. JG has served on advisory boards for and receives honoraria for talks from Novo Nordisk, AstraZeneca, Roche, Bristol Myers Squibb, Pfizer, Cincera, Pharmaxis, Boehringer Mannheim, CSL, Norgine, Gilead, and Eisai. CWS has received honoraria from Sanofi and Novo Nordisk for lectures on MASLD. HC-P has received lecture and advisory board fees from Orphalan, Novo Nordisk, Advanz Pharma, and Boehringer Ingelheim. MP has received honoraria from Dr Falk Pharma and grant support from Ipsen. JHS has served as a consultant for Abbott, Bayer, Corcept Therapeutics, Eli Lilly and Company, Idorsia, Insulet, Madrigal Pharmaceuticals, Novo Nordisk, and Sanofi. DAK is an investigator on an investigator-led trial that is publicly funded by the UK National Institute for Health and Care Research, where the weight loss intervention was donated by Nestlé Health Science and Oviva to the University of Oxford, outside the submitted work. HMP was an expert adviser to the UK National Institute for Health and Care Excellence (NICE) early value assessment HTE14; was a member of the NICE committees for obesity guidance (NG246 and QS212); is a member of the UK Coalition for People Living with Obesity Advisory Group and the British Obesity & Metabolic Surgery Society Council of Management; and has received honoraria for consultancy and professional education from Johnson & Johnson and Boston Scientific. GS has received speaker fees from Merck, Gilead Sciences, AbbVie, Eli Lilly and Company, and Novo Nordisk and has served as an advisory board member for Merck, Novo Nordisk, GSK, and Gilead Sciences. M-HZ has received honoraria for lectures from AstraZeneca, Hisky Medical Technologies, and Novo Nordisk and consulting fees from Boehringer Ingelheim. All other authors declare no competing interests.

Acknowledgments

This work was supported by grants from the Noncommunicable Chronic Diseases National Science and Technology Major Project (2026ZD0557000), the National Key R&D Program of China (2023YFA1800801), the National Natural Science Foundation of China (82070588, 82370577, 82500724, and 32501138), the Key Research and Development Program of the Shaanxi Provincial Department of Science and Technology (2025GH-YBXM-032), the Natural Science Basic Research Program of Shaanxi Province (2025JC-YBQN-1132), the Shaanxi Province Outstanding Young Talents Support Program (Shaanxi Teaching Work Letter [2025]120), the 15th Five-Year Major Project (2025ZD01906200), University-level Research Project of Xi'an Medical University (Special Program for Rural Medicine Research; 2025XCYX04), and Shaanxi Provincial Undergraduate and Continuing Higher Education Teaching Reform Research Project (25BY172). CDB is supported in part by the Southampton UK National Institute for Health and Care Research Biomedical Research Centre (NIHR203319). GS is supported by a Merite Salary Award from Fonds de Recherche Québec–Santé (number 366391). JG is supported by the Robert W Storr Bequest to the Sydney Medical Foundation, University of Sydney, Sydney, NSW, Australia; a National Health and Medical Research Council of Australia Program Grant (APP1053206); Investigator and Medical Research Future Fund grants (APP2032407, NCRI000183, APP2016215, APP2010795, and APP1196492); and a Cancer Institute NSW Grant (2021/ATRG2028). KAA is supported by the National Plan for Science, Technology, and Innovation (Maarifah), King Abdulaziz City for Science and Technology, Riyadh, Saudi Arabia (grant number 08-MED512-02). During the preparation of this work, the authors used ChatGPT (GPT-5.5) for language editing and manuscript refinement. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

Editorial note: The Lancet Group takes a neutral position with respect to territorial claims in published text and institutional affiliations.

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