People with Hypertension and Type II Diabetes Mellitus in Indonesia: A Scoping Review

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Abstract. Type 2 Diabetes Mellitus (T2DM) with comorbid hypertension represents one of the major public health challenges in Indonesia. The high prevalence, complications, and unequal access to healthcare services highlight the need for a comprehensive synthesis of scientific evidence. This study aimed to identify, synthesize, and map existing research evidence on the management of T2DM with hypertension in Indonesia, including associated risk factors, intervention strategies, and policy implications. A scoping review design was employed following the PRISMA-ScR framework. Literature searches were conducted across three international databases PubMed (50 articles), ScienceDirect (125 articles), and ProQuest (107 articles) covering publications from 2014 to 2024. The search strategy used the keywords: People AND Hypertension AND Type II Diabetes Mellitus AND Indonesia. Article selection adhered to PICOS criteria (Population, Intervention, Comparison, Outcomes, Study design). Out of 282 records identified, 24 studies met the inclusion criteria for full analysis. Thematic synthesis revealed five key themes: clinical profiles, complications, and economic burden of T2DM-hypertension; risk factors, socioeconomic status, and lifestyle determinants; clinical interventions, digital health innovations, and m-Health applications; disparities in primary healthcare access and the role of health professionals; and patient perceptions, doctor–patient communication, and cultural influences. Technology-based and community-driven interventions demonstrated promising outcomes in improving treatment adherence and glycemic control. In conclusion, strengthening primary care integration, promoting digital health–supported screening and monitoring, and adopting holistic, culturally sensitive approaches are crucial to optimizing chronic disease management in Indonesia. Future research should explore the effectiveness of community-based digital care models for long-term management of T2DM with hypertension.

H. Saptaningtyas et al. (eds.), *Proceedings of the 4th International Conference on Multidisciplinary Studies 2025 (ICOMSI 2025)*, Advances in Social Science, Education and Humanities Research 1012,
https://doi.org/10.2991/978-2-38476-571-3_27

Keywords: people; hypertension; type II diabetes mellitus; indonesia; scoping review.

1 Introduction

Hypertension and Type 2 Diabetes Mellitus (T2DM) are among the most prevalent non-communicable diseases (NCDs) globally and constitute major contributors to mortality and morbidity due to cardiovascular disease, stroke, renal failure, and other complications. Worldwide, hypertension affects hundreds of millions of adults and remains a leading risk factor for heart disease and stroke [1]. At the same time, the prevalence of T2DM continues to rise, with tens of millions of adults currently living with diabetes a number projected to increase steadily in the coming decades. It is estimated that there were approximately 445 million people with T2DM in 2020, with projections reaching 730 million by 2050 if the current prevalence trend persists [2].

In Indonesia, national survey data have shown a consistent increase in the prevalence of these conditions over recent years. The 2018 Basic Health Research Report (RISKESDAS) recorded a higher prevalence of hypertension compared with previous surveys, indicating that measured hypertension among adults aged ≥18 years reached 34.1%, up from 25.8% in 2013. Similarly, the proportion of diabetes cases many of which remain clinically undiagnosed has also risen, with blood glucose based diabetes prevalence increasing from 6.9% in 2013 to 8.5% in 2018 [3]. These figures suggest persistent challenges in disease detection, treatment, and control at the population level. Contributing risk factors, such as rapid urbanization, high-calorie and high-sodium diets, obesity, and sedentary lifestyles, further exacerbate these trends.

The coexistence of hypertension and T2DM as comorbid conditions is common. Their combination synergistically amplifies cardiovascular risk, with individuals suffering from both disorders facing a substantially higher likelihood of coronary heart disease, stroke, and chronic kidney disease compared with those affected by only one condition [4–7]. This epidemiological and pathophysiological interrelationship underscores the importance of mapping existing evidence on the prevalence, risk factors, management, and health outcomes among populations experiencing both diseases, particularly to inform healthcare planning and preventive policy.

Given the magnitude and complexity of the problem including high prevalence, comorbidity, gaps in detection and control, and underlying socio-environmental determinants a comprehensive evidence-mapping review (scoping review) is warranted. This review aims to identify, synthesize, and map existing research on the management of T2DM with hypertension among adults in Indonesia, encompassing risk factors, interventions, and health policy implications. The findings are expected to provide an evidence base for researchers, clinicians, and policymakers in developing integrated strategies for prevention, early detection, and comprehensive management of these co-existing conditions in Indonesia.

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2 Methods

2.1 Study Design

This study employed a scoping review design, structured according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines. This approach was selected to comprehensively map the available scientific evidence related to individuals with hypertension and Type 2 Diabetes Mellitus (T2DM) in Indonesia, encompassing aspects of prevalence, risk factors, management strategies, and their impact on quality of life.

2.2 Literature Search Strategy.

A systematic literature search was conducted across three major international databases PubMed, ScienceDirect, and ProQuest to identify relevant studies. The search included publications from January 2014 to June 2024, capturing a decade of recent evidence. Boolean operators were used to refine the search strategy with the following combination of keywords: “People” AND “Hypertension” AND “Type II Diabetes Mellitus” AND “Indonesia.”

The initial search yielded 282 articles across the three databases. After removing 35 duplicates, a total of 247 unique articles remained for title and abstract screening. Of these, 172 articles were excluded for not being relevant to the research topic. The full texts of 75 articles were then assessed for eligibility, and 51 articles were excluded for failing to meet the inclusion criteria. Ultimately, 24 studies fulfilled the inclusion criteria and were included in the evidence synthesis and mapping process, in accordance with the PRISMA-ScR (2020) framework. The study selection process is illustrated in Figure 1.

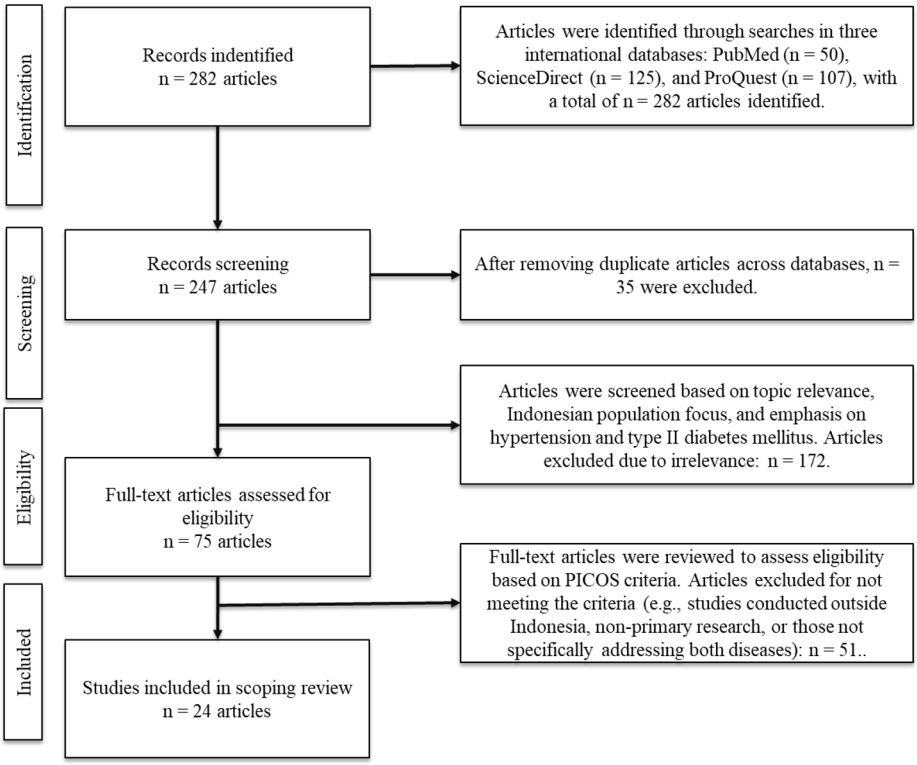

Fig. 1. PRISMA-ScR Flow Diagram of the Study Selection Process

2.3 Eligibility Criteria

The selection of articles followed the PICOS framework (Population, Intervention, Comparison, Outcomes, Study design), defined as follows:

Population (P): Adult individuals in Indonesia diagnosed with hypertension and/or Type 2 Diabetes Mellitus (T2DM).

Intervention (I): Clinical, behavioral, or health policy interventions related to the management of hypertension and diabetes.

Comparison (C): Not mandatory, but when available, comparisons were made with populations without hypertension/diabetes or between different intervention types.

Outcomes (O): Prevalence, risk factors, quality of life, complications, disease control, or intervention effectiveness.

Study Design (S): Primary quantitative or qualitative studies, systematic reviews, and relevant observational or analytical cohort studies.

Articles were excluded if they did not focus on the Indonesian population, were not available in English or Indonesian, or were non-research publications (e.g., editorials, brief reports, or conference abstracts).

2.4 Study Selection and Data Extraction

The article selection process was conducted in three stages: Initial screening of titles and abstracts to exclude irrelevant studies; Full-text review to confirm eligibility based on inclusion criteria; Systematic data extraction from eligible studies using a standardized extraction sheet, capturing information such as author(s), year of publication, objectives, study design, population characteristics, key variables, findings, and conclusions. Out of 282 identified articles, 24 studies met the inclusion criteria and were included for further analysis. The detailed selection process is presented in the PRISMA-ScR flow diagram, which summarizes the number of records screened, assessed, and included at each stage.

2.5 Data Analysis

Data from the included studies were analyzed descriptively and thematically to identify research foci, methodological approaches, main findings, and evidence gaps. Thematic synthesis highlighted key trends in research related to prevalence patterns, risk factors, management strategies, and policy implications for hypertension and diabetes control in Indonesia. This approach provided an integrated understanding of the current state of knowledge and areas requiring further investigation.

3 Results

Table 1. Summary of PICOS Criteria for Included Studies

No	Author(s), Tahun	Judul Artikel	P (Population)	I (Intervention/Exposure)	C (Comparison)	O (Outcome)	S (Study Design)
1	Soeatmadji et al., 2021	Clinicodemographic Profile and Outcomes of Type 2 Diabetes Mellitus in the Indonesian Cohort of DISCOVER: A 3-Year Prospective Cohort Study	Adult patients (≥18 years) diagnosed with Type 2 Diabetes Mellitus (T2DM) in Indonesia who initiated second-line glucose-lowering therapy, either as an add-on or a switch from first-line treatment. Recruitment was conducted across 13 clinical sites—comprising hospitals and public healthcare facilities—representing primary, secondary, and tertiary care levels in eight provinces. The total sample included 221 patients.	No randomized intervention was applied; the study employed a prospective observational cohort design. The analyzed "exposures" included second-line glucose-lowering therapies (types and combinations of medications), treatment modifications during follow-up, as well as comorbid factors (hypertension, hyperlipidemia) and clinical characteristics such as BMI, disease duration, HbA1c levels, and lipid profile.	Comparisons were conducted across time points (baseline and follow-ups at 6, 12, 24, and 36 months) within the same cohort, as well as between subgroups of patients with and without comorbidities or differing levels of glycemic control. No external or untreated control group was included, as all participants received diabetes treatment.	- Reduction in HbA1c, fasting blood glucose (FBG), and postprandial glucose (PPG) levels over a 36-month period; - Prevalence of microvascular complications (peripheral neuropathy, albuminuria, chronic kidney disease) and macrovascular complications (coronary artery disease, heart failure, etc.); - Changes in therapy (transition from monotherapy to combination therapy, or switching treatment lines); - Other clinical parameters, including BMI, blood pressure, and lipid profile.	A multicenter prospective cohort study with a 3-year (36-month) follow-up, collecting clinical data from 13 sites across Indonesia. Descriptive analyses and repeated measures comparisons were conducted, along with evaluations of the prevalence of complications.

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2	Mulyanto et al., 2020	Socioeconomic inequalities in the utilisation of hypertension and type 2 diabetes management services in Indonesia	Adult respondents (aged ≥15 years) from the Indonesia Family Life Survey (IFLS-5) conducted in 2014–2015. The sample included 30,351 individuals diagnosed with hypertension and/or type 2 diabetes mellitus, based on interview data, blood pressure measurements, and blood glucose tests.	Socioeconomic status (SES) was measured using household income and education level as the main exposure variables. The analysis also included healthcare access and utilization indicators, such as physician visits, use of antihypertensive and antidiabetic medications, and frequency of routine medical check-ups.	Comparisons were made between groups with high versus low socioeconomic status, higher versus lower education levels, and higher versus lower household income.	Level of healthcare utilization for hypertension and T2DM management (clinic visits, medication use, laboratory testing). Socioeconomic inequalities in access to and use of healthcare services were assessed using the concentration index (CI) and multivariate logistic regression. Main findings indicated that individuals with higher SES were more likely to receive proper diagnosis, treatment, and disease control compared to those with lower SES	A cross-sectional study using secondary data from IFLS-5 (nationally representative). Statistical analyses included logistic regression and concentration index calculations to assess socioeconomic inequalities.
3	Sasongko et al., 2020	Prevalence of Diabetic Retinopathy and Blindness in Indonesian Adults with Type 2 Diabetes	Adult Indonesians diagnosed with type 2 diabetes mellitus (T2DM) enrolled from 13 major hospitals across Indonesia (Jakarta, Bandung, Medan, Surabaya, Makassar, and other large cities).	T No intervention. Observational study where exposures included duration of diabetes, HbA1c levels, hypertension, body mass index (BMI), and insulin treatment	Comparisons were made between: - Patients with and without diabetic retinopathy (DR). - Patients with and without blindness. Additional analyses	- Prevalence of diabetic retinopathy (DR): 43.1% - Prevalence of blindness: 4.2% - Significant risk factors: longer diabetes duration,	Cross-sectional, multicenter hospital-based study. Fundus examinations were performed by certified ophthalmologists. Statistical analyses included chi-square tests and logistic regression to identify risk factors

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			Total participants: 1,077 T2DM patients.	status as potential risk factors for diabetic retinopathy (DR).	compared the severity of DR between non-proliferative and proliferative categories	HbA1c ≥7%, hypertension, and insulin use ($p < 0.05$) - DR prevalence increased significantly among patients with diabetes duration >10 years	for diabetic retinopathy (DR) and blindness.
4	Kamilah et al., 2019	Analysis of the Determinants of Diabetes Mellitus in Indonesia: A Case Study of the 2014 Indonesia Family Life Survei	Individuals aged ≥14 years in Indonesia who participated in the Indonesia Family Life Survey (IFLS-5), wave 2014. Sample size: 34,257 respondents.	Exposures included risk factors such as obesity, hypertension, and sleep quality, along with socioeconomic variables including age, education level, household income, marital status, and residence location (urban/rural).	Comparisons were made between exposure groups: - Individuals **with vs. without obesity** - Individuals **with vs. without hypertension** - Individuals with **good vs. poor sleep quality** - **Socioeconomic groups** with differing characteristics: **higher vs. lower education**, **higher vs. lower income**, and **urban vs. rural residence**	Outcome: Occurrence of diabetes mellitus, measured based on self-reported diagnosis in the IFLS dataset, and the association between risk factors and the probability of having diabetes.	Desain studi: Cross-sectional study menggunakan data sekunder IFLS-5 (2014). Analisis statistik: Regresi logistik multivariat digunakan untuk mengidentifikasi faktor-faktor determinan diabetes melitus tipe 2 di populasi Indonesia.
5	Rusdiana et al., 2019	The Assessment Metabolic Markers and Cardio Risk Index Among Controlled and Uncontrolled Type 2 Diabetic Patients in Medan City,	Adult patients diagnosed with Type 2 Diabetes Mellitus (T2DM) were recruited from primary	S Glycemic control status was categorized into controlled and uncontrolled groups based on HbA1c levels. Exposure measurements	Perbandingan antara dua kelompok kontrol glikemik (terkontrol dengan tak terkontrol) dalam hal nilai rata-rata	- Comparison of mean values of FBS, HbA1c, triglycerides, HDL, LDL, total cholesterol, and the	An analytical cross-sectional study utilizing clinical and laboratory data from T2DM patients in primary healthcare fa-

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		North Sumatera, Indonesia: Cross-sectional Study	healthcare clinics in Medan City, including facilities in Binjai and Stabat, North Sumatra Province, Indonesia. Data were collected between May and July 2020. A total of 131 patients participated in the study, comprising 57 individuals with controlled T2DM and 74 with uncontrolled T2DM.	included metabolic markers such as fasting blood glucose (FBG), HbA1c, lipid profile (triglycerides, HDL, LDL, and total cholesterol), waist circumference, and cardiovascular risk index (calculated as the LDL/HDL ratio). Demographic and clinical variables such as age, sex, disease duration, and family history of diabetes were also assessed.	marker metabolik dan rasio risiko kardio. Tidak ada intervensi eksternal/kontrol non-DM.	cardio risk index ratio between controlled and uncontrolled groups. - Correlation analysis between the cardio risk index ratio and metabolic markers (cholesterol, HDL, triglycerides, LDL) within each group. - Identification of whether uncontrolled patients exhibited a higher cardiovascular risk based on these metabolic indicators.	cilities. Statistical analyses included mean comparison tests and Pearson or Spearman correlation analyses, depending on data distribution.
6	Amelia et al., 2018	Predictors of Retinopathy in Type 2 Diabetes Mellitus in Medan, North Sumatera, Indonesia	Eighty-nine patients with Type 2 Diabetes Mellitus (T2DM) attending primary healthcare facilities in Medan, North Sumatra, were included in the study, consisting of 60 patients without retinopathy and 29 patients with retinopathy.	Laboratory examinations included measurements of blood glucose level (BGL), HbA1c, lipid profile, apolipoprotein-A1 (Apo-A1), vitamin D, and albuminuria (albumin-to-creatinine ratio, ACR).	Comparisons were made between patients with and without diabetic retinopathy (DR).	The study aimed to identify predictors of diabetic retinopathy (DR) among patients with T2DM. Blood glucose level (BGL), total cholesterol (TC), and albumin-to-creatinine ratio (ACR) were identified as strong predictors, while hypertension, LDL-C, and triglycerides were found to be weaker predictors.	An analytical cross-sectional study employing both bivariate and multivariate analyses using logistic regression tests.

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7	WIdayanti et al., 2020	Lay perceptions and illness experiences of people with type 2 diabetes in Indonesia: a qualitative study	Forty-five individuals diagnosed with Type 2 Diabetes Mellitus (T2DM) from two provinces outside Java Island—East Nusa Tenggara and West Sumatra—participated in the study. Data were collected through focus group discussions (FGDs).	No clinical intervention was conducted. This qualitative study explored participants' personal perceptions of the disease, local cultural contexts, lived experiences with diabetes, and the ways in which social and cultural environments influence patients' understanding and health-related behaviors.	No formal comparison group was established due to the qualitative design. Instead, implicit comparisons were made across participants' narratives—for example, between those employing "normalization" versus "resignation to God" coping strategies, or between individuals who perceived the illness as "beyond control" and those who viewed it differently.	Thematic analysis identified several key categories of perceptions and experiences: - **Understanding of illness** shaped by personal experiences and cultural identity. - **Coping strategies**, including viewing the disease as "beyond control," "normalizing the condition," or "resignation to God." - **Impact of perceptions** on treatment acceptance, therapeutic adherence, and attitudes toward disease management. - **Cultural and local barriers** influencing dietary changes and lifestyle modification.	A qualitative study employing six focus group discussions (FGDs) conducted across several districts in East Nusa Tenggara and West Sumatra provinces. Data were analyzed using inductive qualitative content analysis.
8	Prihatin Putri et al., 2021	Integrated Diabetes Self-Management (IDSM) mobile app to improve self-management and glycemic control among patients with Type 2 Diabetes Mellitus (T2DM) in	Participants included patients with Type 2 Diabetes Mellitus (≥21 years old, diagnosed for at least one year, and enrolled in	The intervention involved the use of the Integrated Diabetes Self-Management (IDSM) Android application, combined with an educational module, family and	A non-equivalent control group design was used, in which control participants did not use the application but received communication via a WhatsApp	Improvement in patients' self-management behaviors (measured using the IDNDSMI 35 instrument) and glycemic control (HbA1c)	An exploratory sequential mixed-methods study protocol consisting of three phases: (1) a qualitative phase (focus group discussions and in-depth interviews) to explore

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		Indonesia: A mixed methods study protocol	the PROLANIS program), family members, and healthcare providers (nurses, physicians, and BPJS officers) from community health centers (Puskesmas) in Yogyakarta. All participants were required to own and be able to operate an Android smartphone.	nurse engagement, user support and training, and continuous monitoring through the application over a three-month period.	group and an educational module. Comparisons were made within and between the intervention and control groups before and after the intervention.	served as the primary outcomes. Secondary measures included application usability, user satisfaction, and feedback collected after three months of use.	user needs; (2) application development and usability testing using heuristic evaluation and the think-aloud method; and (3) a quantitative pre–post study with a non-equivalent control group conducted in primary health centers over a three-month period.
9	Nopitasari et al., 2019	The Effect of Self-Care on Clinical Outcome of Outpatient Diabetes Mellitus Type 2 in Regional General Hospital West Nusa Tenggara Province	Outpatient individuals with Type 2 Diabetes Mellitus (T2DM) from the Regional General Hospital of West Nusa Tenggara Province, Indonesia, participated in the study. The total number of respondents was 34 patients.	Patients' self-care levels were assessed using the Summary of Diabetes Self-Care Activities (SDSCA) instrument, which evaluates key domains such as diet, physical activity, medication adherence, foot care, and blood glucose monitoring, among others.	There was no external control group; comparisons were made among individuals based on variations in their self-care levels. For example, patients with good self-care were compared to those with poor self-care to examine differences in clinical outcomes.	Clinical outcomes measured included Fasting Blood Glucose (FBG), 2-hour Postprandial Blood Glucose (2h-PPG), Random Blood Glucose, and HbA1c, along with their correlations to self-care levels and dietary factors. The study found that the dietary component of self-care had a significant effect on FBG ($p = 0.012$) and revealed a positive correlation between overall self-care levels and HbA1c ($r = 0.254$, $p = 0.023$).	This study employed an observational analytic cross-sectional design. Data were collected using the Summary of Diabetes Self-Care Activities (SDSCA) questionnaire. Statistical analyses included linear regression and correlation tests to examine associations between self-care behaviors and clinical outcomes. The research was conducted at a single hospital (Regional General Hospital) in West Nusa Tenggara Province, Indonesia, over a relatively short data collection period.

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10	Wibowo et al., 2018	An evaluation of community pharmacy-based services for type 2 diabetes in an Indonesian setting	Patients with Type 2 Diabetes Mellitus (T2DM) who visited community pharmacies in Surabaya, Indonesia, participated in the study. Eligible participants were adults aged ≥18 years who were currently using oral antidiabetic medications. The total sample consisted of 196 patients.	The study assessed utilization of community pharmacy services, including medication dispensing, patient education on drug use and side effects, instructions for proper administration and storage, and adherence monitoring. Exposures also included patient characteristics such as income level, occupation, glycemic control, and prior experience with pharmacy services.	No formal control group was included; comparisons were made across patient subgroups—for example, high versus low income, presence versus absence of complication risk factors, or poor/unknown versus good glycemic control. Differences in perceptions of pharmacy services were analyzed according to these patient characteristics.	- Utilization of pharmacy services: e.g., the proportion of patients receiving medication counseling, instructions, and guidance on drug storage. - Patient perceptions of pharmacists' roles beyond dispensing, including education and treatment monitoring. - Patient priorities regarding the types of services they value most in community pharmacies. - Patient characteristics associated with support for expanding the pharmacist's role.	Cross-sectional quantitative survey using patient questionnaires, conducted across 10 community pharmacies in Surabaya, with each pharmacy recruiting approximately 20 eligible patients. Statistical analysis included logistic regression to examine patient characteristics associated with their perceptions of pharmacy services.
11	Sulistiowati et al., 2019	Development of a Validated Diabetes Risk Chart as a Simple Tool to Predict Onset of Diabetes in Bogor, INdonesia	Non-diabetic respondents aged 25–60 years from five villages in Bogor Regency/City, West Java, Indonesia, totaling 4,418 individuals. This cohort	Non-invasive risk factors included age, general obesity (body mass index), central obesity (waist circumference), hypertension, and physical activity. Data were	Comparisons were made between individuals with and without each risk factor, as well as longitudinally across follow-up intervals (2, 4, and 6 years) to identify participants	- Cumulative incidence of type 2 diabetes (T2DM) over 6 years: approximately 17.9%. - Validation of the "Bogor Diabetes Risk Prediction	Prospective cohort study using secondary data from the "Bogor Cohort Study of Risk Factors for Non-Communicable Diseases (BCSRFNCD)," with four follow-up assessments at years 0, 2, 4, and 6.

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			study followed participants over a six-year period.	collected through interviews, physical examinations, and blood lipid tests.	who developed type 2 diabetes mellitus (both diagnosed and previously undiagnosed cases).	(BDRP) chart" showing: sensitivity 76.6%, specificity 50.3%, positive predictive value (PPV) 21.6%, and negative predictive value (NPV) 92.3%. - Area under the ROC curve (AUC) ≈ 0.70 (95% CI: 0.675–0.721), indicating moderate predictive utility of the tool.	Statistical analyses included multivariate logistic regression and ROC curve analysis.
12	Budiastutik et al., 2019	High Prevalence of Prediabetes and Associated Risk Factors in Urban Areas of Pontianak, Indonesia: A Cross-Sectional Study	Adults aged >30 years from five urban subdistricts in Pontianak, West Kalimantan, Indonesia. Of 506 individuals screened, 246 met the inclusion criteria (not pregnant, no chronic diseases other than hypertension, gout, or elevated cholesterol, and not using antidiabetic medications).	Potential risk factors assessed included age, sex, education level, household income, health insurance ownership, smoking habits, history of hypertension, gout, elevated cholesterol, weekly physical activity frequency, and diabetes-related knowledge or education. Clinical measurements included blood pressure (systolic and diastolic) and body mass index (BMI).	Comparisons were made between participants with and without prediabetes, as well as across subgroups such as sex, health insurance ownership, and history of hypertension. Participants in the highest versus lowest categories of exposure variables were compared with respect to prediabetes outcomes.	- Prediabetes prevalence: 76.4% among eligible participants. - Significant correlations observed between age and BMI with prediabetes incidence (Spearman's rho). - Significant risk factors in multivariate analysis: health insurance ownership (OR ≈ 5.956), history of hypertension (OR ≈	Community-based cross-sectional study conducted from February to April 2021. Data were collected using structured questionnaires, physical measurements, and laboratory tests (fasting blood glucose, FBG). Statistical analyses included chi-square tests, Spearman's rho correlation, and multivariate logistic regression. Community-based cross-sectional study conducted from February to April 2021. Data were collected using

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						3.257), and elevated systolic blood pressure (OR ≈ 2.141) for prediabetes.	structured questionnaires, physical measurements, and laboratory tests (fasting blood glucose, FBG). Statistical analyses included chi-square tests, Spearman's rho correlation, and multivariate logistic regression.
13	Siregar et al., 2020	Identifying Adult Population at Risk for Undiagnosed Diabetes Mellitus in Medan City Indonesia Targeted on Diabetes Prevention	Adult individuals aged 30–75 years in Medan City, North Sumatra, Indonesia. Total sample size: 300 participants.	Risk assessment was conducted using the Finnish Diabetes Risk Score (FINDRISC) questionnaire and anthropometric measurements (weight, height, and waist circumference) as risk factors. All participants also underwent a fasting Oral Glucose Tolerance Test (OGTT)..	Comparisons were made across different risk levels based on the FINDRISC scores (low, moderate, high). OGTT results were compared between participants classified as high-risk versus those in the low-to-moderate risk categories.	- Proportion of participants classified as low, moderate, and high risk according to FINDRISC. - OGTT outcome categories: normal, prediabetes, or previously undiagnosed diabetes. - Risk factors significantly associated with OGTT results, including age, BMI, central obesity, fruit and vegetable intake, physical activity, hypertension, history of hyperglycemia, and family history of diabetes.	Observational cross-sectional study; risk survey and glucose testing (OGTT) conducted from July to October 2020 across six sub-districts in Medan using purposive sampling. Statistical analyses included frequency distribution, chi-square tests to examine associations between risk categories and OGTT outcomes, and descriptive statistics.

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14	Fatmawati et al., 2020	Development of cognitive behavior therapy apps for depression management in DM2 patients type II	Adults with Type 2 Diabetes Mellitus (T2DM) experiencing depressive symptoms were the target population for the proposed CBT-based application model. This work is a literature review and application development study, not an empirical interventional study involving patients.	Development of an Android-based Cognitive Behavioral Therapy (CBT) application aimed at managing depression in patients with T2DM. The exposure includes the proposed use of the CBT app and its features, informed by a literature review, covering types of CBT interventions, app functionalities, and usability aspects.	There was no control or comparison group in this study, as it focused on the development and modeling stage rather than conducting a clinical or empirical evaluation with users.	The literature review and synthesis identified key themes for the CBT application, including core intervention components, effectiveness reported in previous studies, usability issues, requirements for security and privacy, and recommendations for future empirical development and evaluation of the app.	Development study / literature review: electronic literature search conducted via ProQuest, EBSCO, PubMed, and Google Scholar for publications between 2015–2019. Findings were reported in a conference proceeding ("3rd International Conference on Healthcare and Allied Sciences 2019") and a journal supplement.
15	Ruslami et al., 2019	The effect of a structured clinical algorithm on glycemic control in patients with with combined tuberculosis and diabetes in Indonesia: A randomized trial	Adults with pulmonary tuberculosis (TB) and comorbid diabetes mellitus (DM) in Indonesia. Total randomized participants: 150 (mean age ≈ 53 years; 51.3% male), with 92% TB culture-positive.	A structured clinical algorithm: a management package including scheduled counseling, regular glucose monitoring, and diabetes medication adjustments following a predefined clinical algorithm (structured protocol for hypoglycemic therapy modification during TB treatment). The intervention was proactive and scheduled.	Routine/usual diabetes management: standard care for diabetes provided at TB treatment facilities without a structured algorithm or scheduled adjustments.	Primary outcome: difference in HbA1c change at 6 months. Key findings: the intervention group experienced a greater reduction in HbA1c compared with the control group, with a mean difference of 1.82% (95% CI: 0.82–2.83, $p < 0.001$). Safety/adverse events: hypoglycemia was more frequent in the intervention group (35.0% vs. 11.8%, $p = 0.002$); hospitalizations and two deaths were reported,	Open-label randomized controlled trial (RCT) conducted at clinical sites in Indonesia, with a 6-month follow-up. Analysis was performed per-protocol and/or intention-to-treat, as reported. Participants were randomly allocated to either the intervention or control arm.

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						both occurring in the intervention arm.	
16	Rahmawati et al., 2019	Counseling by Pharmacists on Diabetes Mellitus patients in Indonesia: Narrative Review	Adults with Type 2 Diabetes Mellitus (T2DM) in Indonesia, both outpatients and inpatients, who received pharmacist-led counseling services across various healthcare settings, including community pharmacies, hospitals, and primary health centers (puskesmas).	Pharmacist-led counseling, encompassing education on the use of antidiabetic medications, explanation of potential side effects, guidance on diet and physical activity, stress management, blood glucose monitoring, and follow-up on therapy adherence.	No pharmacist-led counseling or pre-intervention condition. Some studies included in the review compared intervention groups with control groups.	- Improvement in patients' knowledge about their disease and therapy. - Enhanced medication adherence. - Reduction in blood glucose levels and HbA1c. - Increased patient satisfaction and quality of life. - Decrease in the occurrence of drug-related problems (DRPs).	Narrative review synthesizing findings from various studies in Indonesia—including small RCTs, quasi-experimental studies, and observational surveys—on the role of pharmacists in diabetes patient management.
17	Rokhman et al., 2019	Translation and performance of the Finnish Diabetes Risk Score for detecting undiagnosed diabetes and dysglycaemia in the Indonesian population	Adults aged ≥18 years from multiple regions in Indonesia (Yogyakarta and Malang in Java, and Banggai Laut in Central Sulawesi). A total of 1,403 participants with no prior diagnosis of diabetes mellitus were included.	Risk assessment was conducted using the Finnish Diabetes Risk Score translated into Indonesian (FINDRISC-BI), along with a modified version (Modified FINDRISC-BI) that adapted BMI and waist circumference classifications to the Indonesian population	Comparison was made between the two risk assessment instruments (original FINDRISC-BI vs. the modified version) in detecting: (a) undiagnosed type 2 diabetes, and (b) dysglycemia (prediabetes plus diabetes). Different cut-off points and individual FINDRISC components were also	Diagnostic performance was evaluated using the area under the ROC curve (AUC), sensitivity, specificity, optimal cut-off points, and positive and negative predictive values for detecting undiagnosed T2DM and dysglycemia. Additionally, the analysis identified which FINDRISC components	This was a cross-sectional observational study using primary data collection through community- and government-employee-based sampling, conducted from mid to late 2019. The instruments were culturally adapted, translated, and validated prior to use.

No	Author(s), Tahun	Judul Artikel	P (Population)	I (Intervention/Exposure)	C (Comparison)	O (Outcome)	S (Study Design)
					evaluated as comparative variables.	were most strongly correlated with undiagnosed T2DM or dysglycemia.	
18	Ivanescu et al., 2018	Predictors of Diabetic Retinopathy in Type 2 Diabetes: A Cross-Sectional Study	A total of 302 adult patients with a diagnosis of Type 2 Diabetes Mellitus (T2DM) were recruited from the Outpatient Diabetes Care Facility at the Pius Brînzeu County Emergency Hospital, Timişoara, Romania. The median age was approximately 64 years, with a median diabetes duration of 12 years.	The evaluated risk factors included glycemic control (HbA1c levels), disease duration, age, body mass index (BMI), comorbidities such as hypertension, cardiovascular disease (CVD), chronic kidney disease (CKD), dyslipidemia, and smoking habits.	Comparisons were made between patients with and without diabetic retinopathy (DR). Subgroup analyses included glycemic control (high vs. low HbA1c), disease duration (long vs. short), and age groups (older vs. younger patients).	The study outcomes comprised the presence of diabetic retinopathy (DR), categorized by severity (mild, moderate, severe NPDR, and PDR), overall DR prevalence (34.8%), and the association of risk factors with DR occurrence (odds ratios and p-values). Significant predictors included HbA1c >7.2%, longer diabetes duration, and advanced age.	Cross-sectional observational study analyzing clinical and demographic data, with fundus examination for diabetic retinopathy (DR). Statistical analyses included bivariate and multivariate regression, and receiver operating characteristic (ROC) curves were used to assess predictor performance (AUC for HbA1c, age, and diabetes duration).
19	Supriyatno et al., 2017	Android based Diabetic Manager to Enhance Compliance and to Control Blood Glucose Level among Type 2 Diabetic Patients in Magelang, Central Java, Indonesia	Patients with Type 2 Diabetes Mellitus in Magelang, Central Java, Indonesia; a total of 52 participants were enrolled and divided into two groups: an intervention group using the ABDM application and a control group.	Use of the Android-Based Diabetic Manager (ABDM) application, designed to assist T2DM patients in managing their diet by providing meal reminders and alerts when daily caloric limits are reached, as part of efforts to improve dietary adherence and glycemic control.	Control group receiving standard care without the ABDM application. The study employed a pretest–posttest experimental design with a control group.	Outcomes included patients' dietary adherence and glycemic control. Results showed significant improvements in the ABDM group compared to the control group, with dietary adherence ($p = 0.000$) and glycemic control ($p = 0.048$) both significantly better after the intervention.	Experimental study with a pretest-posttest control group design. Participants were selected using simple randomization. The intervention period was relatively short, and the study was conducted in Magelang City, Central Java, Indonesia.

No	Author(s), Tahun	Judul Artikel	P (Population)	I (Intervention/Exposure)	C (Comparison)	O (Outcome)	S (Study Design)
20	Claramita et al., 2019	Partnership-oriented and culturally-sensitive communication style of doctors can impact the health outcomes of patients with chronic illnesses in Indonesia	Adult patients with chronic conditions—hypertension (n = 45) or type 2 diabetes (n = 51)—attending primary healthcare facilities in Indonesia. A total of 30 physicians were trained, with 15 assigned to the intervention group and 15 to the control group.	Physician training focused on the "Greet-Invite-Discuss" communication style, emphasizing partnership and culturally sensitive interactions during doctor–patient consultations.	Control group: patients received standard care from physicians who had not undergone training in the Greet-Invite-Discuss communication approach; no special communication training was provided to these physicians.	- Changes in physicians' self-perceived communication skills - Patients' perceptions of physicians' communication abilities - Reduction in blood pressure for hypertensive patients and fasting blood glucose for type 2 diabetes patients - Patient experience outcomes, including satisfaction, understanding, and self-management of their condition - Two-hour post-prandial blood glucose was also measured but did not show a significant decreas	Mixed-methods longitudinal study combining quantitative and qualitative approaches: physicians received training, followed by repeated measurements (pre- and post-training), along with focus group discussions to explore both physician and patient experiences.
21	Umaya et al., 2020	The Effect of Medication Remainder Application (MRA) on The Level of Knowledge and Compliance of Type 2 Diabetes Mellitus patients in Universitas Sumatera Utara Hospital, Indonesia	Outpatient adults with Type 2 Diabetes Mellitus (T2DM) at the Universitas Sumatera Utara Hospital, Medan, Indonesia. Total participants: 30.	Intervention: use of the Medication Reminder Application (MRA) on patients' smartphones, accompanied by diabetes education, informational leaflets,	There was no external control group; the study utilized a single-group pretest-posttest design, with measurements con-	Patient outcomes included diabetes knowledge (assessed using the Diabetes Knowledge Questionnaire-24 [DKQ-24]) and medication adherence (measured	Single-group cohort study with a pretest-posttest design, conducted from August to November 2018, with statistical analysis performed using Spearman's correlation.

No	Author(s), Tahun	Judul Artikel	P (Population)	I (Intervention/Exposure)	C (Comparison)	O (Outcome)	S (Study Design)
				and guidance on proper application use.	ducted on the same participants before and after the intervention.	with the Morisky Medication Adherence Scale-8 [MMAS-8]). Results indicated a positive, albeit weak, correlation between knowledge and adherence (r = 0.195), and the Medication Reminder Application (MRA) intervention led to improvements in both outcomes.	
22	Hidayat et al., 2012	DiabCare Asia 2012: management, control, and complications in Indonesian DM2 patients	Adult patients (≥18 years) diagnosed with Type 2 Diabetes Mellitus, receiving care across primary, secondary, and tertiary healthcare facilities in Indonesia. The total sample comprised 1,967 patients, with a mean age of approximately 58.4 ± 9.5 years and a median disease duration of 6.0 years.	No specific intervention was applied; this was a non-interventional observational study. Exposures included type of diabetes treatment (insulin vs. non-insulin), insulin dosage, diabetes management provided by healthcare providers at primary, secondary, and tertiary facilities, routine laboratory monitoring, complication screenings (eye and foot examinations), as well as medical history and medication use records.	Comparisons were made across subgroups within the study population, such as patients using insulin versus those not using insulin, patients with HbA1c below target (<7.0%) versus above target, and patients with longer versus shorter disease duration. No external control group was included, as the study employed a cross-sectional design.	- Proportion of patients achieving glycemic control (HbA1c <7.0%): ~30.8% - Mean HbA1c in the study population: 8.3% ± 2.2 - Insulin use: 34.7% of patients, with an average daily dose of ~37.9 IU - Prevalence of diabetes complications: peripheral neuropathy (~59.1%), erectile dysfunction (~32.4%), ocular complications (~29.1%)	Observational cross-sectional study (non-interventional). Data were collected from patients who had been receiving treatment for ≥1 year at primary, secondary, and tertiary healthcare facilities. HbA1c measurements and complication assessments were performed once per patient. Data collection occurred around 2013–2014, with publication reported in 2019.

No	Author(s), Tahun	Judul Artikel	P (Population)	I (Intervention/Exposure)	C (Comparison)	O (Outcome)	S (Study Design)
						- Management and adherence characteristics associated with glycemic control and complications	
23	Endra Cita et al., 2020	Self Care In Patients of Diabetes Melitus Type II	Outpatients with Type 2 Diabetes Mellitus (T2DM) at Nur Hidayah Hospital, Yogyakarta, totaling 51 patients.	No specific intervention was applied; this was an observational study aimed at assessing patients' self-care behaviors.	- There was no comparison group in this study. - The design was correlational descriptive, focusing on relationships between variables rather than group comparisons.	- The primary outcome measured was patients' random blood glucose levels (mg/dL). - The study aimed to assess the relationship between self-care behaviors and blood glucose control.	- Quantitative correlational study with a cross-sectional design. - Data were collected at a single time point to examine the relationship between self-care behaviors and blood glucose levels.
24	Zainuddin et al., 2023	Geospatial analysis of type 2 diabetes mellitus and hypertension in South Sulawesi, Indonesia	Adults/patients registered with the National Health Insurance Agency (BPJS Kesehatan) in South Sulawesi Province, Indonesia.	Observational ecological / geospatial study.	Comparison across spatial units (districts/cities): areas with higher prevalence of T2DM/hypertension (hotspots) versus areas with lower prevalence; analyses also assessed each location relative to its neighbors using Local Moran's I and Getis-Ord statistics. Additionally, regression models examined inter-district variations in prevalence to evaluate the	- Spatial distribution patterns of T2DM and hypertension (clusters/hotspots, coldspots, or random). - Association statistics: significance of the relationship between T2DM prevalence and hypertension prevalence at the district/city level, analyzed using Generalized Poisson Regression (significant association, $p \leq 0.001$).	Ecological geospatial study using secondary data from BPJS Health Insurance records across 24 districts/cities in South Sulawesi Province, Indonesia. Analytical methods included Global Moran's I, Local Moran's I, Getis-Ord Gi*, and Generalized Poisson Regression. Data were collected for the period 2017–2018.

No	Author(s), Tahun	Judul Artikel	P (Population)	I (Intervention/Exposure)	C (Comparison)	O (Outcome)	S (Study Design)
					association between T2DM and hypertension.	- Prevalence estimates per 100,000 population for each district/city (spatial descriptive data).	

4 Discussion

A total of 24 studies published between 2012 and 2021 were included in this scoping review following the PRISMA-ScR (2020) selection process. These studies were conducted across various regions in Indonesia such as Medan, Bogor, Pontianak, and Magelang and also utilized national datasets including the Indonesia Family Life Survey (IFLS) and DiabCare Asia.

The research designs were diverse, encompassing cross-sectional, qualitative, experimental, validation, and prospective cohort studies. Most studies focused on Type 2 Diabetes Mellitus (T2DM), while a smaller proportion examined the comorbidity of hypertension and diabetes and its management pathways [8].

Collectively, these studies explored several dimensions of disease burden and management: patient profile and epidemiology, self-care and behavioral management, digital technology and mHealth, health education and counseling, screening and risk assessment, clinical management, and clinical outcomes and complications among individuals with T2DM and/or hypertension in Indonesia.

4.1 Risk Factors

Evidence from the included studies revealed a constellation of clinical, metabolic, demographic, socioeconomic, and environmental determinants contributing to the onset and poor control of T2DM with hypertension in the Indonesian context. From the clinical standpoint, through the multicenter DISCOVER cohort, demonstrated that patients with comorbidities (including hypertension) experienced a higher burden of micro- and macrovascular complications and underwent frequent therapy adjustments over three years of follow-up underscoring the strong link between glycemic control, hypertension, and clinical outcomes. The DiabCare Asia 2012 report [9]. Provided a national snapshot, showing a mean HbA1c of approximately 8.3%, with only 30.8% of participants achieving <7%, and a high prevalence of complications such as neuropathy and retinopathy highlighting the scale of poor disease control [10]. A high prevalence of diabetic retinopathy (43.1%) and identified the duration of diabetes mellitus as a key factor, HbA1c ≥7%, found a 43.1% prevalence of diabetic retinopathy and identified diabetes duration, HbA1c ≥7%, and hypertension as significant predictors, while [11]; Amelia et al. (2018) noted blood glucose, total cholesterol, and albumin-creatinine ratio as strong predictors of retinopathy, with hypertension showing a modest effect [12].

Community and cohort-based studies emphasized the role of central obesity, age, and lifestyle factors. In the Bogor cohort study (n = 4,418; six-year follow-up), validated the Bogor Diabetes Risk Prediction (BDRP) chart, reporting a cumulative incidence of 17.9% and confirming that age, BMI, waist circumference, hypertension, and physical inactivity are key non-invasive predictors [13]. Similarly, observed a 76.4% prevalence of prediabetes in Pontianak, with older age, BMI, insurance status, prior hypertension, and high systolic pressure emerging as risk factors [14]. Further validated simplified screening tools such as FINDRISC-BI for identifying undiagnosed high-risk individuals [15, 16].

Spatial and population-level analyses added a socio-environmental perspective. Significant spatial clustering of T2DM and hypertension in South Sulawesi (based on BPJS health data), indicating that geographic context influences disease burden [17]. Using national IFLS data, highlighted socioeconomic disparities education, income, and access tohealthcare as critical determinants of diagnosis and disease control [8]. Qualitative research menunjukkan kesenjangan sosial-ekonomi dan determinan sosial (pendidikan, penghasilan, akses layanan) yang memengaruhi diagnosis, pemanfaatan layanan, dan kontrol penyakit [18]. Secara kualitatif, revealed that cultural beliefs and passive coping attitudes (e.g., "acceptance as fate") may hinder preventive behaviors and adherence to treatment [19].

Studies in primary care further confirmed the heterogeneity of disease control. Clear metabolic differences between controlled and uncontrolled diabetes [20], while large-scale surveys such as DiabCare dan studi kohort emphasized that longer disease duration, insulin use, dyslipidemia, and hypertension strongly predict complications [10]. For international comparison [9], in Romania reported similar predictors HbA1c levels, disease duration, and comorbidities reinforcing global consistency in risk factor patterns [21].

the 24 studies collectively affirm that risk factors for T2DM-hypertension comorbidity in Indonesia are multifactorial, dominated by poor glycemic control, long disease duration, central obesity, dyslipidemia, and hypertension itself, while social, cultural, and geographic determinants exacerbate delays in diagnosis and poor disease control.

4.2 Interventions: Clinical and Behavioral Management

Interventional studies exhibited a wide range of approaches, including digital self-management applications, behavioral/self-care programs, pharmacy-based services, clinical communication training, and structured clinical algorithms.

Digital and self-management applications. Evaluated the Android-Based Diabetic Manager (ABDM) (n = 52) and found significant improvements in dietary adherence and glycemic control compared to controls [22]. Umaya et al. (2020) tested a Medication Reminder Application (MRA) among 30 patients, reporting enhanced knowledge (DKQ-24) and adherence (MMAS-8), albeit with modest correlation strength [23]. Proposed the Integrated Diabetes Self-Management (IDSM) app protocol within PROLANIS, paving the way for larger implementation trials, while [24]. Fatmawati et al. (2020) developed a CBT-based mobile application for diabetes-related depression highlighting the importance of integrating mental health into chronic care.

4.2.1 Behavioral and self-care interventions. Observational studies in primary care, such as revealed significant correlations between self-care behaviors (diet, exercise, foot care, medication adherence) and clinical outcomes (FBG, 2h-PPG, HbA1c). Nopitasari et al. reported a significant effect of diet on fasting blood glucose ($p = 0.012$) and a positive correlation between self-care and HbA1c ($r = 0.254$), supporting the clinical relevance of behavioral education [25].

Pharmacist and community pharmacy services. The patients perceived pharmacists as potential chronic-care partners for counseling and monitoring [26]. Rahmawati et al. (2019, through a narrative review, confirmed that pharmacist-led education improves patient knowledge, adherence, HbA1c levels, and reduces drug-related problems, although most primary evidence came from small or quasi-experimental studies [16].

Clinical communication training. Tested the Greet Invite Discuss communication model among 30 physicians and observed improved patient satisfaction, adherence, and reductions in systolic blood pressure and fasting glucose showing that culturally sensitive communication training can yield both behavioral and clinical benefits [27].

4.2.2 Structured clinical algorithms. A randomized trial in patients with tuberculosis and diabetes (n = 150) demonstrated that a structured insulin-based algorithm significantly reduced HbA1c by 1.82% but increased hypoglycemia (35% vs. 11.8%) and severe adverse events indicating that intensive algorithms require strict safety protocols and monitoring [28].

The interventions demonstrated promise particularly digital health (mHealth), task-shifting to pharmacists, and communication training but evidence remains constrained by small sample sizes, short follow-ups, and quasi-experimental designs. Future research should prioritize large-scale RCTs and hybrid implementation studies to assess effectiveness and scalability within Indonesia's primary care context.

4.3 Policy Implications

Synthesis of the 24 studies suggests several consistent policy directions: Integration of T2DM-Hypertension Care: Cohort findings underline the need for joint clinical pathways, combined BP-glucose monitoring, and integrated electronic records to reduce service fragmentation; Early Detection and Targeted Screening: Validation of BDRP, along with spatial hotspot mapping, support risk-based screening and geographic prioritization at the primary care level; Reducing Inequities in Access and Financing: IFLS-based analyses highlight that low socioeconomic status is linked to under-diagnosis and suboptimal treatment necessitating expansion of BPJS coverage and essential drug subsidies; Empowering Non-Physician Providers: Evidence from pharmacist interventions and physician communication training supports task-shifting and continuous professional education with culturally responsive modules; Digital Health Regulation and Integration: Findings from studies on ABDM, MRA, IDSM, and CBT apps emphasize the need for regulatory frameworks on data privacy, interoperability, and integration with PROLANIS and electronic medical records; Balancing Effectiveness and Safety in Intensive Protocols: The RCT demonstrated dual outcomes improved HbA1c but increased hypoglycemia signaling the importance of safety guidelines and referral systems for high-intensity interventions; Culturally Sensitive Health Promotion: Qualitative insights underscore the need for culturally adapted education and community engagement to foster meaningful behavioral change.

These findings advocate for integrated primary care, geographically targeted resource allocation, expanded pharmacist roles, risk-based screening, digital governance, and inclusive financing models to strengthen chronic disease management in Indonesia.

4.4 Limitations of the Evidence Base

Based on the PICOS table analysis, several recurring methodological limitations were identified: many studies were cross-sectional, limiting causal inference. Some interventions were small-scale or used pre-post designs without adequate control groups, and heterogeneity in outcomes and definitions hindered quantitative synthesis. There was also location bias, as many studies were hospital- or urban-based, restricting generalizability to rural areas. Additionally, several development or protocol studies provided preliminary evidence but lacked outcome data. Critical appraisal of the included studies revealed recurrent methodological limitations. Many were cross-sectional, limiting causal inference, while interventional studies were often small-scale, quasi-experimental, or lacked robust control groups. Outcome measures and disease definitions were heterogeneous, and most studies were hospital- or urban-based, limiting generalizability to rural populations. Moreover, developmental and protocol papers offered preliminary insights but lacked longitudinal outcomes. Future research should therefore include large-scale randomized controlled trials, longitudinal cohort studies in underrepresented regions, and implementation-hybrid designs to evaluate real-world effectiveness and scalability of interventions.

5 Conclusion

The synthesis of 24 studies shows that managing type 2 diabetes mellitus (T2DM) with hypertension in Indonesia remains a multifaceted challenge involving clinical, behavioral, socioeconomic, and policy factors. Hypertension and T2DM often worsen each other, driven by poor glycemic control, long disease duration, central obesity, dyslipidemia, and social determinants such as education, income, and healthcare access. Emerging interventions such as digital health tools, self-management programs, pharmacist counseling, and physician communication training demonstrate positive impacts on adherence and clinical outcomes, though most remain limited in scale and duration. Policy implications emphasize integrating T2DM–hypertension care into primary health services, strengthening non-physician roles, adopting risk-based screening, and promoting culturally sensitive digital health initiatives.

In summary, holistic and cross-sector strategies combining clinical, behavioral, technological, and policy innovations embedded within programs like Prolanis BPJS Kesehatanare crucial to reduce the dual burden of non-communicable diseases in Indonesia.

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