

Evidence-based implementation of lifestyle medicine in healthcare practice: a research agenda

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ABSTRACT

In recent years, significant insights have been gathered into the effectiveness of lifestyle interventions in the treatment of chronic non-communicable diseases (NCD). To speed up the implementation of evidence-based lifestyle medicine, we developed a research agenda in collaboration with Dutch experts in treating NCD, using a hybrid Delphi approach. The research agenda focuses on four key themes: (1) promoting sustainable behavioural change at patient, healthcare professional and organisational levels; (2) optimising research designs, methodology and outcomes for the evaluation of effectiveness and implementation of lifestyle medicine modalities in healthcare practice; (3) elucidating biological mechanisms underlying successful lifestyle interventions and (4) advancing data infrastructure to ensure accessible data for citizens, healthcare professionals, researchers and health insurers for monitoring and evaluation of health and lifestyle outcomes. Collectively, the identified knowledge questions across these four themes provide guidance for (applied) research towards lifestyle medicine in healthcare.

INTRODUCTION

Chronic non-communicable diseases (NCDs) pose a major challenge to healthcare systems worldwide, driven by an ageing population and rising multimorbidity. Simultaneously, healthcare demand grows increasingly complex, leading to rising expenditures, lack of human resources and the need for financially sustainable solutions that maintain quality and equal access. With most chronic NCD burdens linked to unhealthy lifestyles,^{1–3} lifestyle interventions are increasingly seen as part of the solution.

Lifestyle medicine focuses on the application of lifestyle interventions to prevent progression, treat and potentially reverse chronic diseases. Such interventions aim to address the root causes of chronic diseases by making sustainable changes to daily habits, generally pertaining to changes in nutrition, physical activity, stress management, sleep, social connections and avoiding harmful

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Although there is an increasing recognition of lifestyle as treatment goal in healthcare and its inclusion in clinical guidelines for general practitioners and medical specialist for chronic non-communicable diseases, implementing evidence-based lifestyle medicine in healthcare remains challenging.

WHAT THIS STUDY ADDS

⇒ This manuscript addresses key challenges to integrating lifestyle medicine into healthcare practice, proposing a research agenda to strengthen its adoption.

HOW THIS STUDY MIGHT AFFECT RESEARCH

⇒ The research agenda offer guidance for national and international applied research to enhance the implementation of evidence-based lifestyle medicine in healthcare.

substances.⁴ Although there is an increasing recognition of lifestyle as treatment goal in healthcare and its inclusion in clinical guidelines for general practitioners and medical specialist for chronic NCDs, implementing evidence-based lifestyle medicine in healthcare remains challenging.

This manuscript addresses key challenges to integrating lifestyle medicine into healthcare practice, proposing a research agenda to strengthen its adoption. Rather than an isolated effort, this agenda consolidates and complements recent disease-specific research initiatives, offering guidance for national and international applied research to enhance the implementation of evidence-based lifestyle medicine in healthcare.

METHODS

The research agenda were developed using a hybrid consensus development process, combining techniques from several consensus development methods, that is, the Delphi



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method,^{5,6} nominal group technique^{7,8} and the Research and Development/University of California at Los Angeles (RAND/UCLA) appropriateness method.^{9,10} In total, 66 Dutch experts (both as panel member and individually consulted) in lifestyle-related research, healthcare practice, patient support groups and health foundations were involved.

Prior to the consensus development process of the Research agenda, a broad national consultation took place, conducted by the Netherlands Organisation for Health Research and Development (ZonMw), involving approximately 177 respondents, including researchers, policymakers, patient representatives and healthcare professionals. The selection of the domains was guided by criteria such as societal and scientific urgency, potential impact on health and healthcare and the expected value of knowledge development in driving meaningful change. The outcomes of this consultation served as the starting point for further discussion within ZonMw's Research team, which refined, deliberated on and formally established the four domains as the foundation of the current agenda:

1. *Sustainable behaviour change* at patient, healthcare professional and organisational levels.
2. *Understanding biological mechanisms* underlying successful interventions.
3. *Optimising research designs* for evaluating lifestyle medicine effectiveness and implementation.
4. *Improving data infrastructure* for accessible health and lifestyle monitoring.

Experts for the current consensus development process for the Research Agenda were contacted by e-mail and invited to participate in the consensus development process for one of the four research domains. Experts were purposively selected to represent diverse research areas and disciplines within the domains. Given the exploratory and cocreative nature of the process, no formal conflict of interest declarations were required in advance. The focus was on identifying relevant knowledge questions rather than allocating funding or developing policy, which limited the risk of direct conflicts. Transparency, diversity of perspectives and continuous attention to participants' backgrounds and positions helped safeguard the integrity of the process. For that purpose, each expert panel was chaired by two chairpersons, both experienced academic leaders in the field and affiliated at different organisations.

Expert sessions

Between January and November 2023, three online expert sessions were conducted per domain (figure 1). In preparation for the expert sessions, a synthesis of existing knowledge and research agendas was conducted by four trained researchers (TR, MB, RCV, LADMvO). In preparation, 105 existing knowledge agendas (including those of patient organisations), published between January 2015 and September 2023, were reviewed to identify knowledge gaps and research questions relating

to lifestyle in healthcare. These knowledge agendas primarily, although not exclusively, originated from Dutch organisations. This survey resulted in a structured overview of existing and missing knowledge in the field of lifestyle within healthcare in the Netherlands (*available in Dutch at <https://leefstijlcoalitie.nl/publicaties/inventarisatie-van-bestaande-kennisagendas-leefstijl/>*). The overview served as a supplement to the identification of knowledge gaps by the experts (see below).

Expert session 1

The objective of the first expert session was to obtain an initial categorisation of research topics and a corresponding list of relevant knowledge questions. Through discussions, existing knowledge and gaps in knowledge within the main subject were identified. Knowledge questions derived from the review of existing knowledge agendas were also introduced and discussed. The insights gained from this expert session, complemented by input from in-depth interviews, were processed into an initial set of knowledge questions for each domain of interest. This initial draft was shared for input with all experts, including those who were unable to attend the expert session.

Expert session 2

Prior to the second expert session, the knowledge questions for each domain of interest were incorporated into an online questionnaire. Following the Delphi methodology, the purpose of this questionnaire was to gauge the level of consensus regarding the importance of the formulated knowledge questions. All experts received an invitation and link via email to anonymously complete the questionnaire before the start of the expert session, utilising the online survey tool Qualtrics (Provo, Utah). Experts were asked to assess all knowledge questions based on six criteria (see box 1). Experts who had not filled out the questionnaire at the beginning of the second expert session were given the opportunity to do so at the start of the session. The entered data were instantly analysed by using SPSS V.27, and results were discussed collectively. The median and IQR of the assessments of the importance of the knowledge questions, that is, criterion 6, guided the discussion. The discussion focused mainly on questions with a median <4 (on a scale ranging from 1 to 5) or with a high IQR (>1), although all questions were briefly discussed. Substantive or textual adjustments were made in consultation, along with a reassessment of the knowledge questions.

Expert session 3

The insights gained from the second expert session were incorporated into a preliminary knowledge agenda for each of the four domains of interest. This agenda was presented to the experts for written feedback before the third expert session, after which suggestions and adjustments were incorporated. The revised version was then discussed in the third and final expert session for each

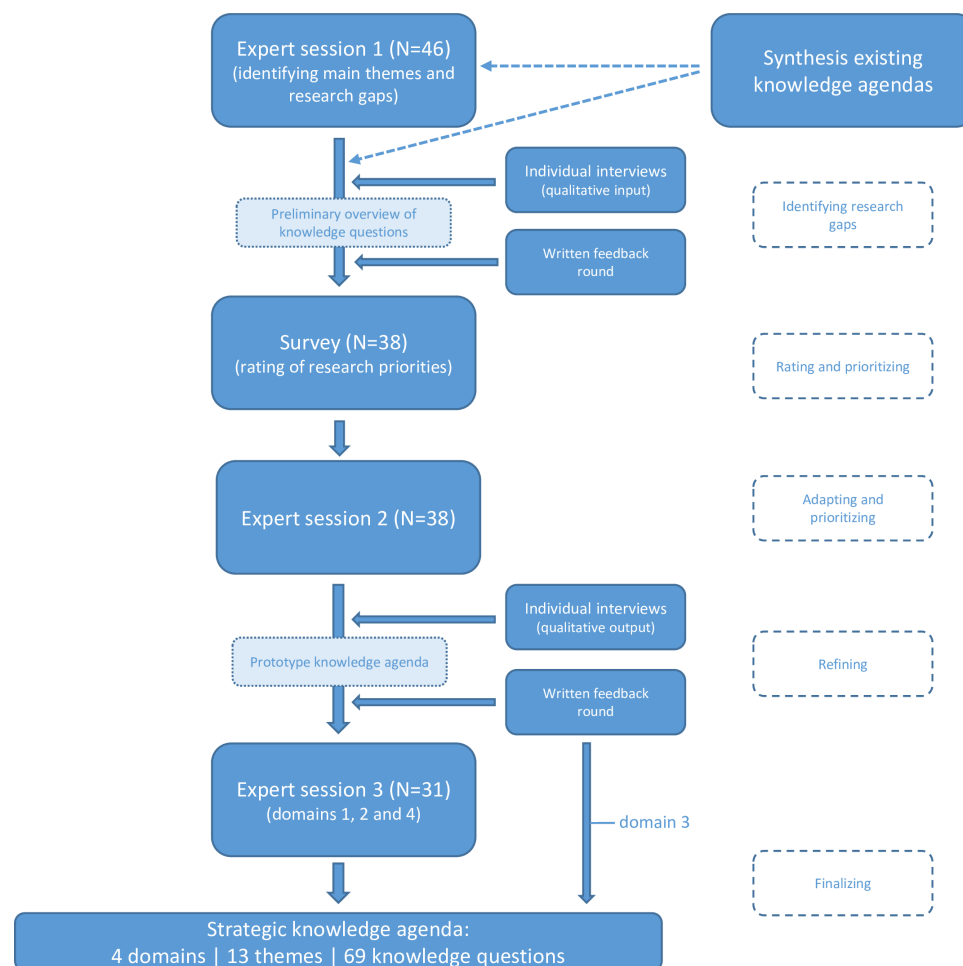


Figure 1 Overview of consensus development process. The process of developing the strategic knowledge agenda including three expert sessions.

domain. During this session, the last, primarily textual, changes to the agenda were discussed collectively, resulting in consensus on 69 research questions across 13 themes within the four domains (online supplemental table 1).

Box 1 Criteria for consensus development regarding knowledge questions, as applied in the online survey

Criteria for consensus development regarding knowledge questions.

1. Societal impact of research results on this knowledge question (1=very low; 5=very high).
 2. Urgency over time; the degree of urgency for research on the knowledge question (1=very low; 5=very high).
 3. Likelihood of successful investigation of the research question (1=very low; 5=very high).
 4. Likelihood of implementation of research results (1=very low; 5=very high).
 5. Scientific impact of the research results (1=very low; 5=very high).
- In addition to the above criteria, experts were also asked to provide an overall assessment of the importance of the knowledge question:
6. To what extent do you consider it important to include this knowledge question within the knowledge agenda? (1=not important; 5=very important).

RESULTS

In total, 69 research questions were identified, divided over 13 themes within the four domains of interest after three written and three consensus meetings (see online supplemental table 1). The items discussed during session 2, including the median and IQR are listed in online supplemental appendix 1.

DOMAIN 1: PROMOTING SUSTAINABLE BEHAVIOUR CHANGE

Behaviour change is key to effective lifestyle interventions in healthcare. This encompasses not only the patient's own behaviour change but also that of many others—for example, family and social network, healthcare providers (primary and secondary care), policymakers,—who all establish the conditions and support to facilitate patients' health behaviour change. Three key research areas were identified to optimise effectiveness and implementation of lifestyle interventions in healthcare:

1. *Strategies to promote sustained behaviour change*—while strategies to initiate behaviour change are well researched, evidence on relapse prevention and maintaining healthy behaviours, particularly in patients, is limited. Systematic, theory-driven research is needed.

2. *Uptake and implementation*—behaviour change in healthcare providers is vital to promote lifestyle interventions. Research should focus on factors influencing adoption by both providers and patients.
3. *System approach*—a holistic perspective considering individual, organisational and societal factors is necessary for sustainable interventions.

DOMAIN 2: ELUCIDATING BIOLOGICAL MECHANISMS UNDERLYING THE EFFECTS OF LIFESTYLE INTERVENTIONS

To optimise the effectiveness of lifestyle interventions and select the right lifestyle intervention for the right patient, it is imperative to understand the biological mechanisms underlying their effects. The causal pathways of many healthcare interventions, such as pharmaceuticals, are well understood. However, knowledge about mechanistic pathways for various lifestyle interventions (eg, exercise regimes, dietary patterns, sleep hygiene) is often deficient, particularly in a curative context. Four key themes emerge:

1. *Generic mechanisms*—more research is needed on how lifestyle changes affect biological systems in patients, especially those with multimorbidity, as knowledge in healthy populations does not fully translate into persons living with a chronic NCD.
2. *Disease-specific mechanisms*—complementary to knowledge on generic biological mechanisms (eg, generic inflammatory mechanisms), investigation of disease-specific mechanisms that underlie the effects of lifestyle changes (eg, biological mechanism of lifestyle change on dementia) and possible interactions of lifestyle interventions and other (disease-specific) therapies is essential.
3. *Individual and contextual factors*—factors like medical history, cultural and ethnic background, (epi)genetic characteristics and microbiome variability impact biological mechanisms and intervention outcomes and require study for development of tailored approaches.
4. *Sustained change mechanisms*—understanding biological pathways supporting lasting behaviour change, such as dopaminergic actions during motivation and reinforcement learning, can enhance intervention design.

DOMAIN 3: OPTIMISING IMPLEMENTATION METHODOLOGY

Implementation research is essential as it assesses how well lifestyle interventions as treatment of chronic NCD is implemented in the complex settings of everyday primary and secondary healthcare practice, beyond the controlled environments of clinical trials. This type of research helps integrate innovations into routine practice and organisational functioning systematically. Determining the most suitable methods for evaluating the implementation and effectiveness of complex lifestyle interventions is crucial, as is identifying the key outcome measures.¹¹ Almost all research in this area can be labelled as complex intervention studies, making it essential to study current practices to understand barriers and facilitators. Given the time

and continuous adaptation required for successful implementation, adaptive designs are recommended.¹¹ Three main themes were identified:

1. *Designs for implementation research*—implementation research should focus on understanding, evaluating or optimising the implementation process. Depending on the aim of the study, different designs are appropriate, such as examining the effectiveness of an implementation strategy, best suited for a randomised controlled trial (RCT), or exploring process aspects like readiness for change and the appropriateness and feasibility of implementation, for which a mixed methods approach is more appropriate.
2. *Designs for effectiveness research*—alternatives to classic RCTs, like type II hybrid implementation trials, randomised clinical trials of intervention principles and interrupted time series studies, need to be applied more often to improve generalisability and flexibility, addressing challenges in real-life contexts, multimorbidity and socially vulnerable groups.
3. *Outcome measures*—consensus is required on appropriate design and measures for effectiveness and implementation research to ensure timely adoption of effective interventions.

DOMAIN 4: ADVANCING HEALTH AND LIFESTYLE-RELATED DATA INFRASTRUCTURE

High-quality research on lifestyle interventions requires a robust data infrastructure that integrates diverse data types and sources. Importantly, while data from healthcare can provide insights on disease, it is important to generate and collect population-based health and lifestyle data to foster an understanding of health and its interaction with lifestyle behaviour.¹² Therefore, beyond healthcare data, this includes information on self-assessed symptoms and health, lifestyle, living environments and socioeconomic conditions of target groups. For citizens, integrating data from various sectors (eg, care, services, wearables, environment) provides insights into their lifestyle and its determinants. For healthcare professionals, it aids in delivering appropriate interventions by combining health and lifestyle data. Policymakers and insurers gain insights into policy impacts and care reimbursements, while researchers access data to develop guidelines and applications. A roadmap aligned with findable, accessible, interoperable, reusable (FAIR) principles, addressing privacy and knowledge gaps, is essential. Three themes are deemed central to advancing health and lifestyle data infrastructure:

1. *Data for research*—lifestyle data collection is often incomplete or absent. Solutions are needed for leveraging self-collected data (eg, wearables), integrating it with healthcare records as well as cohort studies and biobanks, and funding data-sharing strategies to inform research and policy.
2. *Data prerequisites*—efforts are needed to outline the requirements that data and data infrastructures must

satisfy to contribute to usability of data and to societal support for a data infrastructure. Conditions such as privacy, reliability, coverage and compliance with FAIR principles should be outlined at different levels: the citizen, healthcare professional, government and population.

3. *Preparing data for research*—challenges for effective data reuse include, among others, data completeness, context interpretation and lag times. Clear steps are required to reuse lifestyle data responsibly, ensuring quality, relevance and usability for monitoring and research.

REFLECTION AND FUTURE DIRECTIONS

Lifestyle medicine is increasingly recognised as part of the solution to the growing pressures on healthcare systems worldwide. This research agenda acknowledges the complexities of integrating lifestyle interventions into mainstream primary and secondary healthcare and advocates for targeted efforts to address these challenges. It highlights areas for strategic investigation that can help foster a system where lifestyle interventions are as accessible and supported as conventional treatments for NCD.

Challenges identified for the implementation of lifestyle medicine in the treatment of NCD in primary and secondary care were related to fragmented care practices for chronic NCDs (including knowledge about the role of biological mechanisms on lifestyle interventions) as well as varying attitudes and beliefs towards lifestyle medicine by healthcare professionals and patients.¹³ In addition, existing data systems are often not adequately equipped for the seamless integration of lifestyle data into healthcare practice for treatment guidance, and health data are collected in a fragmented manner. Research addressing these knowledge gaps is thus warranted, besides insight in appropriate designs for evaluating effectiveness and implementation of lifestyle interventions in the treatment of patients with NCD in primary and secondary care.

While outlining the main research themes and related questions, several cross-cutting recommendations were identified that should be taken into account in prioritising and designing research on the identified research questions. First, research should emphasise the inclusion of vulnerable populations, such as those with lower socioeconomic position or those with a migration background.¹⁴ When increasing knowledge about effective interventions for these groups and reducing health disparities, findings are equitable and applicable across diverse groups. Second, in the design process of lifestyle interventions cocreation with the end users is essential, including healthcare providers and patients.¹⁵ This approach ensures that interventions are feasible and align with the goals and priorities of users. The cocreation process should be well documented and evaluated. Third, employing innovative approaches and methodologies can enhance the efficiency, quality and impact of the research, offering new insights and solutions that

traditional methods might miss. Where feasible, future research should apply holistic definitions of health and use real-world data. Finally, it is essential to draw insights into successful case studies and best practices related to the implementation of lifestyle interventions in the treatment of NCD in primary and secondary care. By exchanging knowledge across borders and adapting effective interventions to different healthcare settings, we can expand the reach and enhance the impact of successful approaches, allowing them to be implemented widely and sustainably.

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Patient consent for publication Not applicable.

Ethics approval Research based on health professional expert sessions does not fall under the scope of the Medical Research Involving Human Subjects Act (WMO) in the Netherlands.

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