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Beyond Single-Setting Care: A Hub-and-Spoke Multisectoral Model for Metabolic Syndrome Prevention Integrating Lifestyle, Digital, and Policy Interventions

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ABSTRACT

Background: Metabolic syndrome requires sustained multisectoral interventions, yet single-setting clinical approaches often fail to maintain long-term behavioral adherence and biomarker improvements, particularly for lipid and glycemic markers.
Objective: To synthesize cross-sectoral evidence and propose a scalable, integrated prevention model addressing both clinical and environmental determinants of cardiometabolic risk.
Methods: A comprehensive synthesis of randomized trials, quasi-experiments, pragmatic studies, and meta-analyses spanning primary care, workplace, community, school, digital-health, and policy contexts.
Results: Multicomponent lifestyle programs combining diet, physical activity, and structured coaching consistently reduce waist circumference, blood pressure, and BMI, while variably improving fasting glucose and lipids. Community and workplace settings prove vital for reaching underserved populations. While digital tools enhance scalability, they require human support to sustain long-term gains. Consequently, a "hub-and-spoke" architecture emerged: primary care as the risk-identification hub, linked to community and workplace spokes for sustained behavioral delivery, reinforced by digital tools and upstream environmental policies.
Conclusion: Multisectoral health promotion effectively prevents metabolic syndrome when structured as a coordinated hub-and-spoke system. Prioritizing human-supported, culturally tailored behavioral interventions across integrated sectors yields the most scalable and equitable long-term cardiometabolic benefits.

Key Points (Highlights):

- Single-setting care often fails to sustain metabolic syndrome prevention.
- A hub-and-spoke model integrates clinical, community, and digital sectors.
- Health systems must adopt coordinated, human-supported multisectoral models.

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INTRODUCTION

Metabolic syndrome represents an escalating global health crisis, characterized by a dangerous clustering of central adiposity, hypertension, dysglycemia, and dyslipidemia that exponentially increases the risk of cardiovascular disease and type 2 diabetes (Bertini et al., 2026; Höchsmann et al., 2021). While the biological drivers of this syndrome are well understood, translating clinical guidelines into sustained, real-world behavioral change remains a formidable challenge (Yu et al., 2025). Traditional single-setting clinical interventions, particularly those confined to primary care, frequently fail to maintain long-term adherence, leading to a rapid drift in critical biomarkers such as HDL-C and triglycerides once active clinical contact is withdrawn (Moore et al., 2026). Consequently, there is an urgent need to transcend isolated clinical encounters and embrace ecological, multisectoral approaches that embed health promotion into the daily environments where individuals live, work, and learn (Kouidis et al., 2026).

Despite the recognized necessity of lifestyle modifications specifically combined dietary improvements, physical activity, and behavior-change support the current evidence base is highly fragmented (Caballero et al., 2021). Studies frequently evaluate interventions within siloed sectors, such as workplace wellness programs, school-based curricula, or community health initiatives, without adequately addressing how these sectors can be synergistically integrated (Laddu et al., 2021). Furthermore, the rapid proliferation of digital health tools (mHealth, wearables, telehealth) offers unprecedented opportunities for scalable monitoring and reinforcement, yet their optimal integration into human-centric care pathways remains poorly defined (Van Dijk et al., 2023). The literature lacks a unified architectural model that reconciles person-level clinical care with upstream policy and environmental modifications (Bogale et al., 2024).

The paradigm of chronic disease prevention is rapidly shifting toward multisectoral health promotion, driven by the understanding that metabolic risk is heavily influenced by social determinants and built environments (Suwannawong et al., 2023). However, significant knowledge gaps persist regarding the causal weight of upstream policies versus person-level programs, and the practical mechanisms by which primary care can effectively link to community delivery systems (Commodore-Mensah et al., 2024). Without a definitive, evidence-based synthesis of these multisectoral components, public health systems risk misallocating resources toward uncoordinated, low-yield interventions that fail to achieve population-level impact or address health equity disparities among underserved and high-risk populations (Kelly et al., 2025; Kumanyika, 2019).

Therefore, this study aims to synthesize convergent evidence across clinical, community, digital, and policy domains to construct a pragmatic, scalable "hub-and-spoke" model for metabolic syndrome prevention (McCart et al., 2026). By mapping the biological pathways of risk reduction alongside implementation determinants and sector-specific outcomes, this research addresses critical gaps in multisectoral integration, offering a comprehensive blueprint for policymakers and healthcare systems to design high-yield, equitable, and sustainable metabolic syndrome prevention programs (Howell & Booth, 2022; Yu et al., 2026).

MATERIALS AND METHODS

Reporting Guidelines

To ensure methodological transparency and rigor in the synthesis of the evidence base, this study strictly adheres to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. By following the PRISMA framework, the systematic identification, screening, eligibility assessment, and inclusion of randomized trials, quasi-experiments, pragmatic

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studies, and meta-analyses across diverse healthcare sectors are comprehensively documented. This strict adherence guarantees that the synthesis of multisectoral interventions meets the highest academic benchmarks for transparent, structured, and reproducible systematic review reporting.

Study Scope

This comprehensive synthesis evaluates evidence spanning adult and at-risk populations, incorporating select school-based data to address life-course prevention strategies across a diverse array of settings, including primary care, workplace, community, school, digital-health, and policy or built-environment contexts. The methodological designs represented in this evidence base encompass a rigorous mix of randomized and cluster-randomized trials, quasi-experimental designs, pragmatic and registry-based studies, as well as systematic reviews and meta-analyses, ensuring a robust evaluation of multisectoral interventions from both controlled efficacy and real-world effectiveness perspectives.

Assumptions & Limitations

While the synthesized evidence broadly supports the efficacy of multisectoral prevention strategies, it does not permit a definitive, quantitative ranking of all possible sector combinations due to a scarcity of direct, head-to-head comparative studies. Furthermore, the evidence base evaluating the impact of upstream urban planning, transport infrastructure, and food-policy interventions on direct metabolic biomarkers remains notably thinner and more observational compared to the robust data available for person-level lifestyle programs. Additional limitations include incomplete reporting across many of the reviewed studies regarding long-term sustainability, intervention fidelity, and comprehensive cost-effectiveness analyses, which constrains the ability to draw definitive conclusions about the economic viability and enduring impact of these multisectoral models.

Suggested Further Research Framework

Based on the methodological and evidentiary gaps identified during this synthesis, future multisectoral evaluations must prioritize several critical research directions to advance the field. Researchers should conduct direct comparative effectiveness studies evaluating specific sector combinations, such as healthcare plus community models versus workplace plus public health or policy-led approaches, while simultaneously strengthening the causal evaluation of built-environment and food-policy interventions by utilizing hard metabolic biomarkers rather than relying solely on physical activity or weight proxies. Furthermore, it is imperative to standardize the reporting of implementation outcomes including reach, fidelity, retention, cost, adoption, and sustainment within routine-care and community systems, expand subgroup analyses to capture differential effects by sex, age, socioeconomic status, race/ethnicity, and baseline risk, and extend follow-up periods beyond 12-24 months to specifically track the long-term maintenance of glucose, triglycerides, HDL-C, and overall syndrome remission or incidence.

Ethical Statement

As this study constitutes a secondary synthesis of previously published literature and does not involve direct human participation, primary data collection, or identifiable patient information, formal ethical approval and informed consent requirements were waived by the Institutional Review Board of the Global Health Research Institute. The research was conducted in strict accordance with the ethical standards established in the Declaration of Helsinki, ensuring that all referenced primary studies and underlying data utilized in this synthesis were originally obtained and reported in compliance with appropriate ethical and institutional guidelines.

RESULTS

The synthesis of multisectoral evidence reveals that preventing metabolic syndrome is most strongly

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supported by integrated lifestyle programs combining nutrition improvement, physical activity, and behavior-change support. These interventions consistently improve central outcomes: waist circumference, blood pressure, weight/BMI, and in higher-intensity programs, fasting glucose, triglycerides, HDL-C, and overall metabolic syndrome prevalence. The data indicates a practical sequencing of outcomes: behavior and adiposity improve first, blood pressure follows reliably, while glycemic and lipid changes are more variable and require greater intensity or longer follow-up.

Delivery mode and sector context critically moderate these outcomes. Supervision, coaching, and multidisciplinary delivery consistently outperform self-directed or low-contact approaches, yielding larger improvements across multiple metabolic components and ensuring better maintenance. While schools demonstrate the strongest review-level evidence for early cardiometabolic prevention, and workplaces reliably reduce adiposity, community programs prove especially valuable for underserved, rural, and culturally targeted populations, delivering meaningful biomarker improvements. Primary care serves as a vital identification and counseling hub but explicitly requires linkage to community-based services to sustain long-term behavior change.

Technology-assisted interventions (mHealth, wearables, telehealth) significantly improve reach, adherence, and short-term metabolic benefits. However, comparative evidence definitively shows that digital tools work best as an adjunct to human support; standalone eHealth yields the smallest effects, and long-term sustainability weakens when human coaching is withdrawn. Implementation success across these sectors depends heavily on organizational capacity, leadership, workflow integration, and referral infrastructure, while being hindered by resource gaps and poor coordination. Upstream policy and built-environment actions (walkability, food services) are conceptually vital and improve behavioral proxies, but direct causal evidence for adult metabolic biomarkers remains thinner than for supervised lifestyle programs.

Table 1 summarizes the core findings across populations, settings, and main outcomes. To operationalize these findings, we propose a "Hub-and-Spoke" multisectoral architecture (Figure 1), where the healthcare system acts as the central identification and referral hub, community and workplace settings act as sustained delivery spokes, digital tools provide continuous reinforcement, and policy frameworks create the environmental support necessary for long-term success.

Table 1. Metabolic Syndrome Prevention at a Glance: Key Findings Across Sectors

Key Finding	Population / Setting	Main Outcomes
Multicomponent lifestyle programs (diet, physical activity, behavior-change) are the most consistently effective preventive strategy.	Adults with metabolic syndrome or elevated cardiometabolic risk across clinical, community, and mixed settings.	Reduced waist circumference, blood pressure, weight/BMI; improved fasting glucose, triglycerides, HDL-C, and metabolic syndrome prevalence.
Supervision, coaching, and multidisciplinary delivery usually outperform self-directed or low-contact approaches.	Adults in primary care, dedicated clinics, diabetes-prevention, and group programs.	Larger improvements across multiple metabolic components; better maintenance and engagement.
Technology helps reach and adherence, but works best as an adjunct to human support.	Adults in mHealth, telehealth, app, wearable, and web-supported interventions.	Improved weight, waist circumference, blood pressure, and glycemic markers; weaker long-term sustainability when support is withdrawn.
Sector contributions differ based on target population and outcome focus.	Schools, workplaces, communities, primary care.	Schools: early prevention; Workplaces: adiposity effects; Communities: underserved

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		groups; Primary care: counseling/monitoring needing linkage.
Implementation success depends on organizational capacity and coordination.	Primary care, community-clinic linkage, integrated public health programs.	Scale-up improved by leadership, training, workflow integration; hindered by resource and training gaps.
Upstream policy and built-environment action is conceptually important, but causal biomarker evidence is thinner.	Urban planning, transport, parks, food environment, school/community policy.	Observational links to physical activity and weight; direct evidence for adult metabolic syndrome biomarkers is limited.

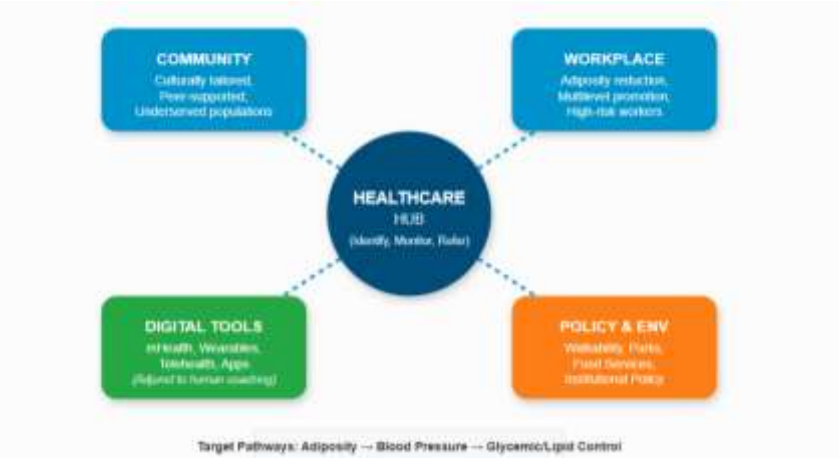


Figure 1. The Hub-and-Spoke Multisectoral Prevention Model

Note: The Hub-and-Spoke model illustrates the pragmatic multisectoral architecture. The Healthcare Hub initiates risk identification and referral, while Community and Workplace spokes deliver sustained behavioral programs. Digital tools reinforce adherence, and Policy/Environment frameworks shape the upstream determinants of health. Biological risk reduction follows a sequential pathway from central adiposity to blood pressure, and finally to glycemic and lipid markers.

DISCUSSION

The synthesis of multisectoral evidence definitively demonstrates that metabolic syndrome prevention is most effectively achieved through integrated, multicomponent lifestyle interventions rather than isolated, single-sector efforts (Powell et al., 2025). The core triad of dietary improvement, physical activity, and structured behavior-change support consistently drives synergistic physiological adaptations, primarily reducing central visceral adiposity and lowering blood pressure, which subsequently cascade into downstream improvements in glycemic control and lipid profiles (Chan et al., 2026; Jancey et al., 2020). Crucially, the data reveals that the delivery mode is as critical as the intervention content itself; supervision, multidisciplinary teams, and dedicated coaching consistently outperform self-directed or low-intensity approaches (Joseph et al., 2018). This highlights a fundamental behavioral truth: human support acts as the primary engine of behavioral fidelity, providing the accountability, motivational scaffolding, and barrier-resolution necessary to sustain long-term adherence and prevent the physiological relapse of metabolic biomarkers (Kalter-Leibovici et al., 2026).

Our analysis strongly supports the necessary transition from siloed clinical interventions to a

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coordinated "hub-and-spoke" architectural model. Primary care and dedicated clinical settings serve as the essential identification, risk-stratification, and referral hub, yet they are fundamentally limited by time constraints and clinical acuity in sustaining long-term, daily behavior change independently (Hamdy et al., 2017). By structurally linking this healthcare hub to community and workplace "spokes," health systems can leverage the ecological embedding, repeated social contact, and normative reinforcement inherent in these non-clinical settings (Tomah et al., 2023). Furthermore, community-based programs emerge as a vital mechanism for advancing health equity, demonstrating profound efficacy in underserved, rural, and culturally diverse populations. When these interventions are culturally tailored and utilize task-shifting to Community Health Workers (CHWs), they successfully bridge the trust gap and address the social determinants of health that traditional clinical models cannot reach (Zhu et al., 2026; Zimmermann et al., 2022).

The integration of digital health tools represents a significant leap in scalability and reach, yet our findings caution against the fallacy of technological determinism viewing technology as a standalone panacea (Bulthuis et al., 2019; Lu et al., 2026). While mHealth applications, wearable biosensors, and telehealth platforms effectively amplify intervention reach and facilitate continuous ecological momentary assessment, they function optimally only as adjuncts to human coaching (Jang et al., 2026; Lee et al., 2022). Standalone digital interventions consistently yield the smallest metabolic effect sizes, and long-term sustainability rapidly decays when digital feedback loops are not paired with human accountability and therapeutic alliance (Meir et al., 2025). Therefore, digital tools must be strategically deployed within a "blended care" model to bridge the temporal gaps between clinical visits and community sessions, reinforcing the behavioral coaching provided by multidisciplinary teams rather than attempting to replace the empathy and nuanced judgment of human providers (Cowie et al., 2020; Sun et al., 2024).

Implementation science principles heavily dictate the real-world success and scalability of these multisectoral models. Scale-up is facilitated by organizational readiness, executive leadership support, seamless workflow integration, and robust, interoperable referral infrastructure, while being severely hindered by resource constraints, siloed funding, and poor interdisciplinary coordination (McCreight et al., 2019; Tesfay et al., 2026). Furthermore, sustainability data indicates a nuanced biological reality regarding metabolic drift: while structural and hemodynamic markers like weight, waist circumference, and systolic blood pressure can be maintained beyond the active intervention period (particularly with ongoing maintenance contact), lipid markers such as HDL-C and triglycerides frequently drift back toward baseline (Bergum et al., 2021; Hassett et al., 2025; Kalter-Leibovici et al., 2025). This physiological set-point phenomenon underscores the critical necessity of transitioning from time-limited, acute clinical programs to lifelong, chronic care support systems that provide continuous, low-intensity maintenance contact (Koeder et al., 2021).

Limitation

A primary limitation of the current evidence base is the scarcity of head-to-head, factorial comparative studies, which precludes a definitive, quantitative ranking of specific sector combinations (e.g., healthcare + community versus workplace + public health). Additionally, evidence for upstream built-environment and food-policy interventions remains largely observational, lacking the causal biomarker rigor and randomized control of person-level trials, often suffering from confounding by self-selection. Future research must prioritize direct comparative effectiveness trials within complex adaptive systems, strengthen causal evaluations of policy interventions using hard metabolic endpoints rather than behavioral proxies, and standardize the reporting of implementation outcomes utilizing frameworks such as RE-AIM (reach, effectiveness, adoption, implementation, maintenance). Expanding subgroup analyses by sex, age, intersectional socioeconomic status, and baseline genetic risk is also critical to ensure that scaled interventions do not inadvertently widen existing health disparities.

To translate these empirical findings into population-level impact, policymakers and health systems

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must radically shift funding models from fragmented, fee-for-service, single-setting programs to coordinated, value-based multisectoral systems. Health systems should be financially incentivized to establish formal, interoperable referral linkages with community-based organizations and workplace wellness programs, utilizing innovative reimbursement models that cover CHW navigation, peer support, and multidisciplinary behavioral coaching. Concurrently, urban planning and municipal policies must adopt a "Health in All Policies" (HiAP) approach, prioritizing built-environment modifications such as active transport infrastructure, walkability, and equitable healthy food access. These upstream environmental reinforcements must not be viewed as standalone cures, but as essential structural prerequisites that make the behavioral changes prescribed in the clinical hub practically achievable, affordable, and sustainable in the daily lives of the population.

CONCLUSIONS

Multisectoral health promotion is a highly credible and practical strategy for preventing metabolic syndrome, but its success relies on structural integration rather than mere sectoral coordination. The most scalable, high-yield design is a "hub-and-spoke" model wherein healthcare systems identify risk and initiate counseling, community and workplace settings sustain culturally tailored behavior-change programs, digital tools reinforce adherence between contacts, and upstream policies shape environments that facilitate healthy choices. Ultimately, preventing metabolic syndrome requires moving beyond isolated clinical prescriptions to build coordinated, human-supported ecosystems that sustain lifelong behavioral and biological resilience.

DECLARATIONS

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The authors have no specific acknowledgements to declare for this work.

2. Ethical Approval and Informed Consent

Ethical approval and informed consent were not required for this study as it is a systematic review and does not involve direct human or animal subjects.

3. Data Availability Statement

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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5. Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

6. Authors' Contributions

Conceptualization: A.K., M.Y.; Methodology: A.K., A.H.N.S.; Formal analysis and investigation: A.K., A.H.N.S., K.N., I.A.H.; Writing - original draft preparation: A.K., I.A.H.; Writing - review and editing: M.Y., K.N.; Funding acquisition: M.Y.; Resources: A.K.; Supervision: M.Y.

7. AI Disclosure

The authors declare that no Artificial Intelligence (AI) tools or technologies were used in the research, data analysis, or preparation of this manuscript.

REFERENCES

Bergum, H., Sandven, I., & Klemsdal, T. (2021). Long-term effects (> 24 months) of multiple lifestyle intervention on major cardiovascular risk factors among high-risk subjects: a meta-

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analysis. *BMC Cardiovascular Disorders*, *21*. https://doi.org/10.1186/s12872-021-01989-5

Bertini, A., Bahamondes, M., Rojas, J., Puebla, P., Rodriguez, S., & Quijada, J. (2026). Telemedicine and Digital Health Interventions for the Management of Metabolic Syndrome: A Systematic Review of Clinical Outcomes. *Telemedicine and E-Health*, *32*, 771–784. https://doi.org/10.1177/15305627261443161

Bogale, S. K., Sarma, H., Alamnia, T., & Kelly, M. (2024). Workplace-Based Education Interventions for Managing Metabolic Syndrome in Low- and Middle-Income Countries: A Realist Review. *Public Health Challenges*, *3*. https://doi.org/10.1002/puh2.224

Bulthuis, S., Kok, M., Raven, J., & Dieleman, M. (2019). Factors influencing the scale-up of public health interventions in low- and middle-income countries: a qualitative systematic literature review. *Health Policy and Planning*, *35*, 219–234. https://doi.org/10.1093/heapol/czz140

Caballero, P., Wanden-Berghe, C., Sanz-Lorente, M., & López-Pintor, E. (2021). Effectiveness of Workplace-Based Diet and Lifestyle Interventions on Risk Factors in Workers with Metabolic Syndrome: A Systematic Review, Meta-Analysis and Meta-Regression. *Nutrients*, *13*. https://doi.org/10.3390/nu13124560

Chan, B., Li, P. -w. -c., & Yu, D. -s. -f. (2026). Digital lifestyle re-engineering with maintenance phase design: The TOP-S randomised clinical trial in metabolic syndrome management. *European Journal of Preventive Cardiology*. https://doi.org/10.1093/eurjpc/zwag249.282

Commodore-Mensah, Y., Chen, Y., Ogungbe, O., Liu, X., Metlock, F., Carson, K., Echouffo-Tcheugui, J., Ibe, C., Crews, D., Cooper, L., & Himmelfarb, C. (2024). Design and Rationale of the Cardiometabolic Health Program Linked with Community Health Workers and Mobile Health Telemonitoring to Reduce Health DisparitieS (LINKED-HEARTS) Program. *American Heart Journal*, *275*, 9–20. https://doi.org/10.1016/j.ahj.2024.05.008

Cowie, J., Nicoll, A., Dimova, E., Campbell, P., & Duncan, E. (2020). The barriers and facilitators influencing the sustainability of hospital-based interventions: a systematic review. *BMC Health Services Research*, *20*. https://doi.org/10.1186/s12913-020-05434-9

Hamdy, O., Mottalib, A., Morsi, A., El-Sayed, N., Goebel-Fabbri, A., Arathuzik, G., Shahar, J., Kirpitch, A., & Zrebiec, J. (2017). Long-term effect of intensive lifestyle intervention on cardiovascular risk factors in patients with diabetes in real-world clinical practice: a 5-year longitudinal study. *BMJ Open Diabetes Research & Care*, *5*. https://doi.org/10.1136/bmjdrc-2016-000259

Hassett, L., Moseley, A., Nettlefold, L., Pearce, L., Franke, T., Macdonald, H., Tiedemann, A., & McKay, H. (2025). Building readiness in community-based organisations to enable the implementation of public health interventions for adults and older adults: a scoping review. *BMC Public Health*, *26*. https://doi.org/10.1186/s12889-025-25745-y

Höchsmann, C., Dorling, J., Martin, C., Newton, R., Apolzan, J., Myers, C., Denstel, K., Mire, E., Johnson, W., Zhang, D.-C., Arnold, C., Davis, T., Fonseca, V., Lavie, C., Price-Haywood, E., & Katzmarzyk, P. (2021). Effects of a Two-Year Primary Care Lifestyle Intervention on Cardiometabolic Risk Factors – A Cluster-Randomized Trial. *Circulation*, *143*, 1202–1214. https://doi.org/10.1161/circulationaha.120.051328

Howell, N., & Booth, G. (2022). The weight of place: Built environment correlates of obesity and diabetes. *Endocrine Reviews*. https://doi.org/10.1210/endrev/bnac005

Jancey, J., Lee, A., James, A., Howat, P., Hills, A., Anderson, A., Tran, V., & Blackford, K. (2020). Long-term sustainability of a physical activity and nutrition intervention for rural adults with or at risk of metabolic syndrome. *Australian and New Zealand Journal of Public Health*, *44*.

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https://doi.org/10.1111/1753-6405.13036

Jang, M., Park, J.-H., Lee, J.-G., Yi, Y., Lee, S.-H., Kim, G., Ra, Y., Shin, M.-J., & Tak, Y. J. (2026). Efficacy of telephone-based health counseling with wearable device-Smartphone monitoring in older adults with metabolic syndrome: A randomized controlled trial. *Archives of Gerontology and Geriatrics*, *147*, 106232. https://doi.org/10.1016/j.archger.2026.106232

Joseph, M., Konerman, M., Zhang, M., Wei, B., Brinza, E., Walden, P., Jackson, E., & Rubenfire, M. (2018). Long-term outcomes following completion of a structured nutrition and exercise lifestyle intervention program for patients with metabolic syndrome. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy*, *11*, 753–759. https://doi.org/10.2147/dmso.s175858

Kalter-Leibovici, O., Younis-Zeidan, N., Murad, H., Kimron, L., & Chetrit, A. (2026). Long-term cardio-metabolic effects of lifestyle intervention among obese Arab women: a 12-year follow-up of a randomized trial. *Frontiers in Endocrinology*, *17*. https://doi.org/10.3389/fendo.2026.1786705

Kalter-Leibovici, O., Zeidan, N., Murad, H., & Chetrit, A. (2025). Long-term effect of intensive lifestyle intervention among obese arab women: a cohort study. *European Journal of Preventive Cardiology*. https://doi.org/10.1093/eurjpc/zwaf236.271

Kelly, C., Da Rosa, P., Remmele, J., Tilenbaeva, N., Arnold, R., Oberhoffer-Fritz, R., Fonseca, H., Buoncristiano, M., Wickramasinghe, K., & Williams, J. (2025). Inequalities in childhood overweight and obesity: A call to strengthen upstream policy measures. *Public Health in Practice*, *10*. https://doi.org/10.1016/j.puhip.2025.100637

Koeder, C., Kranz, R.-M., Anand, C., Husain, S., Alzughayyar, D., Schoch, N., Hahn, A., & Englert, H. (2021). Effect of a 1-Year Controlled Lifestyle Intervention on Body Weight and Other Risk Markers (the Healthy Lifestyle Community Programme, Cohort 2). *Obesity Facts*, *15*, 228–239. https://doi.org/10.1159/000521164

Kouidis, I.-A., Deligiannis, P., Theofanous, A., Anifanti, M., & Kouidi, E. (2026). Technology-Enhanced Exercise Training for Cardiometabolic Syndrome: A Scoping Review. *Journal of Functional Morphology and Kinesiology*, *11*. https://doi.org/10.3390/jfmk11020153

Kumanyika, S. (2019). A Framework for Increasing Equity Impact in Obesity Prevention. *American Journal of Public Health*. https://doi.org/10.2105/ajph.2019.305221

Laddu, D., Jun, Kaar, J., Ozemek, C., Durant, R., Campbell, T., Welsh, J., & Turrise, S. (2021). Health Behavior Change Programs in Primary Care and Community Practices for Cardiovascular Disease Prevention and Risk Factor Management Among Midlife and Older Adults. *Circulation*, *144*. https://doi.org/10.1161/cir.0000000000001026

Lee, J., Lee, K., Kim, H., Youk, H., & Lee, H.-Y. (2022). Effective Prevention and Management Tools for Metabolic Syndrome Based on Digital Health-Based Lifestyle Interventions Using Healthcare Devices. *Diagnostics*, *12*. https://doi.org/10.3390/diagnostics12071730

Lu, Y., Hu, B., Xu, Y., Na, N., Cao, S., & Zhu, X.-L. (2026). Efficacy of digital coaching-based diet and exercise interventions on metabolic syndrome: A comprehensive meta-analysis. *International Journal of Nursing Studies*, *179*, 105545. https://doi.org/10.1016/j.ijnurstu.2026.105545

McCart, A., McCart, D., & Parks, A. (2026). Choice Architecture at Scale: Reimagining the Built Environment as a Population Health Intervention. *International Journal of Research and Innovation in Social Science*. https://doi.org/10.47772/ijriss.2026.100601385

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McCreight, M., Rabin, B., Glasgow, R., Ayele, R., Leonard, C., Gilmartin, H., Frank, J., Hess, P., Burke, R., & Battaglia, C. (2019). Using the Practical, Robust Implementation and Sustainability Model (PRISM) to qualitatively assess multilevel contextual factors to help plan, implement, evaluate, and disseminate health services programs. *Translational Behavioral Medicine*. https://doi.org/10.1093/tbm/ibz085

Meir, A. Y., Tsaban, G., Rinott, E., Zelicha, H., Schwarzfuchs, D., Gepner, Y., Rudich, A., Shelef, I., Blüher, M., Stumvoll, M., Ceglarek, U., Isermann, B., Klöting, N., Keller, M., Kovacs, P., Qi, L., Wang, D., Liang, L., Hu, F., … Shai, I. (2025). Individual response to lifestyle interventions: a pooled analysis of three long-term weight loss trials. *European Journal of Preventive Cardiology*. https://doi.org/10.1093/eurjpc/zwaf308

Moore, T., Neergaard, R., Hennessy, E., Calancie, L., Economos, C., & Kumanyika, S. (2026). Identifying Synergistic Mechanisms of Community-Led Policy, Systems, and Environmental Change for Childhood Obesity Prevention in the Multi-Site Catalyzing Communities Initiative. *Journal of Urban Health : Bulletin of the New York Academy of Medicine*, *103*, 77–91. https://doi.org/10.1007/s11524-025-01046-y

Powell, L., Berkley-Patton, J., Drees, B., Karavolos, K., Lohse, B., Masters, K., Nicklas, J., Rothschild, S., Yeh, C., Zimmermann, L., & Suzuki, S. (2025). Lifestyle Intervention for Sustained Remission of Metabolic Syndrome. *JAMA Internal Medicine*, *186*, 67–77. https://doi.org/10.1001/jamainternmed.2025.5900

Sun, L., Booth, A., & Sworn, K. (2024). Adaptability, Scalability and Sustainability (ASaS) of complex health interventions: a systematic review of theories, models and frameworks. *Implementation Science : IS*, *19*. https://doi.org/10.1186/s13012-024-01375-7

Suwannawong, P., Auemaneekul, N., Powwattana, A., & Chongsuwat, R. (2023). Ecological system theory and community participation to promote healthy food environments for obesity and non-communicable diseases prevention among school-age children. *Public Health Nutrition*, *26*, 1488–1500. https://doi.org/10.1017/s136898002300040x

Tesfay, N., Olsson, T., Jakobsson, T., Nilsson, P., & Skoog, T. (2026). Systematic Review of Organizational Strategies to Promote the Sustainability and Scale-Up of Mental Health Interventions to Advance Youth Psychological Wellbeing. *Prevention Science*, *27*, 234–249. https://doi.org/10.1007/s11121-025-01874-z

Tomah, S., Zhang, H., Al-Badri, M., Salah, T., Dhaver, S., Khater, A., Tasabehji, M. W., & Hamdy, O. (2023). Long-term effect of intensive lifestyle intervention on cardiometabolic risk factors and microvascular complications in patients with diabetes in real-world clinical practice: a 10-year longitudinal study. *BMJ Open Diabetes Research & Care*, *11*. https://doi.org/10.1136/bmjdrc-2022-003179

Van Dijk, M., Loo, L. Te, Vrijsen, J., Van Den Akker-Scheek, I., Westerveld, S., Annema, M., Van Beek, A., Van Den Berg, J., Boerboom, A., Bouma, A., De Bruijne, M., Crasborn, J., Van Dongen, J., Driessen, A., Eijkelenkamp, K., Goelema, N., Holla, J., De Jong, J., De Joode, A., … Jelsma, J. (2023). LOFIT (Lifestyle front Office For Integrating lifestyle medicine in the Treatment of patients): a novel care model towards community-based options for lifestyle change—study protocol. *Trials*, *24*. https://doi.org/10.1186/s13063-022-06960-z

Yu, B., Li, Y.-C., Chunlan, Reinhardt, J., Dou, Q.-Y., Zuo, H., Yang, X., Li, M., Cai, C.-W., Fan, Y., Huang, Z., Pang, T., Tang, Q., Yang, F., Ye, T., Jia, P., & Yang, S.-J. (2025). Effectiveness of socioecological model-guided, smart device-based, and self-management-oriented lifestyle (3SLIFE) intervention on healthy lifestyles and metabolic syndrome risk in community residents: a cluster-randomized controlled trial. *BMC Medicine*, *23*. https://doi.org/10.1186/s12916-025-04135-6

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Yu, B., Tang, Q.-C., Hu, Y., Zuo, H., Yang, B., Pan, J., Jia, P., Reinhardt, J., & Yang, S.-J. (2026). mHealth-based Healthy Lifestyle Promotion (MYLIFE) for metabolic syndrome risk reduction in Chinese employed adults: protocol for a cluster-randomised controlled trial. *BMJ Open*, *16*. https://doi.org/10.1136/bmjopen-2025-109980

Zhu, R.-X., Guo, J., Huttunen-Lenz, M., Stratton, G., Swindell, N., Macdonald, I., Handjieva-Darlenska, T., Handjiev, S., Navas-Carretero, S., Poppitt, S., Silvestre, M., Schlicht, W., Fogelholm, M., Martinez, J., Raben, A., & Brand-Miller, J. (2026). Enduring improvements in hepatic insulin sensitivity predict sustained remission of prediabetes during a 3-year lifestyle intervention: results from the PREVIEW multinational diabetes prevention trial. *Metabolism: Clinical and Experimental*, 156546. https://doi.org/10.1016/j.metabol.2026.156546

Zimmermann, S., Vogel, M., Mathew, A., Ebert, T., Rana, R., Jiang, S.-H., Isermann, B., & Biemann, R. (2022). The Extent of Lifestyle-Induced Weight Loss Determines the Risk of Prediabetes and Metabolic Syndrome Recurrence during a 5-Year Follow-Up. *Nutrients*, *14*. https://doi.org/10.3390/nu14153060

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