Geier A, Schattenberg JM, Teufel A, *et al*. Reported Behaviors of Patients with Metabolic Dysfunction-Associated Steatotic Liver Disease: A Key to Improving Communication. *Health Psychology Research.* 2026;14(1):e81240034. https://doi.org/10.14440/hpr.0277

Research Article

Reported Behaviors of Patients with Metabolic Dysfunction-Associated Steatotic Liver Disease: A Key to Improving Communication

Andreas Geier[1], Jörn M. Schattenberg[2], Andreas Teufel[3,4], Rainer Günther[5], Alisan Kahraman[6], Ali Canbay[7], Wolf Peter Hofmann[8], Imad Maatouk[9], Heide Möller-Slawinski[10], Paula Niessing[11], Achim Kautz11, Diane Langenbacher[11]*

[1]Department of Internal Medicine II, University Hospital Würzburg, Würzburg 97080, Bayern, Germany

[2]Department of Internal Medicine II, University Hospital Saarland, Homburg/Saar 66421, Saarland, Germany

[3]Division of Hepatology, Division of Clinical Bioinformatics, Department of Internal Medicine II, Medical Faculty Mannheim, Heidelberg University, Mannheim 68167, Baden-Württemberg, Germany,

[4]Clinical Cooperation Unit Healthy Metabolism at CPD, Centre for Preventive Medicine and Digital Health, Medical Faculty Mannheim, Heidelberg University, Mannheim 68167, Baden Württemberg, Germany

[5]Department of Internal Medicine I, University Hospital Schleswig-Holstein, Kiel 24105, Schleswig-Holstein, Ger-many

[6]Department of Internal Medicine, Max Grundig Klinik, Bühl 77815, Baden-Württemberg, Germany

[7]Department of Internal Medicine, University Hospital, Knappschaftskrankenhaus, Ruhr University Bochum, Bochum 44892, Nordrhein-Westfalen, Germany

[8]MVZ Gastroenterology Bayerischer Platz Gastroenterology Medical Care Center, Berlin 10825, Germany

[9]Division of Psychosomatic Medicine, Department of Internal Medicine II, University Hospital Würzburg, Würzburg 97080, Bayern, Germany

[10]SINUS Markt- und Sozialforschung GmbH, Heidelberg 69115, Germany

[11]Kautz5 gUG, Köln 51143, Germany

Keywords: Type 2 diabetes mellitus, Public health, Lifestyle, Communication, Obesity, Social class, Liver diseases, Surveys and questionnaires

Health Psychology Research

Vol. 14, 2026

Background

Metabolically dysfunction-associated steatotic liver disease (MASLD) is an increasing public health issue globally.

Objective

This study is the first to explore the detailed behavioral characteristics of patients with MASLD by categorizing them into groups of like-minded individuals, based on similar lifestyle preferences, values, social standing, communication patterns, and consumption behaviors.

Methods

A total of 2,420 anonymized questionnaires were distributed to diagnosed MASLD patients, with 527 responses collected, yielding a 22% response rate. The validated Sinus Institute methodology was extended with a set of investigator-generated questions assessing disease knowledge, comorbidities, and clinically relevant lifestyle patterns within the cohort.

Results

The cohort aligns well with existing clinical data. Compared with the general population, MASLD is overrepresented in the consumer-hedonistic (11% vs. 8%), post-materialist (16% vs. 12%), and conservative-upscale milieu (15% vs. 11%). Notable findings were observed

***Corresponding author:**
Diane Langenbacher
Kautz5 gUG, Köln 51143, Germany.
Email: langenbacher@kautzhoch5.de

in subpopulations: obesity was the highest in the precarious milieu (23%), type 2 diabetes in the consumer-hedonistic milieu (50%), and hypertension in the traditional milieu (75%).

Conclusion

Metabolic dysfunction-associated steatotic liver disease occurs across all milieus and social classes; however, certain milieus appear particularly relevant and may warrant targeted communication strategies to support sustainable lifestyle changes. Further studies are needed to validate this approach in clinical settings and to determine whether improved, tailored communication enhances adherence to lifestyle interventions and improves clinical outcomes.

1. INTRODUCTION

Metabolic dysfunction-associated steatotic liver disease (MASLD), formerly termed non-alcoholic fatty liver disease (NAFLD), is an increasing public health issue in Europe, with estimates suggesting that over 25% of the adult population has MASLD, and 3–5% are in advanced stages of metabolic dysfunction-associated steatohepatitis (MASH; formerly termed non-alcoholic steatohepatitis) and fibrosis.[1]

The number of MASLD patients in Germany has increased over recent decades and is approximately 18.4 million, with more than 3 million affected by MASH. Among these, the number of patients with advanced fibrosis and cirrhosis may reach 600,000 and 200,000, respectively, and these subgroups are expected to more than double by 2030. This large discrepancy between estimated and diagnosed cases highlights the frequent underdiagnosis in clinical practice.

Liver steatosis represents the hepatic manifestation of metabolic syndrome, which is reflected in the new terminology, "metabolic dysfunction-associated steatotic liver disease." Patients with advanced disease are more frequently diagnosed with diabetes, arterial hypertension, and notably, coronary heart disease, and experience significant impairments in quality of life.[2,3]

Patients with MASH and more advanced disease require more frequent physician visits, both as outpatients and inpatients.

Current clinical management emphasizes sustainable lifestyle changes as the primary and most immediate intervention.[4] Following a thorough metabolic workup, appropriate treatment of relevant comorbidities is also warranted.

Despite the strong association of MASLD with metabolic syndrome and lifestyle factors, such as unhealthy nutrition and low levels of physical activity, very limited data exist regarding potential socioeconomic and sociocultural interventions. Few studies have examined the health-related values, attitudes, and lifestyles of this patient population. Understanding these factors is crucial for developing targeted communication strategies that effectively promote behavioral change.[5,6]

Therefore, this study aims to address this gap by applying the validated Sinus-Milieus approach to identify distinct population groups with differing communication needs. To our knowledge, this research is the first to investigate the detailed behavioral characteristics of patients with MASLD by categorizing them according to the Sinus-Milieus® approach.

2. MATERIALS AND METHODS

The Sinus-Milieus categorize individuals based on similarities in their way of life and attitudes. Basic values, including patients' social situation and attitudes toward work, family, leisure, health, money, and consumption, are considered in the analysis. This approach places individuals and the holistic reference system of their living environment at the center of analysis.[7,8]

Detailed Sinus-Milieu models, available not only for Germany but also for Austria and Switzerland, are initially developed through qualitative interviews in the respective country, covering key sociodemographic segments (e.g., gender, age, education, income, and region). In real-world explorations lasting several hours, interviewees describe all relevant areas of life in their own words. The resulting milieu model summarizes individuals with similar values, life attitudes, and lifestyle patterns.

This validated Sinus Institute methodology has been applied in its updated 2022 version to perform the cohort's milieu allocation. In the 2022 model outlined by Barth *et al.*,[7] 10 Sinus-Milieus were defined for the general population in Germany. They can be visualized in a milieu diagram using the dimensions "social status" and "basic values." In the diagram, each axis is divided into three sections.

The "social status" dimension represents socioeconomic factors, such as income, education, and occupational status. From bottom to top, the axis is divided into lower/lower-middle, middle, and upper-middle/upper social classes.

The "basic values" dimension represents sociocultural factors, such as lifestyle, orientations, and life goals. From left to right, categories include tradition, modernization/individualization, and new values. The position of the Sinus-Milieus in the diagram is not strictly confined by the axes; most milieus extend across different social classes and value orientations, and overlap with adjacent milieus at their edges. This model allows for a clear assignment of the most fitting Sinus-Milieu to each participant.

2.1. ETHICAL CONSIDERATIONS

Prior to the study, the Ethics Committee of the North Rhine Medical Association confirmed, upon request, that the anonymized survey did not require formal consultation according to Section 15 of the professional code and Section 2.1 of the Statutes of the Ethics Commission (dated September 8, 2021).

Patients with an MASLD or MASH diagnosis were eligible and approached by clinicians during routine visits at liver centers. Participating patients received a study information package outlining the aim, rationale, project description, voluntary participation, and confidentiality measures. Informed consent was obtained either on paper by returning the completed questionnaire or online by submitting it electronically.

To ensure anonymization, patients were provided with stamped, pre-addressed return envelopes without any

indication of the sender to return their questionnaire. No personal identifying information was requested in the questionnaire. Responses from paper questionnaires were manually entered into SurveyMonkey. For online submissions, IP addresses were encrypted prior to registration.

2.2. PATIENT RECRUITMENT AND QUESTIONNAIRES

A total of 2,420 anonymized questionnaires were distributed to participating healthcare professionals (HCPs; 24 hospital- and office-based hepatologists) for distribution to eligible diagnosed MASLD patients during routine visits—six core centers received 400 questionnaires each, two centers received 100 each, and 16 centers received 10 each. Inclusion criteria were patients diagnosed with MASLD, and exclusion criteria were insufficient German language skills.

The standard Sinus-Milieu indicator questionnaire was extended with a set of investigator-generated questions covering basic characteristics, including age, gender, weight, and height (for calculation of body mass index [BMI]). Additional questions assessed knowledge about the disease, comorbidities, and clinically relevant lifestyle patterns, including nutrition, physical activity, and alcohol consumption. This extended section of the questionnaire was pre-tested with 12 MASH patients for readability and comprehension; formal validation was not performed.

Paper questionnaires were used initially, and online questionnaires were subsequently offered to increase patient response rates. In total, 460 completed paper questionnaires and 87 online questionnaires were collected in a fully anonymized manner.

2.3. ANALYSIS

To determine the milieu affiliation of respondents—particularly in large-scale surveys—the Sinus-Milieu indicator was used as a standardized instrument. The milieu indicator is a set of statements designed to reconstruct the hypothetical milieu model as accurately as possible. The milieu indicator for Germany contains 29 statements (2022 version), assessed on a four-point response scale. It is widely used in quantitative surveys, including face-to-face, telephone, online, and mixed-mode surveys.[9]

The criterion for selecting statements is their ability to differentiate between milieus optimally. Differentiation strength is determined using discriminant analysis. Statements that capture respondents' basic beliefs or effective everyday motives have been shown to perform best.

Respondent milieu assignment was performed using a probability model with a specially adapted form of cluster analysis.[10] For each milieu group, a specific distribution of response probabilities across all indicator items is determined (norm profiles). Classification of new cases is based on similarity to the probability model, using the smallest Euclidean distance as the classification criterion (profile comparison logic). Reliable milieu assignment requires the full response profile of a respondent across all statements; individual responses alone are not sufficient. As mentioned, standard profiles and assignment models are continuously updated.

Beyond the specific Sinus-Milieu analysis, the collected data were analyzed descriptively only.

3. RESULTS

A total of 527 responses were collected from 11 centers over a study duration of 18 months, corresponding to a 22% response rate.

3.1. BASIC PATIENT CHARACTERISTICS

The cohort comprised 51% female (n = 269) and 49% male (n = 258), with a mean age of 55.9 years; 72% (n = 379) were over 50 years (Table 1). Self-reported comorbidities included type 2 diabetes (40%; n = 211), elevated blood pressure (58%; n = 306), elevated cholesterol (54%; n = 285), and a history of heart attack or cardiac catheterization (8%; n = 42).

Mean BMI was 32.6 kg/m^2, distributed as follows: 25–29: 30% (n = 158), 30–34: 30% (n = 158), 35–39: 18% (n = 95), and ⩾40: 11% (n = 58). In line with an unselected cohort of MASLD patients, the mean Fibrosis-4 (FIB-4) index was 2.07, with only 4% (n = 21) exceeding 3.25, indicating a population with mostly early-stage disease. This cohort was overrepresented in upper- and middle-class social milieus.

Table 1. Baseline patient characteristics

Baseline patient characteristics	Value
Gender (female/male)	51%/49%
Mean age (years)	55.9
Mean BMI	32.6
Type 2 diabetes	40%
Hypertension	58%
Hypercholesterolemia	54%
Cardiovascular events	8%
Mean FIB-4 index	2.07
FIB-4 >3.25	4%

Abbreviations: BMI: Body mass index; FIB-4: Fibrosis-4.

3.2. SINUS-MILIEU ALLOCATION OF PATIENTS WITH METABOLIC DYSFUNCTION-ASSOCIATED STEATOTIC LIVER DISEASE IN GERMANY

Compared with the general population, MASLD patients are overrepresented in the consumer-hedonistic (11% vs. 8%), post-materialist (16% vs. 12%), and conservative-upscale milieus (15% vs. 11%). However, MASLD occurs across all milieus and social classes.

Gender differences were observed: women were overrepresented in the traditional and adaptive-pragmatic middle-class milieus, whereas men were overrepresented in the consumer-hedonistic and neo-ecological milieus.

In general, consumer-hedonists exhibit lower health awareness and tend to ignore health risks. The body is perceived as a "resilient material," with eating and drinking treated carelessly. Physical activity is typically aimed at body shaping rather than prevention or maintaining health.

Post-materialists prioritize personal responsibility, self-efficacy, self-care (body–mind–spirit balance), prevention, wellness, and overall life balance. For them, health is closely linked to quality of life and is deeply ingrained in the milieu's ethos. They are open to different treatment

approaches and carefully weigh risks and side effects when using medications.

Conservative-upscale individuals view health as a responsibility toward themselves and society. Maintaining health requires personal effort as well as financial and time investment. They perceive health as essential for leading a self-determined life.

3.3. SUBGROUP ANALYSIS OF MASLD PATIENTS

The findings revealed that 40% (n = 211) of respondents reported concomitant type 2 diabetes, which was overrepresented in the expeditive (50%), nostalgic middle-class (50%), consumer-hedonistic (50%), and traditional (48%) milieus (Figure 1).

Additionally, 58% (n = 306) of respondents were classified as obese (BMI ⩾ 30), with representation across all social classes. Among these, 11% (n = 58) had BMI ⩾ 40 (grade III obesity), overrepresented in the expeditive (14%), conservative-upscale (15%), adaptive-pragmatic middle-class (18%), and precarious (23%) milieus (Figure 2).

Moreover, 58% (n = 306) of respondents reported hypertension, 54% (n = 285) reported elevated blood lipids, and 8% (n = 42) reported a history of heart attack or cardiac catheterization (e.g., stent), consistent with data from the German SLD registry.[3] Patients with hypertension and/or elevated cholesterol or blood lipids were overrepresented in the traditional (75% for hypertension, 65% for increased blood lipids) and consumer-hedonistic milieus (67% for elevated blood lipids).

Intriguingly, 6% (n = 32) of respondents reported alcohol consumption exceeding 20 g/day for women and 30 g/day for men, based on the anonymized questionnaire, which contrasted with the amounts reported to their HCPs. This was overrepresented in lower social class milieus (precarious = 10%, consumer-hedonistic = 14%, and nostalgic middle-class = 9%). Despite this potentially harmful alcohol intake—now considered metabolic dysfunction- and alcohol-related liver disease—none of these respondents had a FIB-4 index above 3.25, indicating no increased risk for advanced disease.

Furthermore, 39% (n = 206) reported engaging in physical exercise for more than three hours per week, with overrepresentation in upper-class milieus (post-materialist = 49%, performer = 55%, and conservative-upscale = 56%) and underrepresentation in the traditional (28%) and consumer-hedonistic (10%) milieus.

Regarding nutrition patterns, 38% (n = 200) reported consuming more than 300 g of red meat per week. This is overrepresented in the adaptive-pragmatic middle-class (48%) and consumer-hedonistic milieus (53%). Moreover, 64% (n = 337) reported consciously consuming less processed food, overrepresented in upper-class milieus (performer = 72%, expeditive = 73%, conservative-upscale = 74%, and post-materialist = 83%) and underrepresented in the consumer-hedonistic milieu (36%).

Overall knowledge of liver parameters was 38%, with lower social class milieus scoring lowest.

4. DISCUSSION

The findings demonstrate that MASLD occurs across all social classes, providing valuable insights into patients' health attitudes, readiness to implement lifestyle changes, communication triggers, and preferred styles of interaction with their physicians.

Five relevant milieus were identified in MASLD patients, including post-materialist, conservative-upscale, consumer-hedonistic, traditional, and precarious milieus, for which communication recommendations were developed.

Individualized clinician–patient communication appears to be an integral component of personalized medicine, and our findings contribute to this concept.

The study highlights challenges in recruiting MASLD patients for clinical evaluation and research, reflected by the extended study duration and a response rate of only 22%. Contributing factors include low awareness among the general population and among primary HCPs managing comorbidities. We identified urgent educational needs both in the general population and among primary care physicians, along with a need for practical, widely accepted, risk-adapted referral pathways.[11]

A recent population-based liver screening study in Germany demonstrated that almost half of patients identified as at risk for advanced liver disease did not present for secondary evaluation at specialized centers.[12] This loss along the intended care pathway underscores the need for

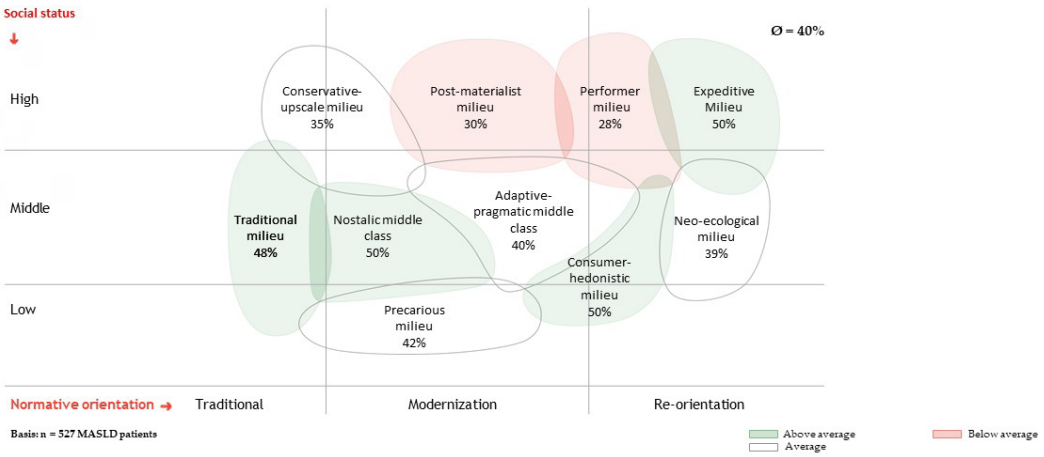

Figure 1. Subgroup analysis of metabolic dysfunction-associated steatotic liver disease (MASLD) patients with type 2 diabetes mellitus

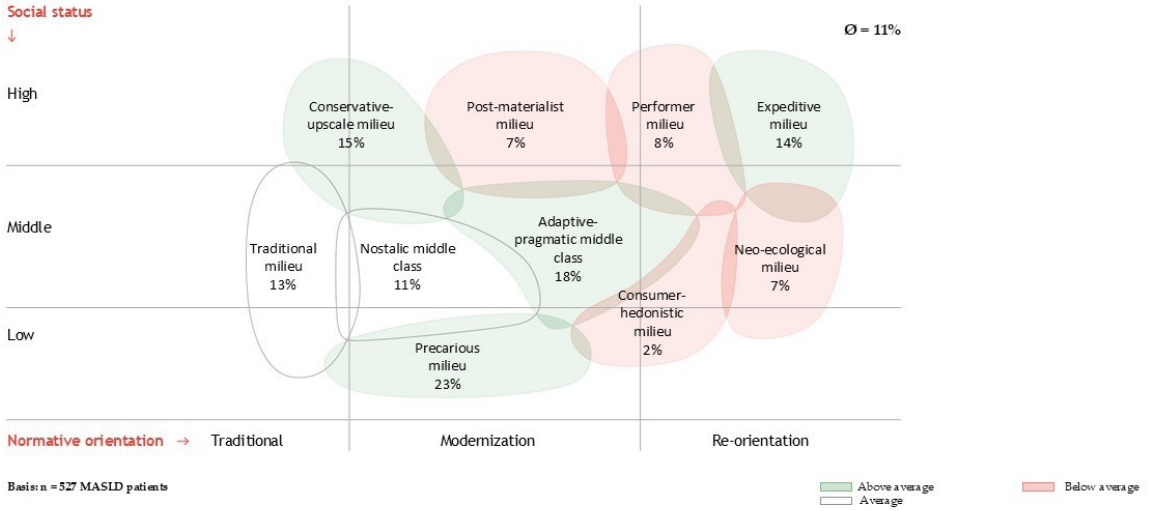

Figure 2. Subgroup analysis of metabolic dysfunction-associated steatotic liver disease (MASLD) patients with obesity grade III (body mass index ⩾40)

improved communication to affected individuals, both by involved HCPs and through publicly available information in appropriate formats.

The general knowledge of liver parameters is significantly lower compared with other liver diseases,[13] with lower social class milieus scoring lowest. Low attention to liver diseases may be particularly pronounced when additional comorbidities draw the patient's focus. However, there may also be value in HCPs pre-framing information and providing varying levels of detail tailored to the patient. Empowered patients tend to be more prevalent in upper- and middle-class social milieus.

Furthermore, obesity and MASLD carry substantial stigma, particularly following the adoption of the current disease nomenclature under recent international consensus.[14,15] This stigma arises from the common misconception that individuals with obesity are primarily responsible for their weight gain due to personal behavioral choices, rather than recognizing the multifactorial etiology. Additionally, the complex interplay between obesity and socioeconomic factors creates barriers to prevention and care for obesity and related diseases such as MASLD.[16]

Our study shows that MASLD occurs across all social classes and is overrepresented in milieus with high health awareness, such as post-materialist and conservative-upscale milieus. This contrasts with other studies suggesting associations with educational levels and/or financial or economic status.[17,18]

Socioeconomic indicators of low socioeconomic position—including occupational social class of the head of household at birth and during childhood, earlier adulthood occupational social class, contemporaneous occupational social class, educational attainment, and area-level deprivation—were generally inversely associated with adult obesity risk in the United Kingdom.[19]

One study examined secular trends in obesity prevalence by socioeconomic position and resulting obesity inequalities in the German adult population using surveys conducted in 1990–1992, 1997–1999, and 2008–2011. In each survey period, the highest socioeconomic groups had the lowest obesity prevalence, whereas the low and medium socioeconomic groups showed increases; no such trend was observed in medium-high socioeconomic groups.[20]

While overrepresentation of MASLD in the consumer-hedonistic milieu is somewhat expected, this is not the case for the post-materialist and conservative-upscale milieus. Individuals in the upper social class, especially those adhering to modern and less traditional values, perceive themselves as healthy, have a high affinity for health topics, and are well-informed about relevant health issues. Their educational background and media literacy facilitate access to accurate health information, and in these milieus, the concept of an "informed patient" is most likely to apply. Healthy nutrition, physical activity, and preventive measures are integral to their daily lives.

By contrast, individuals in lower social classes, such as the consumer-hedonistic milieu, demonstrate lower health affinity, reduced interest in health information, and limited need for such information, making it challenging to reach them with health education.[21]

4.1. IMPORTANCE OF BEHAVIORAL PATTERNS

It is well established that physical activity and healthy nutrition can prevent MASLD.[22] There is also evidence that lifestyle modification programs can improve liver outcomes, with the potential to reduce fibrosis.[12] However, the question remains why many patients struggle to achieve sustainable lifestyle changes. Ongoing research focuses on how such programs should be designed to promote long-term adherence.[23]

Our findings indicate that individuals belonging to specific milieus may experience greater difficulty adopting lifestyle changes, and consequently, their metabolic disorders may progress until comorbidities such as MASLD develop.

For this analysis, we used the Best4planning cohort (n = 30,086) as a population-based reference.[24] In this cohort, type 2 diabetes is overrepresented in the conservative-upscale, nostalgic middle-class, traditional, and precarious milieus. In contrast, our dataset of patients with MASLD/MASH and type 2 diabetes showed overrepresentation in the expeditive, traditional, nostalgic middle-class, and consumer-hedonistic milieus. This overlap suggests that the traditional and nostalgic middle-class face particular challenges in implementing lifestyle changes, resulting in progression of metabolic dysfunction over time, as reflected by the diagnosis of MASLD and particularly MASH, which represents a more advanced disease stage.

When comparing obesity alone with obesity in combination with MASLD/MASH, the consumer-hedonistic milieu appears to be the most affected.

Overall, these findings suggest that the traditional, nostalgic middle-class, and consumer-hedonistic milieus require targeted attention when implementing sustainable lifestyle interventions.

4.2. TRANSLATION INTO CLINICAL PRACTICE

Based on these findings, we aim to promote more individualized clinician–patient communication and to develop effective strategies to reach at-risk populations. One of the major challenges in the management of patients with MASLD/MASH is supporting sustainable lifestyle change, given that breaking established behavioral patterns is particularly difficult. To increase patient acceptance, lifestyle recommendations should be communicated in a targeted manner, taking into account individual beliefs, motivations, and behavioral triggers, rather than repeatedly delivering generic advice such as "eat less, eat healthier, and increase physical activity."

In addition, shared decision-making grounded in respectful and accepting communication between clinicians and patients has been shown to improve adherence and persistence, reduce healthcare costs, and lead to more favorable long-term outcomes.[25,26] The Sinus-Milieu framework may therefore serve as a practical tool to support clinicians in tailoring communication strategies, particularly under the time constraints of routine clinical practice.

Extensive research has examined why individuals adopt healthy behaviors and why behavioral changes are initiated and maintained—or abandoned.[27] A common determinant across behavioral models is the intention or motivation to change, which is typically high initially but must be sustained over time. This process depends on five core psychological conditions: (i) a strong goal intention; (ii) a high degree of self-concordance with this goal; (iii) realistic action planning; (iv) effective strategies to overcome barriers; and (v) positive reinforcement resulting from the new behavior.[28]

To provide patients with optimal starting conditions for lifestyle change, communication plays an essential role, particularly in addressing individual attitudes, beliefs, and capabilities. There is substantial potential to improve clinician–patient communication regarding lifestyle modification and its benefits through the incorporation of milieu-specific communication triggers and the targeted adaptation of messaging.

A deeper analysis of the health-related attitudes and beliefs underlying the Sinus-Milieus reveals distinct patterns across individual milieus, which are further reflected in differences in dietary supplement use and willingness to consult alternative practitioners.[18]

With the aim of deriving practical guidance that can be readily integrated into routine clinical communication, we clustered these findings according to dimensions considered most relevant for inducing sustainable lifestyle changes in patients with MASLD. Our hypothesis posits three primary domains that differentiate individuals' likelihood and capacity to achieve lasting lifestyle modification: (i) affinity toward health-related topics, (ii) willingness and readiness to change lifestyle, and (iii) the nature of the clinician–patient relationship. In particular, the clinician–patient relationship appears to be the strongest determinant of communication style.

Our analysis demonstrated that MASLD occurs across all milieus and social classes; however, the consumer-hedonistic, post-materialist, conservative-upscale, traditional, and precarious milieus appear to be of particular relevance and therefore warrant targeted attention, especially with regard to tailoring clinician communication to support sustained patient commitment to lifestyle changes (Table 2).

As a next step, prospective evidence is required to validate whether this approach effectively increases the likelihood of sustainable lifestyle changes and leads to improved clinical outcomes.

4.3. LIMITATIONS

The Sinus-Milieus questionnaire and milieu allocation approach are validated for the German population and

Table 2. Communication recommendations

Relevant milieus	Communication recommendations
Post-materialist milieu and conservative-upscale milieu	Trustful and factual, with an emphasis on personal responsibility and a clear call to action. Encourage mindfulness, conscious choices, and balance For example: "Treat yourself with high-quality food from time to time"
Consumer-hedonistic milieu	Rational, functional, and technical. Avoid judgment and remain non-patronizing. Justify recommendations with scientific evidence and clarify misconceptions (e.g., weight loss pills, Hollywood myths). Present options for enjoying small pleasures while maintaining health For example: "Science and medicine can achieve a lot, but a little has to be done by yourself to keep your body in shape currently and to be able to have it in the future"
Traditional milieu and precarious milieu	Directive but non-patronizing. Ask about the individual's life situation without judgment. Highlight social support aspects (e.g., exercise prescriptions, reimbursement for medications) For example: "We will find a way together that works for you. There are many places where you can do something, and we will find the ones that work well for you"

cannot be directly generalized to contexts outside Germany. However, validated Sinus-Milieus models are available for several other countries, which may allow future cross-national applications.

The response rate of 22% was lower than anticipated, and selection bias related to milieu-specific attitudes cannot be excluded. In particular, there is a markedly below-average willingness to participate in voluntary, non-incentivized surveys among individuals in the precarious milieu. This reluctance may reflect perceptions of inadequacy, hierarchical distance, and generalized skepticism toward institutions and research initiatives. Similarly, within the nostalgic middle-class milieu, an increasing proportion of individuals tend to devalue scientific evidence. In contrast, post-materialist and conservative-upscale individuals often participate in scientific, evidence-based studies out of conviction. Among performers, participation depends on a favorable time–benefit ratio, while expeditive individuals tend to participate primarily when the topic aligns with their personal interests.

Although the total study population ($n = 527$) is sufficient to be considered representative of the German MASLD/MASH population, some analyzed subgroups were small in size (e.g., patients with elevated FIB-4 scores, BMI $\geqslant 40$, or self-reported alcohol consumption). Consequently, the robustness and generalizability of subgroup-specific conclusions remain limited.

5. CONCLUSION

Our findings provide important insights into the value of milieu-informed, tailored clinician–patient communication in MASLD management. By accounting for patients' social context, health-related attitudes, and behavioral patterns, this approach may enhance patient engagement, support sustainable lifestyle changes, and ultimately contribute to improved clinical outcomes and quality of life.

ACKNOWLEDGMENTS

We thank the patients with MASLD who participated in this study for their willingness to provide their data. We also thank the participating centers for their efforts in recruiting patients. We acknowledge the Sinus Institute for its support in analyzing and interpreting the dataset.

FUNDING

This work was supported by the unrestricted grants from Gilead Sciences GmbH, NovoNordisk Pharma GmbH, and Pfizer Pharma GmbH.

CONFLICT OF INTEREST

All authors declare no conflicts of interest.

AUTHOR CONTRIBUTIONS

Conceptualization: Andreas Geier, Achim Kautz, Diane Langenbacher
Formal analysis: Heide Möller-Slawinski, Achim Kautz, Paula Nießing, Diane Langenbacher
Investigation: Andreas Geier, Jörn M Schattenberg, Andreas Teufel, Rainer Günther, Alisan Kahraman, Ali Canbay, Wolf Peter Hofmann
Methodology: Andreas Geier, Heide Möller-Slawinski
Writing–original draft: Andreas Geier, Imad Maatouk, Heide Möller-Slawinski, Diane Langenbacher
Writing–review & editing: Achim Kautz, Diane Langenbacher

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Prior to the study, the Ethics Committee of the North Rhine Medical Association confirmed, upon request, that the anonymized survey did not require formal consultation according to Section 15 of the professional code and Section 2.1 of the Statutes of the Ethics Commission (dated September 8, 2021). Informed consent was obtained either on paper by returning the completed questionnaire or online by submitting it electronically.

CONSENT FOR PUBLICATION

All participants provided informed consent to participate in the study. Data were fully anonymized prior to analysis and publication; therefore, no additional consent for publication was required.

DATA AVAILABILITY STATEMENT

Data is available from the corresponding author upon reasonable request.

Submitted: 26 August 2025; Revision received: 30 September 2025; Accepted: 27 October 2025; Published: 06 March 2026

REFERENCES

1. Estes C, Anstee QM, Arias-Loste MT, *et al*. Modelling NAFLD disease burden in China, France, Germany, Italy, Japan, Spain, United Kingdom, and United States for the period 2016-2030. *J Hepatol*. 2018;69(4):896-904. doi: 10.1016/j.jhep.2018.05.036

2. Tacke F, Horn P, Wai-Sun Wong V *et al*. EASL-EASD-EASO Clinical Practice Guidelines on the management of metabolic dysfunction-associated steatotic liver disease (MASLD). *J Hepatol*. 2024;81(3):492-542. doi: 10.1016/j.jhep.2024.04.031

3. Geier A, Rinella ME, Balp MM, *et al*. Real-World Burden of Nonalcoholic Steatohepatitis. *Clin Gastroenterol Hepatol*. 2021;19(5):1020-1029.e7. doi: 10.1016/j.cgh.2020.06.064

4. 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.0000000000000323

5. van der Gaag M, Heijmans M, Spoiala C, Rademakers J. The importance of health literacy for self-management: A scoping review of reviews. *Chronic Illn*. 2022;18(2):234-254. doi: 10.1177/17423953211035472

6. Oldenburg B. Preventing chronic disease and improving health: broadening the scope of behavioral medicine research and practice. *Int J Behav Med*. 2002;9(1):1-16. doi: 10.1207/s15327558ijbm0901_01

7. Barth B, Flaig BB, Schäuble N, Tautscher M, eds. *The Sinus-Milieus® model in practice: Present and future of a modern social and target group model* [in German]. Springer; 2018.

8. Kleineberg-Massuthe H, Papst L, Bassler M, Köllner V. Milieu-specific differences in symptom severity and treatment outcome in psychosomatic rehabilitation in Germany. *Front Psychiatry*. 2023;14:1198146. doi: 10.3389/fpsyt.2023.1198146

9. Use of Milieu Indicator. Sinus Institute. Available from: https://www.sinus-institut.de/expertise [Last accessed on 2025 July 12].

10. Möller-Slawinski H. Sinus-Milieus® and Health: Concepts, Findings, Perspectives [in German]. *Psychosoziale und Medizinische Rehabilitation*. 2023;365:21-28.

11. Teufel A, Geier A, Sarrazin C, *et al*. Intersectoral management of patients with abnormal liver enzymes and non-alcoholic fatty liver disease (NAFLD) [in German]. *Z Gastroenterol*. 2023;61(8):1028-1036. doi: 10.1055/a-1957-5671

12. Labenz C, Arslanow A, Nguyen-Tat M, *et al*. Structured Early detection of Asymptomatic Liver Cirrhosis: Results of the population-based liver screening program SEAL. *J Hepatol*. 2022;77(3):695-701. doi: 10.1016/j.jhep.2022.04.009

13. Niederau C, Fischer C, Kautz A. Socioeconomic characteristics, quality of life and level of knowledge among patients with hepatitis B virus infection in Germany [in German]. *Z Gastroenterol*. 2007;45(5):355-368. doi: 10.1055/s-2007-963102

14. Rinella ME, Lazarus JV, Ratziu V, *et al*. A multisociety Delphi consensus statement on new fatty liver disease nomenclature. *J Hepatol*. 2023;79(6):1542-1556. doi: 10.1016/j.jhep.2023.06.003

15. Kim D, Wijarnpreecha K, Cholankeril G, Ahmed A. Metabolic dysfunction-associated steatotic liver disease and all-cause/cause-specific mortality among adults in the United States. *J Hepatol*. 2024;80(2):e79-e81. doi: 10.1016/j.jhep.2023.09.014

16. Washington TB, Johnson VR, Kendrick K, *et al*. Disparities in Access and Quality of Obesity Care. *Gastroenterol Clin North Am*. 2023;52(2):429-441. doi: 10.1016/j.gtc.2023.02.003

17. Koutny F, Aigner E, Datz C, *et al*. Relationships between education and non-alcoholic fatty liver disease. *Eur J Intern Med*. 2023;118:98-107. doi: 10.1016/j.ejim.2023.07.039

18. Tang M, Liu M, Zhang Y, Xie R. Association of family income to poverty ratio and vibration-controlled transient elastography quantified degree of hepatic steatosis in U.S. adolescents. *Front Endocrinol (Lausanne)*. 2023;14:1160625. doi: 10.3389/fendo.2023.1160625

19. El-Sayed AM, Scarborough P, Galea S. Unevenly distributed: a systematic review of the health literature about socioeconomic inequalities in adult obesity in the United Kingdom. *BMC Public Health*. 2012;12(1):18. doi: 10.1186/1471-2458-12-18

20. Hoebel J, Kuntz B, Kroll LE, *et al*. Socioeconomic Inequalities in the Rise of Adult Obesity: A Time-Trend Analysis of National Examination Data from Germany, 1990-2011. *Obes Facts*. 2019;12(3):344-356. doi: 10.1159/000499718

21. Wippermann C, Möller-Slawinski H, Arnold N, Borchard P, Marx P. *Equal opportunities in the healthcare system* [in German]. 1st ed. VS Verlag für Sozialwissenschaften, Springer Fachmedien Wiesbaden GmbH; 2011.

22. 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

23. Krüger K, Oedingen C, Kautz A, *et al*. Lifestyle interventions for patients with non-alcoholic steato-hepatitis–Design, rationale and protocol of the study "target group-specific optimisation of lifestyle interventions for behavior change in non-alcoholic steato-hepatitis (OPTI-NASH)". *PLoS One*. 2023;18(7):e0288905. doi: 10.1371/journal.pone.0288905

24. Gesellschaft für integrierte Kommunikationsforschung mbh & Co. KG. Best4planning 2023 – Counting via online database tool [in German]. Available from: https://gik.media/best-4-planning/ [Last accessed on 2024 May 15]

25. Grote Westrick M. Decide together [in German]. In: *Daten, Analysen, Perspektiven*. No. 4. Bertelsmann Stiftung; 2018. Available from: www.bertelsmann-stiftung.de/fileadmin/files/BSt/Publikationen/GrauePublikationen/VV_SpotGes_Gemeinsam_entscheiden_final.pdf [Please add Access Date].

26. Lofland JH, Johnson PT, Ingham MP, Rosemas SC, White JC, Ellis L. Shared decision-making for biologic treatment of autoimmune disease: influence on adherence, persistence, satisfaction, and health care costs. *Patient Prefer Adherence*. 2017;11:947-958. doi: 10.2147/PPA.S133222

27. Lippke S, Renneberg B. Theories and models of health behavior [in German]. In: *Gesundheitspsychologie*. 2006:35-42.

28. Fuchs R. The motivational volition concept [in German]. *Public Health Forum*. 2013;21(2):32-34. doi: 10.1016/j.phf.2013.03.004