

Commentary

Type 2 Diabetes Remission in Sub-Saharan Africa: Why Pragmatic Lifestyle Trials Are a Health System Priority

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Sub-Saharan Africa is facing a rapid rise in type 2 diabetes, but many patients in public primary care cannot reliably obtain the medicines they are prescribed. Randomised trials in China, India, the USA, the UK, and Qatar show that structured lifestyle intervention can prevent diabetes and, in selected adults with early disease, induce remission. Yet no remission-focused randomised trial has been identified in published literature in sub-Saharan Africa to date. This gap matters because populations in the region often present younger and earlier in the disease course, but also show marked heterogeneity in body composition, beta-cell function, and food environments. Existing evidence therefore justifies local testing rather than direct transfer. We argue for a phased agenda of feasibility work, pragmatic trials in primary care, and guideline space for remission-oriented research in eligible adults with early type 2 diabetes.

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Introduction

Sub-Saharan Africa now has approximately 24 million people living with diabetes, a figure projected to exceed 55 million by 2045 as urbanisation and nutritional transition accelerate across the region.^{[1][2]} Yet patients diagnosed with T2DM in public primary care settings are frequently unable to access the medicines they are prescribed. Essential NCD medicines in African public-sector facilities are often unavailable, and the clinical systems designed to manage diabetes at primary care level are structurally ill-equipped to deliver continuous pharmacotherapy.^[3]

Between January and August 2024, we conducted a mixed-methods study of the financial determinants of NCD care in primary health facilities in Seme Sub-County, Kisumu County, Kenya.^[4] Not one facility had a dedicated NCD budget line. Not one had the authority to procure medicines locally when central supplies failed. Approval for local spending took three to four weeks in most facilities and over two months in others. Eighty-six percent of the facilities reported frequent stockouts of NCD drugs. These findings come from one county and should not be extrapolated mechanically. Even so, they illustrate the operational problem that this paper addresses: treatment strategies for chronic disease often assume a continuity of medicine access that many primary-care settings struggle to deliver.

This paper does not argue against medicines. Pharmacotherapy is lifesaving and must be strengthened across the region. What this paper argues is that an evidence-based and potentially remission-inducing treatment pathway has been established in selected settings: structured lifestyle modification targeting glycaemic remission in patients with early T2DM. Three decades of randomised trial data support this approach, and yet no remission-focused randomised trial has been identified in published literature in sub-Saharan Africa to date.^[5] We consider that absence to be a gap requiring urgent explanation and urgent correction.

The African Diabetes Context

Type 2 diabetes mellitus (T2DM) in sub-Saharan Africa has distinctive features that are directly relevant to the question of whether lifestyle modification might be effective in this setting. As Mbanya and colleagues documented in *The Lancet*, the epidemic in sub-Saharan Africa is driven by rapid urbanisation, major changes in dietary patterns, and declining physical activity, and is concentrated in populations undergoing the nutrition transition.^[6] The urban-to-rural gradient in diabetes prevalence across the region is substantial: Sobngwi and colleagues documented a rural prevalence of at most 1 to 2% against urban rates of 1 to 13% or more in West Africa, and Hall and colleagues' systematic review found population prevalence estimates ranging from around 1% in rural Uganda to 12% in urban Kenya.^[7] ^[8] These gradients confirm that urban lifestyle exposures are central to the disease's epidemiology in the region.

Two features of the African diabetes phenotype are particularly important for this discussion. First, patients in sub-Saharan Africa often present with T2DM at younger ages and sometimes at lower BMI than populations described in European-origin cohorts, although this pattern is heterogeneous across

settings; several studies suggest an important contribution of impaired beta-cell function, but the balance between beta-cell dysfunction and insulin resistance varies across populations.^{[8][9]} Second, studies from Cameroon and regional reviews show that African-origin populations living in urban environments have substantially higher diabetes prevalence than those in rural environments, and that migration-related lifestyle change is plausibly part of that pattern.^{[2][10]} Urban diabetes prevalence has often been reported at roughly two to five times that of rural populations across several African settings, a pattern consistent with the hypothesis that lifestyle exposures are central to the disease's epidemiology.^{[2][10]} That observation supports, but does not by itself prove, the possibility of reversibility through targeted lifestyle change.

Sub-Saharan Africa does not constitute a single metabolic or epidemiological entity. Diabetes phenotype, body composition at diagnosis, dietary patterns, and disease duration at presentation vary substantially across urban and rural settings, across eastern, western, central, and southern African zones, and along socioeconomic gradients.^{[6][8][10]} The features described here are recurring patterns documented across the regional literature, not a single continental phenotype, and any future trial will need to account for that heterogeneity in its eligibility criteria and stratification. Whether remission models developed in European and Middle Eastern populations are directly applicable to sub-Saharan African populations with different body composition profiles and metabolic phenotypes remains uncertain. That uncertainty is not a reason to defer investigation; it is the scientific rationale for conducting locally relevant trials.

The Commission on diabetes in sub-Saharan Africa published by Atun and colleagues in *The Lancet Diabetes & Endocrinology* noted the limited context-specific evidence available to guide diabetes care in the region, and observed that much of clinical practice continues to rely on treatment approaches developed and validated in high-income country settings.^[11] This paper is partly a response to that observation.

The Evidence from Randomised Controlled Trials

Prevention: Da Qing, IDPP-1, and the US Diabetes Prevention Program

The oldest and most geographically relevant evidence comes from Da Qing, China, where Pan and colleagues enrolled 577 adults with impaired glucose tolerance (IGT) in 1986 and randomly assigned them by clinic to diet, exercise, diet plus exercise, or control for six years. Adjusted for baseline differences, lifestyle interventions achieved a reduction in diabetes incidence of 31 to 46% across the three

intervention arms during the trial period.^[12] Thirty-year follow-up data showed that participants originally assigned to lifestyle intervention had a mean increase of 1.44 years in life expectancy, a median delay in diabetes onset of nearly four years, and significantly fewer cardiovascular events and microvascular complications compared with controls.^[13] This is evidence of durable, life-extending benefit from a lifestyle intervention conducted in a lower-middle-income setting in a non-Western population, with no specialist medical technology.

In India, Ramachandran and colleagues randomised 531 adults with impaired glucose tolerance to control, lifestyle modification alone, metformin alone, or the combination.^[14] The mean BMI of participants was 25.8 kg/m², showing effectiveness in a relatively lean population by the standards of many Western remission trials. Over three years, lifestyle modification reduced diabetes incidence by 28.5%, almost identically to metformin (26.4%). Adding the drug to lifestyle change produced no additional benefit. The intervention cost approximately US\$117 per participant over three years.

The US Diabetes Prevention Program (DPP) randomised 3,234 adults at high risk of diabetes and found that intensive lifestyle intervention reduced three-year diabetes incidence by 58% relative to placebo, and metformin by 31% relative to placebo, with the lifestyle arm significantly outperforming metformin.^[15] The DPP enrolled a racially diverse cohort in which 45% of participants were from minority racial or ethnic groups, and the lifestyle benefit was consistent across major subgroups. Long-term follow-up through the DPP Outcomes Study confirmed that the reduction in diabetes incidence persisted over 15 years; there was no significant overall reduction in the aggregate microvascular outcome, although participants who did not progress to diabetes had substantially lower complication prevalence than those who did.^[16]

These three trials (Da Qing, IDPP-1, and the DPP) are prevention studies: they enrolled adults with impaired glucose tolerance, not established diabetes, and their primary question was whether lifestyle modification could prevent progression to T2DM. They are not remission studies, and the argument of this paper does not rest on treating them as such. The evidence they provide is that lifestyle intervention produces durable metabolic responsiveness in biologically and socioeconomically diverse non-Western populations, including at low cost and in lower-middle-income settings. The next two trials address a distinct and more specific clinical question: whether structured lifestyle intervention can produce full glycaemic remission in patients with established T2DM of short duration. Both literatures are relevant here; they are not interchangeable, and the argument of this paper depends on reading them in sequence.

Remission: DiRECT and DIADEM-I

In this paper, “remission” refers to the definition agreed by the 2021 international consensus: HbA1c below 48 mmol/mol sustained without glucose-lowering medication for at least three months.^[17] The Diabetes Remission Clinical Trial (DiRECT) established that glycaemic remission meeting this standard is achievable in primary care. Lean and colleagues enrolled 306 adults with T2DM of up to six years’ duration across primary care practices in Scotland and northern England.^[18] The intervention involved total diet replacement, structured food reintroduction, and weight-loss maintenance support, delivered by practice nurses and dietitians. At 12 months, 46% of the intervention group achieved remission, compared to 4% of controls. Five-year extension data showed that approximately one in four (26%) of those who had achieved remission at two years remained in remission at five years, and that serious adverse events in the original intervention group (4.8 per 100 patient-years) were approximately half those in the control group (10.2 per 100 patient-years).^[19]

The leading proposed biological explanation for these findings is that T2DM in susceptible individuals involves ectopic fat accumulation in the liver and pancreas impairing beta-cell function, and that sustained weight loss can reverse this process in eligible patients. Whether this mechanism operates comparably in African populations (whose body composition and metabolic phenotype differ in important respects from the DiRECT cohorts) is precisely the question African trials must answer, and the uncertainty is not a reason to delay them.

DIADEM-I, published in *The Lancet Diabetes & Endocrinology* in 2020, extended the remission evidence to a non-European population. Taheri and colleagues enrolled 158 adults of Middle Eastern and North African ancestry in primary care in Qatar and applied an intervention closely modelled on DiRECT.^[20] Participants had a mean age of 42.1 years and disease duration of up to three years. Remission was achieved in 61% of the intervention group at 12 months, a rate higher than DiRECT, and attributed to the younger age and shorter disease duration of the DIADEM-I cohort. Both features are relevant to many clinical settings in sub-Saharan Africa, though direct comparisons across populations with different body composition profiles must be made cautiously.

The Look AHEAD trial: a careful reading

The null cardiovascular result of the Look AHEAD trial (the largest ever randomised trial of lifestyle intervention in people with established T2DM) is sometimes invoked against lifestyle intervention, but

the trial addressed a different question from remission-focused intervention in early diabetes.^[21]

Look AHEAD enrolled 5,145 overweight and obese adults with T2DM and followed them for a median of 9.6 years. The primary composite cardiovascular endpoint was not significantly reduced in the intensive lifestyle group compared to the control group. However, the control condition in Look AHEAD was not a standard-care placebo. It was an active Diabetes Support and Education programme that included structured group sessions and lifestyle guidance. At study end, the control group had lost approximately 3.5% of baseline weight.^[22] When both trial arms show substantive improvement, detecting a between-group difference becomes statistically difficult, and the investigators noted that lower-than-expected cardiovascular event rates in the control group substantially reduced the study's statistical power.

The broader Look AHEAD literature tells a more nuanced story: the intervention group achieved greater improvements in HbA1c, fitness, sleep apnoea, and several cardiometabolic risk factors, and often required less medication, even though the primary cardiovascular endpoint was neutral.^[23] A post-hoc analysis found that, across both trial groups combined, participants who achieved 10% or more weight loss in the first year had a 21% lower risk of the primary cardiovascular composite outcome and approximately 24% lower risk of the expanded secondary composite outcome, relative to those with stable weight or weight gain.^[24] Look AHEAD therefore does not close the question addressed here. Rather, it shows that modest, partly unsustained weight loss in older populations with longer-duration diabetes and an active control arm is not equivalent to testing deeper weight loss for remission in earlier disease.

The Evidence Gap in Sub-Saharan Africa

Trial	Outcome type	Setting	Population	Intervention	Key finding
Da Qing	<i>Prevention</i>	China (LMIC)	IGT; mean BMI 25.8	Diet, exercise, or combined; 6 years	31–46% diabetes incidence reduction; 30-year survival and complication benefit; 1.44-year mean life expectancy gain
IDPP-1	<i>Prevention</i>	India (LMIC)	IGT; mean BMI 25.8	Lifestyle vs metformin vs combined	Lifestyle as effective as metformin; 28.5% incidence reduction at US\$117/participant
DPP	<i>Prevention</i>	USA (HIC)	High-risk; multiethnic	Lifestyle vs metformin vs placebo	58% incidence reduction; consistent across Black, Hispanic, and Asian subgroups; durable prevention at 15 years
Look AHEAD	<i>Cardiovascular outcomes</i>	USA (HIC)	Obese; established T2DM; median duration 6.8 years	Intensive lifestyle vs active control	Neutral CVD endpoint vs active control; improvements in HbA1c, fitness, and medication use; lower post-hoc CVD risk with at least 10% weight loss
DiRECT	<i>Remission</i>	UK (HIC)	T2DM up to 6 years; BMI >27	Total diet replacement in primary care	46% remission at 12 months; 26% of those in remission at 2 years remained in remission at 5 years
DIADEM-I	<i>Remission</i>	Qatar (UMIC)	Middle Eastern/North African; T2DM up to 3 years; mean age 42.1 years	DiRECT-modelled intervention	61% remission at 12 months in a non-European population

Trial	Outcome type	Setting	Population	Intervention	Key finding
Sub-Saharan Africa	Remission (not studied)	No trial conducted	Not studied	Not studied	2023 scoping review identified 16 lifestyle-remission trials in 10 countries; none were conducted in Africa

Table 1. Landmark randomised trials of lifestyle modification for type 2 diabetes prevention and remission

IGT = impaired glucose tolerance. T2DM = type 2 diabetes mellitus. HIC = high-income country. LMIC = low- and middle-income country. UMIC = upper-middle-income country. The Outcome type column distinguishes prevention trials (enrolling adults with IGT or prediabetes) from remission trials (enrolling adults with established T2DM). Karera and colleagues (2023) searched PubMed, Embase, Cochrane, and CINAHL for trials designed to achieve remission through lifestyle intervention alone; 16 eligible trials were identified, conducted in 10 countries, none in sub-Saharan Africa.^[5]

Table 1 summarises the central point of this paper. Major randomised trials of lifestyle intervention for diabetes prevention or remission have been conducted across Asia, North America, Europe, and the Middle East, but not in sub-Saharan Africa. Given the region's rising diabetes burden and constrained access to pharmacotherapy, that absence is an evidence gap with direct policy relevance rather than a marginal omission.

Across the regional literature, T2DM in sub-Saharan Africa is characterised in many settings by younger age at diagnosis and shorter disease duration than in Western cohorts, features documented in the epidemiological record^{[6][10][11]} even where population-level data remain incomplete. The DIADEM-I result (61% remission in a cohort with a mean disease duration under three years) demonstrates that this population profile can be associated with higher remission rates, at least in a Middle Eastern population of comparable phenotype. In many settings, T2DM has emerged alongside relatively recent urbanisation, dietary change, and declining physical activity rather than long-term severe obesity. If some of these exposures can be modified, there may be greater potential for metabolic reversibility in at least a subset of adults, but that remains a hypothesis requiring direct African evidence.

Taken together, these features support a testable hypothesis: some adults in sub-Saharan Africa, particularly those identified earlier in the disease course, may have greater potential for metabolic reversibility with remission-oriented lifestyle intervention. They do not establish that effect in advance. The purpose of this paper is to argue that the hypothesis is sufficiently important and plausible to warrant direct testing in African primary care.

Community delivery infrastructure for this kind of intervention partially exists. The Kerala Diabetes Prevention Programme in India showed that peer-led lifestyle intervention can be delivered in community settings in a lower-middle-income country.^[25]

Community health worker structures are active across Kenya and much of sub-Saharan Africa, though their current capacity is concentrated on maternal-child health, HIV, tuberculosis, and immunisation programmes, and their role in NCD self-management remains limited and largely unevaluated. A remission-oriented intervention would also have to contend with food affordability, household food insecurity, competing work demands, workforce burden, and access to HbA1c or fasting glucose testing. Key implementation challenges, including maintaining intervention fidelity, achieving adequate retention over a 12-month programme, and verifying outcomes biochemically at primary care level, require systematic feasibility assessment before a full-scale trial can be responsibly designed. These structures do not need to be built from scratch, but they do need to be adapted and evaluated rather than assumed.

Why the gap persists

Identifying a research gap is straightforward. Explaining why it persists requires more careful thinking.

Lifestyle modification trials are structurally disadvantaged in the global health research funding landscape. They do not generate intellectual property returns. They cannot be commercialised by a pharmaceutical company. They do not fit the procurement models of major international health programmes. The result is that dietary and behavioural interventions, even when they have demonstrated efficacy equivalent to or exceeding that of pharmaceutical agents in direct comparative trials (as the IDPP-1 data show), attract a fraction of the research investment directed at drug development and drug access programmes.

This imbalance falls most heavily on LMICs, where national research budgets are constrained and the pipeline of locally generated NCD evidence remains thin. In the absence of that evidence, LMIC clinical

guidelines default to treatment recommendations developed for and validated in high-income country populations, a pattern documented extensively by Atun and colleagues.^[11] Those guidelines assume a pharmacological infrastructure that, as our research in Kisumu confirms and the regional literature corroborates, does not reliably exist at the primary care level in rural sub-Saharan Africa. The assumption is circular: guidelines recommend medicines; the absence of trial evidence for alternatives reinforces that recommendation; the absence of alternative trial evidence is itself partly a product of how global health research is funded and what kinds of interventions attract investment.

This evidence gap has direct implications for health system planning. In settings where continuous pharmacotherapy cannot be reliably delivered, treatment strategies that depend exclusively on long-term medicine access risk widening inequities between people who can purchase drugs privately and those who cannot. Generating evidence on remission-oriented lifestyle interventions is therefore not only a clinical research question; it is also a health systems question about resilience, affordability, and equity in chronic disease care.

There is also a clinical translation gap. The 2021 international consensus defining T2DM remission as a formal clinical target appears to have had limited uptake in the regional guideline literature.^[17] Without some institutional recognition, clinicians have limited policy space for offering or evaluating remission-focused care, even in carefully selected patients or pilot programmes. The result is that a potential treatment pathway remains invisible at the point of care, precisely where it is most urgently needed.

The Ethical Dimension

The absence of lifestyle modification research in sub-Saharan Africa is not an ethically neutral situation. Medical ethics, as articulated in the Declaration of Helsinki and subsequent international frameworks, requires that research be conducted in a manner that reflects the health needs of the populations most affected by the diseases being studied, and that effective treatments be made accessible to those who need them.

We are not arguing that lifestyle modification should be recommended for African patients on the basis of evidence generated elsewhere, without contextual testing. That would itself be an ethical failure, and it would be precisely the kind of generalisation from high-income country populations to LMIC settings that has caused harm in global health before. We are making a more basic claim: the evidence base accumulated across six major trials in China, India, the United States, the United Kingdom, and Qatar is

sufficient to justify conducting an adequately powered, locally adapted trial in sub-Saharan Africa. The decision not to conduct that trial, while continuing to prescribe pharmacotherapy to patients who cannot reliably access it, is not a cautious or neutral position. It is a choice with clinical and ethical consequences.

We propose a three-part policy and research agenda

First, research funders, ministries of health, and academic institutions should support a pragmatic randomised trial of structured lifestyle modification for type 2 diabetes remission in sub-Saharan African primary care. The trial should focus on adults with early type 2 diabetes, use locally appropriate eligibility criteria, and adapt remission-oriented intervention models to local food environments and delivery platforms. Remission at 12 months, defined as HbA1c below 48 mmol/mol sustained without glucose-lowering medication for at least 3 months, should be prespecified as the primary outcome, but medication use, weight change, safety, retention, and cost-effectiveness should also be built into the design from the outset. The study should be prospectively registered, include robust ethics oversight, and incorporate structured community engagement.

Second, before any full-scale trial is launched, preparatory feasibility work should be funded in routine primary care settings. This work should assess how remission-oriented interventions can be adapted to local diets and household budgets, delivered through primary care teams and community health workers, and supported by reliable follow-up for HbA1c or fasting glucose measurement. It should also examine implementation fidelity, participant retention, and the practical consequences of food insecurity, travel costs, and competing livelihood demands. Such preparatory work is necessary to ensure that any subsequent trial is locally grounded, operationally feasible, and scientifically robust.

Third, national diabetes and NCD guidelines in sub-Saharan Africa should create explicit space for remission-oriented lifestyle intervention to be studied and piloted in eligible patients within primary care. This is not a call for service-wide adoption before African trial evidence is available. Rather, it is a call for guidelines to recognise remission as a valid research and pilot-programme objective in early type 2 diabetes. The 2021 international consensus statement defined type 2 diabetes remission as a formal clinical target.^[17] Explicit recognition of remission as a research and pilot-programme objective appears to remain limited in the regional guideline literature. Incorporating that framing would provide a scientifically coherent basis for locally generated evidence and policy learning.

Conclusion

Three decades of randomised evidence from China, India, the USA, the UK, and Qatar show that structured lifestyle intervention can prevent type 2 diabetes and, in selected patients with early disease, induce remission. The missing question is not whether remission is biologically plausible in sub-Saharan Africa, but whether it can be achieved safely, equitably, and at scale in the settings where medicine access is least reliable.

Patients in rural primary care in Kisumu are living with the consequences of a treatment model that assumes continuous drug availability when that availability is often interrupted. An African remission trial would not replace the obligation to improve access to medicines. It would address a parallel failure: the absence of locally generated evidence on whether a structured, culturally adapted, remission-oriented intervention could reduce lifelong treatment dependence for some patients with early type 2 diabetes. That question is clinically important, operationally testable, and now overdue for serious funding and policy attention. Ministries of health, funders, and guideline groups do not need to endorse remission as established care before African evidence exists, but they do need to create the conditions in which that evidence can be generated.

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Author Contributions

NWA conceptualised this paper from fieldwork conducted in Seme Sub-County and led the literature review and writing. JO contributed to the conceptual framing, provided clinical epidemiology guidance, and contributed to all sections. JAO contributed to the conceptual framing, reviewed the manuscript, and

provided critical intellectual input. All authors approved the final version and accept full responsibility for its content.

Use of Generative AI

During the preparation of this manuscript, the authors used generative AI tools (ChatGPT, OpenAI) for language editing, proofreading, and review. The authors reviewed and edited all content and take full responsibility for the final version of the manuscript.

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References

1. [△]Magliano DJ, Boyko EJ, IDF Diabetes Atlas 10th edition scientific committee (2021). *IDF DIABETES ATLAS, 10th edn. Brussels: International Diabetes Federation.* <http://www.ncbi.nlm.nih.gov/books/NBK581934/>.
2. ^{a, b, c}Motala AA, Mbanya JC, Ramaiya K, Pirie FJ, Ekoru K (2022). "Type 2 Diabetes Mellitus in Sub-Saharan Africa: Challenges and Opportunities." *Nat Rev Endocrinol.* **18**:219–29.
3. [△]Yenet A, Nibret G, Tegegne BA (2023). "Challenges to the Availability and Affordability of Essential Medicines in African Countries: A Scoping Review." *Clinicoecon Outcomes Res.* **15**:443–58.
4. [△]Amollo NW, Ogol J, Museve E, Owenga JA, Aduda DO, Onguru D (2026). "Financial Determinants of Effective Hypertension and Diabetes Care in Rural Primary Health Facilities in Kisumu, Kenya: A Mixed-Methods Study." *BMC Public Health.* doi:[10.1186/s12889-026-26963-8](https://doi.org/10.1186/s12889-026-26963-8).
5. ^{a, b}Duhuza Karera MG, Wentzel A, Ishimwe MCS, et al (2023). "A Scoping Review of Trials Designed to Achieve Remission of Type 2 Diabetes with Lifestyle Intervention Alone: Implications for Sub-Saharan Africa." *Diabetes Metab Syndr Obes.* **16**:677–92.
6. ^{a, b, c}Mbanya JCN, Motala AA, Sobngwi E, Assah FK, Enoru ST (2010). "Diabetes in Sub-Saharan Africa." *Lancet.* **375**:2254–66.
7. [△]Sobngwi E, Mauvais-Jarvis F, Vexiau P, Mbanya JC, Gautier JF (2001). "Diabetes in Africans. Part 1: Epidemiology and Clinical Specificities." *Diabetes Metab.* **27**:628–34.

8. ^{a, b, c}Hall V, Thomsen RW, Henriksen O, Lohse N (2011). "Diabetes in Sub Saharan Africa 1999–2011: Epidemiology and Public Health Implications. A Systematic Review." *BMC Public Health*. **11**:564.
9. ^ΔGoedecke JH, Mendham AE (2022). "Pathophysiology of Type 2 Diabetes in Sub-Saharan Africans." *Diabetologia*. **65**:1967–80.
10. ^{a, b, c, d}Sobngwi E, Mbanya J-C, Unwin NC, et al (2004). "Exposure Over the Life Course to an Urban Environment and Its Relation with Obesity, Diabetes, and Hypertension in Rural and Urban Cameroon." *Int J Epidemiol*. **33**:769–76.
11. ^{a, b, c}Atun R, Davies JI, Gale EAM, et al (2017). "Diabetes in Sub-Saharan Africa: From Clinical Care to Health Policy." *Lancet Diabetes Endocrinol*. **5**:622–67.
12. ^ΔPan XR, Li GW, Hu YH, et al (1997). "Effects of Diet and Exercise in Preventing NIDDM in People with Impaired Glucose Tolerance. The Da Qing IGT and Diabetes Study." *Diabetes Care*. **20**:537–44.
13. ^ΔGong Q, Zhang P, Wang J, et al (2019). "Morbidity and Mortality After Lifestyle Intervention for People with Impaired Glucose Tolerance: 30-Year Results of the Da Qing Diabetes Prevention Outcome Study." *Lancet Diabetes Endocrinol*. **7**:452–61.
14. ^ΔRamachandran A, Snehalatha C, Mary S, et al (2006). "The Indian Diabetes Prevention Programme Shows That Lifestyle Modification and Metformin Prevent Type 2 Diabetes in Asian Indian Subjects with Impaired Glucose Tolerance (IDPP-1)." *Diabetologia*. **49**:289–97.
15. ^ΔKnowler WC, Barrett-Connor E, Fowler SE, et al (2002). "Reduction in the Incidence of Type 2 Diabetes with Lifestyle Intervention or Metformin." *N Engl J Med*. **346**:393–403.
16. ^ΔDiabetes Prevention Program Research Group (2015). "Long-Term Effects of Lifestyle Intervention or Metformin on Diabetes Development and Microvascular Complications Over 15-Year Follow-Up: The Diabetes Prevention Program Outcomes Study." *Lancet Diabetes Endocrinol*. **3**:866–75.
17. ^{a, b, c}Riddle MC, Cefalu WT, Evans PH, et al (2021). "Consensus Report: Definition and Interpretation of Remission in Type 2 Diabetes." *Diabetes Care*. **44**:2438–44.
18. ^ΔLean ME, Leslie WS, Barnes AC, et al (2018). "Primary Care-Led Weight Management for Remission of Type 2 Diabetes (DiRECT): An Open-Label, Cluster-Randomised Trial." *Lancet*. **391**:541–51.
19. ^ΔLean ME, Leslie WS, Barnes AC, et al (2024). "5-Year Follow-Up of the Randomised Diabetes Remission Clinical Trial (DiRECT) of Continued Support for Weight Loss Maintenance in the UK: An Extension Study." *Lancet Diabetes Endocrinol*. **12**:233–46.
20. ^ΔTaheri S, Zaghloul H, Chagoury O, et al (2020). "Effect of Intensive Lifestyle Intervention on Bodyweight and Glycaemia in Early Type 2 Diabetes (DIADEM-I): An Open-Label, Parallel-Group, Randomised Controlled

d Trial." *Lancet Diabetes Endocrinol.* 8:477–89.

21. ^ΔLook AHEAD Research Group, Wing RR, Bolin P, et al (2013). "Cardiovascular Effects of Intensive Lifestyle Intervention in Type 2 Diabetes." *N Engl J Med.* 369:145–54.
22. ^ΔLook AHEAD Research Group (2014). "Eight-Year Weight Losses with an Intensive Lifestyle Intervention: The Look AHEAD Study." *Obesity (Silver Spring).* 22:5–13.
23. ^ΔWing RR, Lang W, Wadden TA, et al (2011). "Benefits of Modest Weight Loss in Improving Cardiovascular Risk Factors in Overweight and Obese Individuals with Type 2 Diabetes." *Diabetes Care.* 34:1481–6.
24. ^ΔLook AHEAD Research Group, Gregg E, Jakicic J, et al (2016). "Association of the Magnitude of Weight Loss and Changes in Physical Fitness with Long-Term Cardiovascular Disease Outcomes in Overweight or Obese People with Type 2 Diabetes: A Post-Hoc Analysis of the Look AHEAD Randomised Clinical Trial." *Lancet Diabetes Endocrinol.* 4:913–21.
25. ^ΔThankappan KR, Sathish T, Tapp RJ, et al (2018). "A Peer-Support Lifestyle Intervention for Preventing Type 2 Diabetes in India: A Cluster-Randomized Controlled Trial of the Kerala Diabetes Prevention Program." *PLoS Med.* 15:e1002575.

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