

Study Protocol

Combining Theory-Driven Realist Approach and Systems Thinking to Unpack Complexity of Type 2 Diabetes and Hypertension Management in Low and Middle-Income Countries: Protocol for a Realist Review

Fatemeh Ehteshami ^{1,2,*} , Rachel Cassidy ^{3,4} , Fabrizio Tediosi ^{1,5}, Günther Fink ^{1,6}  and Daniel Cobos Muñoz ¹

¹ Epidemiology and Public Health Department, Swiss Tropical and Public Health Institute (Swiss TPH), 4123 Allschwil, Basel, Switzerland; fabrizio.tediosi@swisstph.ch (F.T.); guenther.fink@swisstph.ch (G.F.); daniel.cobos@swisstph.ch (D.C.M.)

² Faculty of Medicine, University of Basel, 4001 Basel, Switzerland

³ KPM Center for Public Management, University of Bern, 3012 Bern, Switzerland; rachel.cassidy@unibe.ch

⁴ Swiss Institute for Translational and Entrepreneurial Medicine, 3010 Bern, Switzerland

⁵ Faculty of Science, University of Basel, 4001 Basel, Switzerland

⁶ Faculties of Economics and Natural Sciences, University of Basel, 4001 Basel, Switzerland

* Correspondence: fatemeh.ehteshami@swisstph.ch

Abstract: The burden of type 2 diabetes mellitus (T2DM) and hypertension (HTN) has increased worldwide in recent decades, particularly in low- and middle-income countries (LMICs). In these countries, health systems often struggle to provide effective health care services for the management of chronic conditions. We have developed a study protocol with the aim of conducting a realist review to delve into the complexities behind the management of T2DM and HTN in LMICs. First, we have developed a causal loop diagram (CLD) serving as the initial program theory to represent the health system drivers associated with the effective (or ineffective) management of T2DM and HTN. Next, we will search, select, appraise, extract and analyze the relevant evidence. This evidence will be used to refine and extend the initial program theory to transform it into a middle-range program theory. This will then be verified through Group Model Building (GMB) sessions. The evidence will be summarized applying RAMESES (Realist And Meta-narrative Evidence Syntheses: Evolving Standards). In combining a systems thinking approach with a realist approach to program evaluation, we aim to unravel the mechanisms that govern the management of T2DM and HTN, and the relation between health system-related factors, which lead to outcomes, in different contexts.

Keywords: realist approach; systems thinking; health care services; type 2 diabetes; hypertension; low- and middle-income countries



Citation: Ehteshami, F.; Cassidy, R.; Tediosi, F.; Fink, G.; Cobos Muñoz, D. Combining Theory-Driven Realist Approach and Systems Thinking to Unpack Complexity of Type 2 Diabetes and Hypertension Management in Low and Middle-Income Countries: Protocol for a Realist Review. *Systems* **2024**, *12*, 16. <https://doi.org/10.3390/systems12010016>

Academic Editor: William T. Scherer

Received: 13 October 2023

Revised: 13 December 2023

Accepted: 19 December 2023

Published: 6 January 2024



Copyright: © 2024 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

1. Introduction

Over the last few decades, there has been a marked escalation in the prevalence of diabetes mellitus (DM), largely driven by a continuous rise in the incidence of type 2 DM (T2DM) cases. In 2021, there were around 537 million people aged between 20 to 79 years with DM globally, and 80% of this population resided in low- and middle-income countries (LMICs) [1,2]. DM and hypertension (HTN) are tightly interlinked because of similar risk factors. Moreover, there is substantial overlap between the cardiovascular disease (CVD) complications of DM and HTN [3]. HTN occurs in over 50% of diabetics and is a major contributor to both micro-vascular and macro-vascular disease in DM. Around 40% of people over the age of 25 years have HTN and two thirds of them live in LMICs [4]. Patients who have both DM and HTN have a four times higher risk of developing CVD compared to individuals who are non-diabetic and normotensive [5].

Although the burden of T2DM and HTN has been increasing, the control of these conditions remains unsatisfactory in many LMIC contexts [6,7]. This highlights the fundamental need for the provision of integrated and effective healthcare services for these conditions. In response, there have been efforts to initiate approaches at the primary care settings [8] and integrated programs to address the concurrent management of T2DM and HTN. However, the provision of efficient and effective healthcare services for chronic conditions depends on numerous entities and factors within a complex and adaptive health system.

To further disentangle and better understand the mechanisms that drive behaviors and outcomes in complex systems, a set of holistic and dynamic approaches is essential. Systems thinking can help to unravel complex issues and explain dynamic non-linear behaviors. It involves a specific way of thinking to uncover the underlying causes of problems through a set of tools [9,10]. Causal loop diagrams (CLDs) are one of the powerful systems thinking tools that can be used to visualize and model the various interactions among system parts and the cause–effect linkages to address problems. The CLD structure comprises system elements (variables), and elucidates the polarities of links between elements, non-linear relationships, feedback loops and time delays. Feedback loops are considered a key element in CLDs as their identification helps us to visualize certain structural drivers for behavior that stakeholders want to promote or destabilize. Feedback loops are considered to be either reinforcing or balancing loops. A reinforcing loop is characterized by a self-reinforcing, amplified behavior, which explains directional change through growth or decline over time, perpetuating desirable (virtuous) or undesirable (vicious) cycles of action. A balancing loop exhibits stabilizing behavior over time, directing the loop to an equilibrium state [9,11,12]. CLDs provide valuable insight for key stakeholders by the visualization of complex system behavior [13], including the identification of drivers for problematic system behavior and leverage points, which can be targeted to produce desired system outcomes [14]. One source of data for the development of CLDs is secondary data, such as evidence identified through systematic or realist reviews [15].

A realist synthesis is a research approach that considers the implementation of complex intervention programs, taking into account the various mechanisms that lead to outcomes across different contexts [16,17]. It involves identifying, unpacking and understanding underlying mechanisms and exploring how intervention programs work under certain conditions, corresponding to the Context–Mechanism–Outcome (C-M-O) configuration. The underlying mechanism is a fundamental entity that generates specific outcomes in particular contexts. It encompasses the components of a program and the way that individuals respond to and interact with these components. Contexts are the factors in the environment of a program such as cultural norms, demographics and individual and organizational characteristics that may activate or deactivate the mechanisms and affect the outcomes. Understanding the interaction and relationship between the context and mechanisms is vital to explain how and why the program works. Outcomes are intended or unintended results according to context–mechanism interactions, e.g., the effectiveness of a program and health outcomes [18].

The realist synthesis begins with the development of an initial program theory that explains how a complex phenomenon works. The initial program theory should identify the key mechanisms and how they interact with each other to produce the outcomes. Once the initial theory has been developed, a full review of the evidence is conducted with the aim to test the hypotheses generated by the theoretical framework, and to refine it to propose a revised theoretical framework (the middle-range program theory) [19–21].

In this study, we will combine the ability of realist reviews to identify the evidence-based mechanisms of health system behavior, with a system thinking method such as CLD, to better visualize and capture complex system phenomena. We hope to further understand the key health providers-related system factors (supply side) and the response of patient-related system factors (demand side) with regard to the management of T2DM

and HTN, including the identification of mechanisms that may facilitate or hinder the control of blood sugar and blood pressure outcomes in these populations.

Thus, we will try to address questions regarding “what works (supply side), for whom (demand side), how (the underlying mechanisms) and under what circumstances (different contexts).

More specifically, we will seek to answer the following questions:

- What are the key characteristics of the management of T2DM and HTN in LMICs?
- What programs have been implemented for the management of T2DM and/or HTN in LMICs?
- What are the mechanisms of T2DM and/or HTN management that lead to outcomes in different contexts?

2. Materials and Methods

The study will be conducted in several steps following Pawson et al.’s methodology [21], namely, (1) articulating the initial program theory, (2) searching for evidence, (3) selection and appraising documents, (4) extraction of data and data analysis, (5) synthesis of findings and (6) developing a middle range theory.

We have categorized the steps of the realist review in the three following phases:

First phase: conceptualization of the initial program theory to address the complexity of T2DM and HTN management in LMICs using a CLD.

Second phase: search, selection, appraisal, extraction of evidence regarding programs for T2DM and HTN management in LMICs.

Third phase: analysis of data and development of the middle range theory, i.e., a revised CLD and then validation through Group Model Building (GMB) sessions.

2.1. First Phase: Conceptualization of the Initial Program Theory to Address the Complexity of T2DM and HTN Management in LMICs Using a CLD

We have developed a CLD as the initial program theory based on the research team’s prior knowledge and preliminary review of evidence on barriers of T2DM and HTN healthcare services’ management in LMICs. We mapped out the causal structures using Vensim (Figure 1). The preliminary reviewed evidence was mainly qualitative studies on perspectives of patients and healthcare providers regarding the management of T2DM and HTN in LMICs (Appendix A, Table A1). We categorized our initial findings into two categories (1) demand side: patient-related system factors, and (2) supply side: healthcare providers-related system factors (Table 1).

Table 1. Drivers of T2DM and HTN treatment based on the preliminary gathered evidence.

Categories	Drivers	Examples
Patient-related system factors (demand side)	Awareness	Awareness of population affected by T2DM and HTN
	Acceptability	Patients adopting treatment procedure Patients’ willingness to attend the health facilities
	Seeking care	Seeking for alternative sources such as herbal medicine and private care
	Affordability	Financial burden due to medications and medical supplies, examination fees, healthcare visits and transportation fees
Health care Providers related system factors (supply side)	Availability	Lack of essential clinical facilities for DM care Out of stock of medicines and supplies Shortage of equipment and laboratory services Shortage and/or turnover of healthcare workers
	Accessibility	Distance from health facilities (geographical distance)
	Knowledge Compliance	Knowledge of healthcare professionals on DM and HTN care Providing patients with sufficient information Compliance of health professionals to clinical guidelines
	Timeliness	Long waiting time due to providers’ work load
	Integration	Discontinuity between health center and district facilities Fragmented healthcare pathways and referrals

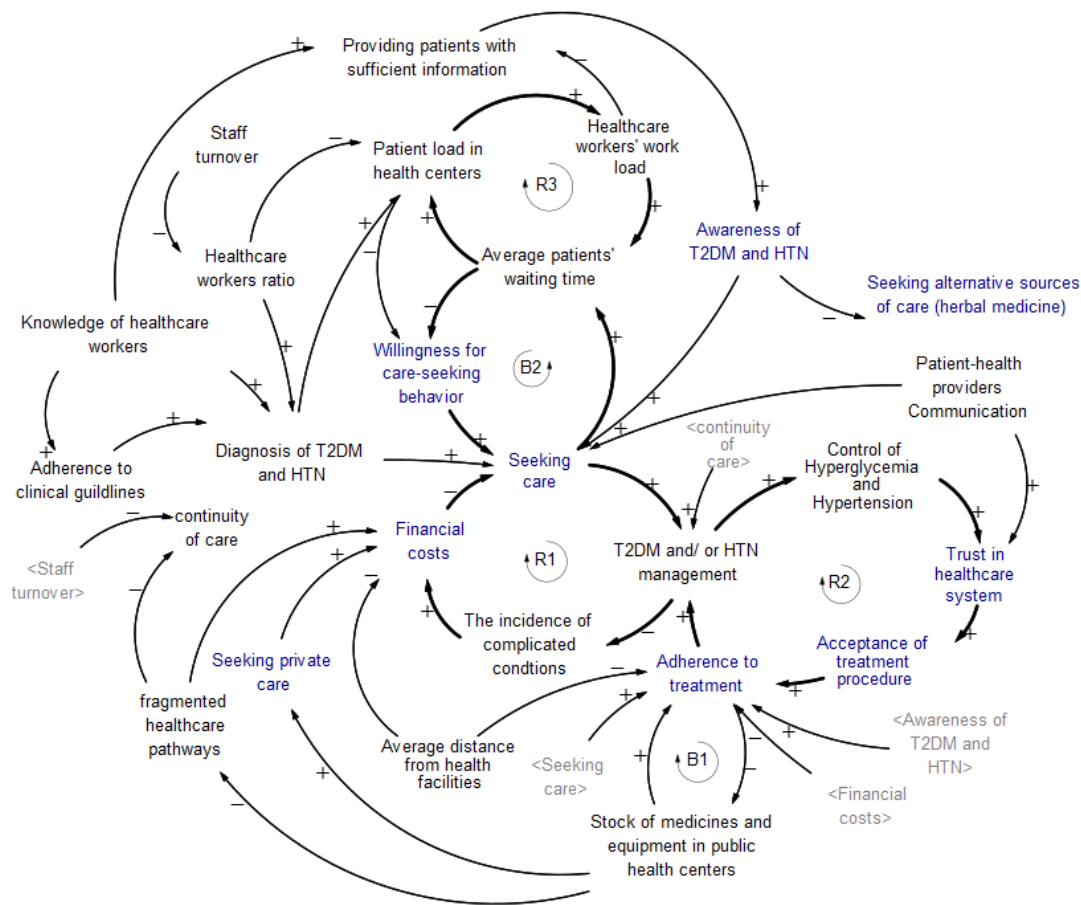


Figure 1. Conceptual CLD (the initial program theory) for the management of T2DM and HTN, showing the cause–effects relations between supply side (in black) and demand side (in navy blue) that create reinforcing (R) and balancing (B) feedback loops (tick arrows).

2.2. Second Phase: Search, Selection, Appraisal, Extraction of Evidence Regarding Programs for T2DM and HTN Management in LMICs

The following phases will be conducted according to Pawson and colleagues’ methodology for a realist review. Pawson and colleagues assert that the process of a realist review should be rigorous and transparent. However, a realist review is more iterative and could be more challenging from a methodological standpoint [17,20]. Thus, in order to make the process of the realist review in this study rigorous and transparent, the review will be reported according to the Realist And Meta-narrative Evidence Syntheses (RAMESES) standards [22,23].

2.2.1. Search for Studies

The search strategy will be developed with the assistance of an information specialist and using the combination of medical subject headings (MeSH) and keywords. A range of terms related to T2DM and HTN care such as “healthcare services”, “program”, “care model”, “type 2 diabetes”, “hypertension”, and their synonyms is searched. The search will be restricted to studies conducted in LMICs according to the World Bank. The electronic databases including MEDLINE (PubMed), the Cochrane Central Register of Control Trials (CENTRAL), Web of Science (Core collection), Embase will be searched. In addition, reference lists from reviewed publications, in order to identify further appropriate and relevant publications, will be searched. The search will include articles published in the last 10 years, from 2013 to 2023, and various types of studies, including descriptive studies, experimental and quasi-experimental studies such as randomized controlled trials (RCTs),

non-randomized controlled trials and controlled before and after studies, observational studies such as cross-sectional, qualitative and mixed methods and case studies.

2.2.2. Selection and Appraisal:

Studies with the following criteria will be included in the review:

The criteria for inclusion of studies in the review are mentioned here. A system level program targeting healthcare services for management of T2DM and/or HTN incorporating at least two components from WHO health system building blocks including health workforce, medical products, technologies, health information systems, leadership and governance, financing [24]. The program must be implemented in primary and secondary healthcare facilities. It must target adults with T2DM and/or HTN living in LMICs who receive health care services at the health facilities and from key stakeholders such as health-care professionals providing healthcare services at health facilities for T2DM and/or HTN in LMICs. People with conditions other than T2DM and/or HTN in LMICs, people who are not directly involved in T2DM and/or HTN care services at health facilities, and people from high-income countries (HICs) are excluded.

Moreover, the included evidence also must describe mechanisms. A mechanism is the interaction between the components of a program that determines a specific outcome in different LMIC contexts. Accordingly, we include descriptive studies, which describe mechanisms that lead to the management of T2DM and/or HTN. We also extract outcomes from analytical studies about the clinical effectiveness of programs (blood sugar and blood pressure control).

Next, the included evidence will be appraised before the extraction of data. In terms of the appraisal of the quality of, relevance and validity of research articles, we will use the Critical Appraisal Skills Program (CASP) checklist for each peer-reviewed study [25]. Two reviewers will be involved in the quality assessment. Any disagreements between the two reviewers will be discussed and resolved by consensus. When consensus cannot be reached, a third reviewer will support the process.

2.2.3. Extraction of Data

All literature will be exported to the reference manager Endnote X9 and then Covidence, where the duplicates are removed. The initial screening will be conducted based on the titles and abstracts. Then, full-text screening of extracted data will be assessed according to inclusion and exclusion criteria. Two independent authors will screen full texts to determine their eligibility for the inclusion criteria. The last author will assist in resolving any disagreement through a third review and after discussion with the review team. Studies which are in accordance with the inclusion and exclusion criteria will be included in the final list. Data will be exported to a Microsoft Excel 2022 spreadsheet. We will capture information on general study characteristics such as the title, authors, publication year, study setting, study period, study population, methods, types of programs, description of mechanisms, contexts and outcomes related to management of T2DM and HTN. More specifically, a study must describe at least two components representing different WHO health system building blocks so that we can extract the interactions between the components, denoted as mechanisms. (e.g., shifting of healthcare tasks to lay healthcare workers to address the shortage of physicians, the use of mobile health technologies for activities such as patient counseling and medication adherence to improve access). In addition, a study must identify outcomes (e.g., blood glucose and blood pressure control) and possibly the contexts (e.g., lay healthcare workers potentially understanding the cultural dynamics of a particular setting, the organizational dynamics of healthcare providers).

2.3. Analysis of Data and Development of the Middle Range Theory, i.e., a Revised CLD and then Validation through Group Model Building (GMB) Sessions

The data analysis will create the middle-range program theory to identify what works, for whom, how and under what circumstances. The eligible evidence will be examined to

find out how categorized programs and mechanisms related to the management of T2DM and HTN affect the cause–effects in the initial program theory. An iterative and explanatory approach to the synthesis of the data will be adopted. We will use a thematic synthesis of descriptive studies [26]. The middle-range program theory according to analysis and interpretation of the eligible literature will be drawn in the revised CLD.

The constructed CLD requires a validation to mitigate potential unconscious bias. Validation can be carried out through stakeholder dialogue, Group Model Building (GMB) sessions, and using secondary sources such as organization reports or policy documents [15]. Furthermore, the link between context and mechanisms and outcomes is essential for guiding policy makers in making effective and targeted decisions that enhance interventions [13]. Therefore, the modified CLD as a middle-range theory can be adapted in LMIC settings based on context-specific variations. The differences across countries may arise from socio-economic status, socio-demographic characteristics, political, cultural and organizational situations and other contextual factors. Considering the key relationship between context and mechanisms, Group Model Building (GMB) is an appropriate approach in various settings to adjust the theoretical CLD. GMB is a participatory and collaborative technique through actively engaging people in the modeling process [27]. The insights and feedback gained from participants during the sessions will adapt, refine and shape the causal loop diagram. In this study, we will validate and adapt the theoretical CLD through GMB sessions with key related stakeholders including healthcare professionals and patients with T2DM, HTN and both conditions in the context of Iran’s health system (Isfahan province).

3. Expected Results

This protocol describes the steps of a realist review to unpack the complexity of healthcare services’ provision for T2DM and HTN in LMICs. The combination of a realist review and CLD is an appropriate way to explore the complexity and dynamics of the management of non-communicable diseases. Adopting a holistic and systemic lens will enable us to obtain a rich understanding of the cause–effect drivers that impede or facilitated the control of T2DM and/or HTN by addressing questions on “how”, “why” and “under what circumstances”, according to Context–Mechanism–Outcome (CMO).

We will extract the components of a program, mechanisms resulting from the interaction of the program components, and the outcomes of the management of T2DM and HTN in different contexts in LMICs. We expect to have a categorization of the implemented programs in LMICs for both conditions (integrated T2DM and HTN programs) and specific programs for each condition. Furthermore, we will identify the commonalities and differences across the mechanisms, based on extracting the components linked to the WHO building blocks in various LMICs, and highlight the contextual variations. Particularly, we will capture the mechanisms that are likely to function similarly in different contexts. Thus, the similar patterns (causal mechanisms) across different LMIC settings will be characterized. We will then develop a refined CLD, which will include the mechanisms for effective (or ineffective) T2DM management, HTN management, and similar mechanisms for both conditions. The modified theoretical CLD will have the flexibility to be applied in different LMIC settings. Through participatory model building workshops involving key stakeholders, the model will be verified and adjusted based on the problem at hand and the variation in social, demographical, economic and cultural characteristics. In this study, the findings of the review will be adjusted in the context of Isfahan province, Iran, as a LMIC setting, through organizing GMB workshops where key stakeholders related to DM and HTN care will participate.

Author Contributions: Conceptualization, F.E., R.C., F.T. and D.C.M.; methodology, F.E., R.C. and D.C.; software, F.E.; formal analysis, F.E., R.C., F.T. and D.C.M.; investigation, F.E., R.C. and D.C.M.; resources, F.E., R.C. and D.C.M.; data curation, F.E.; writing—original draft preparation, F.E.; writing—review and editing, F.E., R.C., F.T., G.F. and D.C.M.; visualization, F.E.; supervision, F.T., G.F. and D.C.M.; project administration, F.E.; All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Informed Consent Statement: Informed consent will be obtained from all participants involved in the GMB workshops.

Data Availability Statement: Not applicable.

Acknowledgments: We acknowledge the support from Swiss Government Excellence Scholarships (FCS).

Conflicts of Interest: The authors declare no conflicts of interest.

Appendix A

Table A1. Studies on factors related to the management of diabetes and/or hypertension in LMICs.

Reference	Title	Target Condition	Study Setting	Study Type	Year
Bayked, Workneh and Kahissay, 2022 [28]	Sufferings of its consequences; patients with Type 2 diabetes mellitus in North-East Ethiopia, A qualitative investigation	Diabetes	Ethiopia	Qualitative study	2022
Beran, 2015 [29]	The Impact of Health Systems on Diabetes Care in Low and Lower Middle Income Countries	Diabetes	Low- and Lower Middle-Income Countries	Literature review	2015
Bhojani et al., 2013 [30]	Constraints faced by urban poor in managing diabetes care: patients' perspectives from South India	Diabetes	India	Qualitative study	2013
Birabwa, Bwambale, Waiswa and Mayega, 2019 [31]	Quality and barriers of outpatient diabetes care in rural health facilities in Uganda—a mixed methods study	Diabetes	Uganda	Qualitative study	2019
Chary et al., 2023 [32]	Qualitative study of pathways to care among adults with diabetes in rural Guatemala	Diabetes	Guatemala	Qualitative study	2023
Chukwuma, Gong, Latypova and Fraser-Hurt, 2019 [33]	Challenges and opportunities in the continuity of care for hypertension: a mixed-methods study embedded in a primary health care intervention in Tajikistan	Hypertension	Tajikistan	Mixed methods study	2019
Dekker, Amick, Scholcoff and Doobay-Persaud, 2017 [34]	A mixed-methods needs assessment of adult diabetes mellitus (type II) and hypertension care in Toledo, Belize	Diabetes and hypertension	Belize	Mixed methods study	2017
Fort et al., 2021 [35]	Hypertension in Guatemala's Public Primary Care System: A Needs Assessment Using the Health System Building Blocks Framework	Hypertension	Guatemala	Qualitative study	2021
Galson et al., 2023 [36]	Hypertension in an Emergency Department Population in Moshi, Tanzania; A Qualitative Study of Barriers to Hypertension Control	Hypertension	Tanzania	Qualitative study	2023
Gyawali, Ferrario, van Teijlingen and Kallestrup, 2016 [37]	Challenges in diabetes mellitus type 2 management in Nepal: a literature review	Diabetes	Nepal	Literature review	2016
Habebo et al., 2022 [38]	A Mixed Methods Multicenter Study on the Capabilities, Barriers, and Opportunities for Diabetes Screening and Management in the Public Health System of Southern Ethiopia	Diabetes	Ethiopia	Mixed methods study	2022
Kamvura et al., 2022 [39]	Barriers to the provision of non-communicable disease care in Zimbabwe: a qualitative study of primary health care nurses	Diabetes, hypertension, and depression	Zimbabwe	Qualitative study	2022
Karachaliou, Simatos and Simatou, 2020 [40]	The Challenges in the Development of Diabetes Prevention and Care Models in Low-Income Settings	Diabetes	Low-income countries	Literature review	2020
Kebede, Hailu, Kabeta and Mulugeta, 2023 [41]	Facilitators and barriers for early detection and management of type II diabetes and hypertension, Sidama Regional State, Ethiopia: a qualitative study	Diabetes and hypertension	Ethiopia	Qualitative study	2023

Table A1. Cont.

Reference	Title	Target Condition	Study Setting	Study Type	Year
Legido-Quigley et al., 2019 [42]	Patients' experiences on accessing health care services for management of hypertension in rural Bangladesh, Pakistan and Sri Lanka: A qualitative study	Hypertension	Bangladesh, Pakistan and Sri Lanka	Qualitative study	2019
Lewis and Newell, 2014 [43]	Patients' perspectives of care for type 2 diabetes in Bangladesh –a qualitative study	Diabetes	Bangladesh	Qualitative study	2014
Mendenhall and Norris, 2015 [44]	Diabetes care among urban women in Soweto, South Africa: a qualitative study	Diabetes	Soweto, South Africa	Qualitative study	2015
Mohseni et al., 2020 [45]	Challenges of managing diabetes in Iran: meta-synthesis of qualitative studies	Diabetes	Iran	Qualitative study	2020
Murphy, Chuma, Mathews, Steyn and Levitt, 2015 [46]	A qualitative study of the experiences of care and motivation for effective self-management among diabetic and hypertensive patients attending public sector primary health care services in South Africa	Diabetes and hypertension	South Africa	Qualitative study	2015
Musinguzi et al., 2018 [47]	Factors Influencing Compliance and Health Seeking Behaviour for Hypertension in Mukono and Buikwe in Uganda: A Qualitative Study	Hypertension	Uganda	Qualitative study	2018
Mwangome, Geubbels, Klatser and Dieleman, 2017 [48]	Perceptions on diabetes care provision among health providers in rural Tanzania: a qualitative study	Diabetes	Tanzania	Qualitative study	2017
Nang et al., 2019 [49]	Patients' and healthcare providers' perspectives of diabetes management in Cambodia: a qualitative study	Diabetes	Cambodia	Qualitative study	2019
Pati et al., 2021 [50]	Managing diabetes mellitus with comorbidities in primary healthcare facilities in urban settings: a qualitative study among physicians in Odisha, India	Diabetes with comorbidities	India	Qualitative study	2021
Pati, van den Akker, Schellevis, Sahoo and Burgers, 2023 [51]	Management of diabetes patients with comorbidity in primary care: a mixed-method study in Odisha, India	Diabetes with comorbidities	India	Mixed methods study	2023
Perera et al., 2019 [52]	Patient perspectives on hypertension management in health system of Sri Lanka: a qualitative study	Hypertension	Sri Lanka	Qualitative Study	2019
Quigley, Naheed, de Silva, Jehan and Samad, 2019 [42]	Patients' experiences on accessing health care services for management of hypertension in rural Bangladesh, Pakistan and Sri Lanka: A qualitative study	Hypertension	Bangladesh, Pakistan and Sri Lanka	Qualitative Study	2019
Sato et al., 2023 [53]	Patient trust and positive attitudes maximize non-communicable diseases management in rural Tanzania	hypertension (HTN), diabetes mellitus (DM), and HTN/DM comorbidity	Tanzania	Qualitative Study	2023
Sharma et al., 2023 [54]	Determinants of Treatment Adherence and Health Outcomes in Patients With Type 2 Diabetes and Hypertension in a Low-Income Urban Agglomerate in Delhi, India: A Qualitative Study	Diabetes and hypertension	India	Qualitative Study	2023
Vedanthan et al., 2016 [55]	Barriers and Facilitators to nurse Management of Hypertension: a Qualitative analysis from Western Kenya	Hypertension	Kenya	Qualitative Study	2016
Xiong et al., 2023 [56]	Factors associated with the uptake of national essential public health service package for hypertension and type-2 diabetes management in China's primary health care system: a mixed-methods study	Diabetes and hypertension	China	Mixed methods study	2023
Yan et al., 2017 [57]	Hypertension management in rural primary care facilities in Zambia: a mixed methods study	Hypertension	Zambia	Mixed methods study	2017
Chang et al., 2019 [58]	Challenges to hypertension and diabetes management in rural Uganda: a qualitative study with patients, village health team members, and health care professionals	Diabetes and hypertension	Uganda	Qualitative study	2019
Barquera et al., 2013 [59]	Diabetes in Mexico: cost and management of diabetes and its complications and challenges for health policy	Diabetes	Mexico	Literature review of quantitative data	2013

References

1. Magliano, D.J.; Boyko, E.J. *IDF Diabetes Atlas*; IDF: Brussels, Belgium, 2022.
2. Rahim, N.E.; Flood, D.; Marcus, M.E.; Theilmann, M.; Aung, T.N.; Agoudavi, K.; Aryal, K.K.; Bahendeka, S.; Bicaba, B.; Bovet, P. Diabetes risk and provision of diabetes prevention activities in 44 low-income and middle-income countries: A cross-sectional analysis of nationally representative, individual-level survey data. *Lancet Glob. Health* **2023**, *11*, e1576–e1586. [[CrossRef](#)] [[PubMed](#)]
3. Petrie, J.R.; Guzik, T.J.; Touyz, R.M. Diabetes, hypertension, and cardiovascular disease: Clinical insights and vascular mechanisms. *Can. J. Cardiol.* **2018**, *34*, 575–584. [[CrossRef](#)] [[PubMed](#)]
4. Campbell, N.R.; Lackland, D.T.; Niebylski, M.L. High blood pressure: Why prevention and control are urgent and important—A 2014 fact sheet from the World Hypertension League and the International Society of Hypertension. *J. Clin. Hypertens.* **2014**, *16*, 551. [[CrossRef](#)] [[PubMed](#)]
5. Lastra, G.; Syed, S.; Kurukulasuriya, L.R.; Manrique, C.; Sowers, J.R. Type 2 diabetes mellitus and hypertension: An update. *Endocrinol. Metab. Clin.* **2014**, *43*, 103–122. [[CrossRef](#)] [[PubMed](#)]
6. Geldsetzer, P.; Manne-Goehler, J.; Marcus, M.-E.; Ebert, C.; Zhumadilov, Z.; Wessch, C.S.; Tsabedze, L.; Supiyev, A.; Sturua, L.; Bahendeka, S.K. The state of hypertension care in 44 low-income and middle-income countries: A cross-sectional study of nationally representative individual-level data from 1·1 million adults. *Lancet* **2019**, *394*, 652–662. [[CrossRef](#)]
7. Shen, J.; Kondal, D.; Rubinstein, A.; Irazola, V.; Gutierrez, L.; Miranda, J.J.; Bernabé-Ortiz, A.; Lazo-Porras, M.; Levitt, N.; Steyn, K. A multiethnic study of pre-diabetes and diabetes in LMIC. *Glob. Heart* **2016**, *11*, 61–70. [[CrossRef](#)]
8. World Health Organization. *WHO Package of Essential Noncommunicable (PEN) Disease Interventions for Primary Health Care*; World Health Organization: Geneva, Switzerland, 2020.
9. Meadows, D.H. *Thinking in systems: A Primer*; Chelsea Green Publishing: Chelsea, VT, USA, 2008.
10. Monat, J.P.; Gannon, T.F. What is systems thinking? A review of selected literature plus recommendations. *Am. J. Syst. Sci.* **2015**, *4*, 11–26.
11. Kim, D.H. *Introduction to Systems Thinking*; Pegasus Communications: Waltham, MA, USA, 1999; Volume 16.
12. Lounsbury, D.W.; Hirsch, G.B.; Vega, C.; Schwartz, C.E. Understanding social forces involved in diabetes outcomes: A systems science approach to quality-of-life research. *Qual. Life Res.* **2014**, *23*, 959–969. [[CrossRef](#)]
13. Renmans, D.; Holvoet, N.; Criel, B. No mechanism without context: Strengthening the analysis of context in realist evaluations using causal loop diagramming. *New Dir. Eval.* **2020**, *2020*, 101–114. [[CrossRef](#)]
14. Rwashana, A.S.; Nakubulwa, S.; Nakakeeto-Kijjambu, M.; Adam, T. Advancing the application of systems thinking in health: Understanding the dynamics of neonatal mortality in Uganda. *Health Res. Policy Syst.* **2014**, *12*, 36. [[CrossRef](#)]
15. Cassidy, R.; Borghi, J.; Semwanga, A.R.; Binyaruka, P.; Singh, N.S.; Blanchet, K. How to do (or not to do)... using causal loop diagrams for health system research in low and middle-income settings. *Health Policy Plan.* **2022**, *37*, 1328–1336. [[CrossRef](#)]
16. Rycroft-Malone, J.; McCormack, B.; Hutchinson, A.M.; DeCorby, K.; Bucknall, T.K.; Kent, B.; Schultz, A.; Snelgrove-Clarke, E.; Stetler, C.B.; Titler, M. Realist synthesis: Illustrating the method for implementation research. *Implement. Sci.* **2012**, *7*, 33. [[CrossRef](#)]
17. Berg, R.C.; Nanavati, J. Realist review: Current practice and future prospects. *J. Res. Pract.* **2016**, *12*, R1.
18. Jagosh, J. Realist synthesis for public health: Building an ontologically deep understanding of how programs work, for whom, and in which contexts. *Annu. Rev. Public Health* **2019**, *40*, 361–372. [[CrossRef](#)]
19. Pawson, R.; Tilley, N. *Realistic Evaluation*; Sage: London, UK, 1997.
20. Pawson, R.; Greenhalgh, T.; Harvey, G.; Walshe, K. Realist synthesis—An introduction. *ESRC Res. Methods Program* **2004**, *2*, 55.
21. Pawson, R.; Greenhalgh, T.; Harvey, G.; Walshe, K. Realist review—a new method of systematic review designed for complex policy interventions. *J. Health Serv. Res. Policy* **2005**, *10* (Suppl. S1), 21–34. [[CrossRef](#)]
22. Greenhalgh, T.; Wong, G.; Westhorp, G.; Pawson, R. Protocol-realist and meta-narrative evidence synthesis: Evolving standards (RAMESES). *BMC Med. Res. Methodol.* **2011**, *11*, 115. [[CrossRef](#)]
23. Wong, G.; Greenhalgh, T.; Westhorp, G.; Buckingham, J.; Pawson, R. RAMESES publication standards: Realist syntheses. *BMC Med.* **2013**, *11*, 21. [[CrossRef](#)]
24. World Health, O. *Monitoring the Building Blocks of Health Systems: A Handbook of Indicators and Their Measurement Strategies*; World Health Organization: Geneva, Switzerland, 2010.
25. Zeng, X.; Zhang, Y.; Kwong, J.S.; Zhang, C.; Li, S.; Sun, F.; Niu, Y.; Du, L. The methodological quality assessment tools for preclinical and clinical studies, systematic review and meta-analysis, and clinical practice guideline: A systematic review. *J. Evid.-Based Med.* **2015**, *8*, 2–10. [[CrossRef](#)]
26. Thomas, J.; Harden, A. Methods for the thematic synthesis of qualitative research in systematic reviews. *BMC Med. Res. Methodol.* **2008**, *8*, 45. [[CrossRef](#)]
27. Hovmand, P.S.; Hovmand, P.S. *Group Model Building and Community-Based System Dynamics Process*; Springer: New York, NY, USA, 2014.
28. Bayked, E.M.; Workneh, B.D.; Kahissay, M.H. Sufferings of its consequences; patients with Type 2 diabetes mellitus in North-East Ethiopia, A qualitative investigation. *Heliyon* **2022**, *8*, e08871. [[CrossRef](#)]
29. Beran, D. The impact of health systems on diabetes care in low and lower middle income countries. *Curr. Diabetes Rep.* **2015**, *15*, 20. [[CrossRef](#)]

30. Bhojani, U.; Mishra, A.; Amruthavalli, S.; Devadasan, N.; Kolsteren, P.; De Henauw, S.; Criel, B. Constraints faced by urban poor in managing diabetes care: Patients' perspectives from South India. *Glob. Health Action* **2013**, *6*, 22258. [[CrossRef](#)]
31. Birabwa, C.; Bwambale, M.F.; Waiswa, P.; Mayega, R.W. Quality and barriers of outpatient diabetes care in rural health facilities in Uganda—A mixed methods study. *BMC Health Serv. Res.* **2019**, *19*, 706. [[CrossRef](#)]
32. Chary, A.N.; Nandi, M.; Flood, D.; Tschida, S.; Wilcox, K.; Kurschner, S.; Garcia, P.; Rohloff, P. Qualitative study of pathways to care among adults with diabetes in rural Guatemala. *BMJ Open* **2023**, *13*, e056913. [[CrossRef](#)]
33. Chukwuma, A.; Gong, E.; Latypova, M.; Fraser-Hurt, N. Challenges and opportunities in the continuity of care for hypertension: A mixed-methods study embedded in a primary health care intervention in Tajikistan. *BMC Health Serv. Res.* **2019**, *19*, 925. [[CrossRef](#)]
34. Dekker, A.M.; Amick, A.E.; Scholcoff, C.; Doobay-Persaud, A. A mixed-methods needs assessment of adult diabetes mellitus (type II) and hypertension care in Toledo, Belize. *BMC Health Serv. Res.* **2017**, *17*, 171. [[CrossRef](#)]
35. Fort, M.P.; Mundo, W.; Paniagua-Avila, A.; Cardona, S.; Figueroa, J.C.; Hernández-Galdamez, D.; Mansilla, K.; Peralta-García, A.; Roche, D.; Palacios, E.A. Hypertension in Guatemala's public primary care system: A needs assessment using the health system building blocks framework. *BMC Health Serv. Res.* **2021**, *21*, 908. [[CrossRef](#)]
36. Galson, S.W.; Pesambili, M.; Vissoci, J.R.N.; Manavalan, P.; Hertz, J.T.; Temu, G.; Staton, C.A.; Stanifer, J.W. Hypertension in an Emergency Department Population in Moshi, Tanzania; A Qualitative Study of Barriers to Hypertension Control. *PLoS ONE* **2023**, *18*, e0279377. [[CrossRef](#)]
37. Gyawali, B.; Ferrario, A.; van Teijlingen, E.; Kallestrup, P. Challenges in diabetes mellitus type 2 management in Nepal: A literature review. *Glob. Health Action* **2016**, *9*, 31704. [[CrossRef](#)] [[PubMed](#)]
38. Habebo, T.T.; Jaafaripooyan, E.; Mosadeghrad, A.M.; Foroushani, A.R.; Gebriel, S.Y.; Babore, G.O. A Mixed Methods Multicenter Study on the Capabilities, Barriers, and Opportunities for Diabetes Screening and Management in the Public Health System of Southern Ethiopia. *Diabetes Metab. Syndr. Obes. Targets Ther.* **2022**, *15*, 3679–3692. [[CrossRef](#)]
39. Kamvura, T.; Dambi, J.M.; Chiriseri, E.; Turner, J.; Verhey, R.; Chibanda, D. Barriers to the provision of non-communicable disease care in Zimbabwe: A qualitative study of primary health care nurses. *BMC Nurs.* **2022**, *21*, 64.
40. Karachaliou, F.; Simatos, G.; Simatou, A. The challenges in the development of diabetes prevention and care models in low-income settings. *Front. Endocrinol.* **2020**, *11*, 518. [[CrossRef](#)]
41. Kebede, T.; Hailu, D.; Kabeta, A.; Mulugeta, A. Facilitators and barriers for early detection and management of type II diabetes and hypertension, Sidama Regional State, Ethiopia. *Ethiop. J. Public Health Nutr.* **2023**, *6*, 29–41.
42. Legido-Quigley, H.; Naheed, A.; De Silva, H.A.; Jehan, I.; Haldane, V.; Cobb, B.; Tavajoh, S.; Chakma, N.; Kasturiratne, A.; Siddiqui, S. Patients' experiences on accessing health care services for management of hypertension in rural Bangladesh, Pakistan and Sri Lanka: A qualitative study. *PLoS ONE* **2019**, *14*, e0211100. [[CrossRef](#)]
43. Lewis, C.P.; Newell, J.N. Patients' perspectives of care for type 2 diabetes in Bangladesh—A qualitative study. *BMC Public Health* **2014**, *14*, 737. [[CrossRef](#)]
44. Mendenhall, E.; Norris, S.A. Diabetes care among urban women in Soweto, South Africa: A qualitative study. *BMC Public Health* **2015**, *15*, 1300. [[CrossRef](#)]
45. Mohseni, M.; Shams Ghoreishi, T.; Houshmandi, S.; Moosavi, A.; Azami-Aghdash, S.; Asgarlou, Z. Challenges of managing diabetes in Iran: Meta-synthesis of qualitative studies. *BMC Health Serv. Res.* **2020**, *20*, 534. [[CrossRef](#)]
46. Murphy, K.; Chuma, T.; Mathews, C.; Steyn, K.; Levitt, N. A qualitative study of the experiences of care and motivation for effective self-management among diabetic and hypertensive patients attending public sector primary health care services in South Africa. *BMC Health Serv. Res.* **2015**, *15*, 303. [[CrossRef](#)] [[PubMed](#)]
47. Musinguzi, G.; Anthierens, S.; Nuwaha, F.; Van Geertruyden, J.-P.; Wanyenze, R.K.; Bastiaens, H. Factors influencing compliance and health seeking behaviour for hypertension in Mukono and Buikwe in Uganda: A qualitative study. *Int. J. Hypertens.* **2018**, *2018*, 8307591. [[CrossRef](#)] [[PubMed](#)]
48. Mwangome, M.; Geubbels, E.; Klatser, P.; Dieleman, M. Perceptions on diabetes care provision among health providers in rural Tanzania: A qualitative study. *Health Policy Plan.* **2017**, *32*, 418–429. [[CrossRef](#)]
49. Nang, E.E.K.; Dary, C.; Hsu, L.Y.; Sor, S.; Saphonn, V.; Evdokimov, K. Patients' and healthcare providers' perspectives of diabetes management in Cambodia: A qualitative study. *BMJ Open* **2019**, *9*, e032578. [[CrossRef](#)]
50. Pati, S.; Pati, S.; van den Akker, M.; Schellevis, F.G.; Sahoo, K.C.; Burgers, J.S. Managing diabetes mellitus with comorbidities in primary healthcare facilities in urban settings: A qualitative study among physicians in Odisha, India. *BMC Fam. Pract.* **2021**, *22*, 99. [[CrossRef](#)]
51. Pati, S.; van den Akker, M.; Schellevis, F.G.; Sahoo, K.C.; Burgers, J.S. Management of diabetes patients with comorbidity in primary care: A mixed-method study in Odisha, India. *Fam. Pract.* **2023**, *40*, cma144. [[CrossRef](#)]
52. Perera, M.; de Silva, C.K.; Tavajoh, S.; Kasturiratne, A.; Luke, N.V.; Ediriweera, D.S.; Ranasinha, C.D.; Legido-Quigley, H.; de Silva, H.A.; Jafar, T.H. Patient perspectives on hypertension management in health system of Sri Lanka: A qualitative study. *BMJ Open* **2019**, *9*, e031773. [[CrossRef](#)]
53. Sato, H.; Nakamura, K.; Kibusi, S.; Seino, K.; Maro, I.I.; Tashiro, Y.; Bintabara, D.; Shayo, F.K.; Miyashita, A.; Ohnishi, M. Patient trust and positive attitudes maximize non-communicable diseases management in rural Tanzania. *Health Promot. Int.* **2023**, *38*, daad007. [[CrossRef](#)]

54. Sharma, N.; Mariam, W.; Basu, S.; Shrivastava, R.; Rao, S.; Sharma, P.; Garg, S.; Mariam, W. Determinants of Treatment Adherence and Health Outcomes in Patients With Type 2 Diabetes and Hypertension in a Low-Income Urban Agglomerate in Delhi, India: A Qualitative Study. *Cureus* **2023**, *15*, e34826. [[CrossRef](#)]
55. Vedanthan, R.; Tuikong, N.; Kofler, C.; Blank, E.; Kamano, J.H.; Naanyu, V.; Kimaiyo, S.; Inui, T.S.; Horowitz, C.R.; Fuster, V. Barriers and facilitators to nurse management of hypertension: A qualitative analysis from western Kenya. *Ethn. Dis.* **2016**, *26*, 315. [[CrossRef](#)] [[PubMed](#)]
56. Xiong, S.; Jiang, W.; Meng, R.; Hu, C.; Liao, H.; Wang, Y.; Cai, C.; Zhang, X.; Ye, P.; Ma, Y. Factors associated with the uptake of national essential public health service package for hypertension and type-2 diabetes management in China's primary health care system: A mixed-methods study. *Lancet Reg. Health–West. Pac.* **2023**, *31*, 100664. [[CrossRef](#)] [[PubMed](#)]
57. Yan, L.D.; Chirwa, C.; Chi, B.H.; Bosomprah, S.; Sindano, N.; Mwanza, M.; Musatwe, D.; Mulenga, M.; Chilengi, R. Hypertension management in rural primary care facilities in Zambia: A mixed methods study. *BMC Health Serv. Res.* **2017**, *17*, 111. [[CrossRef](#)] [[PubMed](#)]
58. Chang, H.; Hawley, N.L.; Kalyesubula, R.; Siddharthan, T.; Checkley, W.; Knauf, F.; Rabin, T.L. Challenges to hypertension and diabetes management in rural Uganda: A qualitative study with patients, village health team members, and health care professionals. *Int. J. Equity Health* **2019**, *18*, 38. [[CrossRef](#)] [[PubMed](#)]
59. Barquera, S.; Campos-Nonato, I.; Aguilar-Salinas, C.; Lopez-Ridaura, R.; Arredondo, A.; Rivera-Dommarco, J. Diabetes in Mexico: Cost and management of diabetes and its complications and challenges for health policy. *Glob. Health* **2013**, *9*, 3. [[CrossRef](#)] [[PubMed](#)]

Disclaimer/Publisher's Note: The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.