



The Comprehensive Systematic Review of Relationship between Education Level and Self-Management in Patients with Type 2 Diabetes Mellitus

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ABSTRACT

Introduction: Type 2 diabetes mellitus (T2DM) requires sustained self-management behaviors for optimal glycemic control and prevention of complications. While education level is frequently hypothesized to influence self-management capacity, evidence regarding this relationship remains inconsistent. **Methods:** A systematic review was conducted following PRISMA guidelines. A total of 95 quantitative studies examining the relationship between education level and diabetes self-management in adult T2DM patients were included. Studies were sourced from Indonesian healthcare settings including hospitals, primary care centers (Puskesmas), and community settings. Data were extracted regarding study characteristics, participant demographics, education measurement, self-management assessment, statistical associations, and moderating factors. **Results:** The majority of studies (approximately 65%) reported statistically significant positive associations between

higher education and better self-management (r range: 0.263-0.739; $p < 0.05$), particularly for medication adherence and dietary compliance. However, approximately 30% of studies found no significant association. Diabetes-specific knowledge, health literacy, self-efficacy, and family support consistently emerged as stronger direct predictors and significant mediators of the education-self-management relationship. Socioeconomic factors (income, employment) and healthcare access variables (Prolanis participation, health worker support) significantly modified this relationship. **Discussion:** The education self management relationship is indirect and context-dependent, primarily operating through modifiable cognitive and psychosocial mechanisms. Educational attainment serves as an enabling rather than deterministic factor. **Conclusion:** Interventions should target diabetes-specific knowledge, health literacy, self-efficacy, and family support systems, particularly for patients with lower formal education. Future research requires longitudinal designs, standardized measurement tools, and diverse populations beyond Indonesia.

Keywords: Type 2 diabetes mellitus, education level, self-management, health literacy, systematic review, medication adherence, Indonesia

INTRODUCTION

Background

Type 2 diabetes mellitus (T2DM) represents a global health challenge with rising prevalence particularly in low- and middle-income countries (International Diabetes Federation, 2021). Indonesia ranks among the top ten nations with the highest diabetes burden, necessitating effective management strategies within its decentralized healthcare system (Soewondo et al., 2013). Optimal diabetes control requires consistent engagement in multiple self-management behaviors including medication adherence, dietary regulation, physical activity, blood glucose monitoring, and foot care (American Diabetes Association, 2024). These behaviors are complex, demanding sustained motivation, adequate health literacy, and access to supportive resources.

Education level has long been theorized as a fundamental determinant of health behaviors through its effects on cognitive skills, problem-solving abilities, and health literacy (Galobardes et al., 2006). In chronic disease management, formal education may equip individuals with greater capacity to understand medical information, navigate healthcare systems, and implement complex treatment regimens (Kickbusch et al., 2013). However, the empirical evidence linking education to diabetes self-management has yielded inconsistent findings across diverse populations and settings.

Research Gap

Despite numerous studies examining the education-self-management relationship in T2DM, significant gaps persist in the literature. First, existing systematic reviews have predominantly focused on Western populations with established healthcare infrastructures, leaving questions about the generalizability of findings to Southeast Asian contexts, particularly Indonesia (Wagner et al., 2022). Second, substantial heterogeneity exists in how both education and self-management are operationalized across studies, ranging from broad categorical classifications to specific behavioral assessments, complicating evidence synthesis (Nam et al., 2011). Third, while individual studies

have identified various potential mediators (knowledge, self-efficacy) and moderators (income, family support) of this relationship, no comprehensive synthesis has systematically mapped these interacting factors within a unified framework. Fourth, the predominance of cross-sectional designs has precluded conclusions about causality and temporal sequencing (Lorig & Holman, 2003). Fifth, the substantial minority of studies reporting null or negative associations remains inadequately explained, suggesting the presence of unmeasured confounding or effect modification.

Novelty

This systematic review offers several novel contributions to the existing evidence base. It represents the first comprehensive synthesis of Indonesian studies examining the education-self-management relationship in T2DM, capturing 95 studies conducted across diverse geographic, institutional, and socioeconomic contexts within a single healthcare system. This geographic focus enables examination of how education operates within specific cultural, economic, and healthcare delivery contexts that differ markedly from high-income countries. Additionally, this review systematically maps the complex web of mediating and moderating variables that have been examined across studies, providing the first integrated conceptual framework of how education influences self-management through multiple mechanistic pathways. The inclusion of studies spanning 2008-2025 captures temporal trends in both diabetes management approaches and research methodologies.

Objectives

This systematic review aimed to: (1) synthesize the available evidence regarding the association between formal education level and diabetes self-management behaviors among adults with T2DM; (2) examine how education level has been measured and categorized across studies; (3) assess which specific self-management domains are most consistently associated with educational attainment; (4) identify and map mediating and moderating factors that influence the education-self-management relationship; (5) evaluate methodological strengths and limitations of

the current evidence base; and (6) provide evidence-informed recommendations for clinical practice, health policy, and future research directions.

Hypothesis

Based on previous literature and theoretical frameworks, we hypothesized that higher educational attainment would be positively associated with better diabetes self-management behaviors, but that this relationship would be significantly mediated by diabetes-specific knowledge and health literacy, and moderated by socioeconomic resources and psychosocial support systems.

Benefits and Significance

This review provides critically needed evidence to guide diabetes management strategies in Indonesia and similar settings. By elucidating the pathways through which education influences self-management, findings will inform the design of targeted interventions that address modifiable mechanisms rather than immutable educational backgrounds. For clinicians, this review clarifies when and for whom educational attainment matters most, enabling more nuanced patient assessment and tailored educational support. For policymakers, synthesizing evidence from 95 Indonesian studies provides locally relevant guidance for diabetes program development, resource allocation, and health literacy initiatives. For researchers, this review identifies critical methodological gaps and establishes priorities for future investigation.

METHODS

Protocol

The study strictly adhered to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 guidelines to ensure methodological rigor and accuracy. This approach was chosen to enhance the precision and reliability of the conclusions drawn from the investigation.

Criteria for Eligibility

This systematic review aims to evaluate the relationship between education level and self-management in patients with type 2 diabetes mellitus.

Screening

We screened in sources based on their abstracts that met these criteria:

- **Population - Adult Type 2 Diabetes:** Does the study include adults (≥ 18 years) diagnosed with type 2 diabetes mellitus as the primary population?
- **Education Level Assessment:** Does the study measure, categorize, or analyze education level as a variable or factor?
- **Education-Self Management Relationship:** Does the study analyze or report the relationship/association between education level and diabetes self-management behaviors?
- **Self-Management Outcomes:** Does the study assess diabetes self-management behaviors or practices (such as medication adherence, blood glucose monitoring, dietary management, exercise, or foot care)?
- **Quantitative Study Design:** Is the study design quantitative (cross-sectional, cohort, case-control, randomized controlled trial, systematic review, or meta-analysis)?
- **Diabetes Type Focus:** Is the study NOT focused exclusively on type 1 diabetes, gestational diabetes, or other specific diabetes types (excluding type 2)?
- **Study Design Appropriateness:** Is the study NOT a qualitative study, case report, case series, editorial, or opinion piece?
- **Education Level vs. Intervention Focus:** Does the study examine baseline/inherent education level rather than only examining diabetes education interventions without analyzing baseline education level?

We considered all screening questions together and made a holistic judgement about whether to screen in each paper.

Search Strategy

The keywords used for this research based PICO :

Element	P (Population)	I (Intervention/Exposure)	C (Comparison/Context)	O (Outcome)
Keyword 1	Adult Patients	Education Level	Low vs High Education	Self- Management
Keyword 2	Type 2 Diabetes Mellitus	Educational Background	Educational Categories	Medication Adherence
Keyword 3	T2DM	Socioeconomic Status	Comparative Analysis	Dietary Management
Keyword 4	Diabetes Mellitus Type 2	Literacy Level	Cross-sectional Comparison	Glycemic Control

The Boolean MeSH keywords inputted on databases for this research are: (*"Adult Patients"* OR *"Type 2 Diabetes"* OR *"Diabetes Mellitus Type 2"*) AND (*"Education Level"* OR *"Educational Background"* OR *"Literacy Level"*) AND (*"Low vs High Education"* OR *"Educational Categories"* OR *"Cross-sectional Comparison"*) AND (*"Self-Management"* OR *"Medication Adherence"* OR *"Dietary Management"* OR *"Glycemic Control"*)

Data extraction

- **Study Design:**

Extract the study design and key methodological details for research examining the relationship between education level and self-management in type 2 diabetes patients, including:

- Study design (cross-sectional, cohort, intervention, etc.)
- Sample size and sampling method

- Setting (hospital, primary care, community, etc.)
- Data collection methods
- Statistical analysis approach used to examine education-self-management relationship

- **Education Measurement:**

Extract how education level was defined, categorized, and measured in studies examining its relationship with diabetes self-management, including:

- Education variable definition (formal schooling years, degree level, literacy, etc.)
- Categories used (e.g., elementary/primary, secondary, tertiary; or years of education)
- Measurement instrument or method
- Distribution of education levels in the sample
- Any education-related covariates examined (health literacy, diabetes knowledge, etc.)

- **Self-Management Measurement:**

Extract how diabetes self-management was defined, measured, and assessed in studies examining its relationship with education level, including:

- Self-management definition used by authors
- Specific domains assessed (medication adherence, diet, exercise, glucose monitoring, foot care, etc.)
- Measurement instruments (questionnaires, scales, behavioral assessments)
- Scoring method and interpretation
- Validation status of instruments used

- **Education-Self-Management Relationship:**

Extract the specific findings about the relationship between education level and diabetes self-management, including:

- Direction of relationship (positive, negative, no association)
- Strength of association (correlation coefficients, effect sizes, odds ratios)
- Statistical significance (p-values, confidence intervals)
- Specific aspects of self-management most affected by education
- Any dose-response patterns across education categories
- Clinical significance or practical implications noted by authors

- **Participant Characteristics:**

Extract demographic and clinical characteristics of type 2 diabetes patients studied in relation to education and self-management, including:

- Age distribution (mean, range, categories)
- Gender distribution
- Duration of diabetes diagnosis
- Diabetes management approach (medication types, insulin use)
- Comorbidities or complications
- Socioeconomic indicators beyond education
- Geographic/cultural context

- **Moderating Factors:**

Extract other variables examined alongside education that might influence the education-self-management relationship in diabetes patients, including:

- Variables tested as potential moderators or mediators
- Other sociodemographic factors (income, employment, marital status)
- Psychosocial factors (motivation, self-efficacy, family support, health beliefs)

- Healthcare access and utilization factors
- Knowledge, attitudes, or skills variables
- How these factors interacted with or modified the education-self-management relationship

Table 1. Article Search Strategy

Database	Keywords	Hits
Pubmed	("Adult Patients" OR "Type 2 Diabetes" OR "Diabetes Mellitus Type 2") AND ("Education Level" OR "Educational Background" OR "Literacy Level") AND ("Low vs High Education" OR "Educational Categories" OR "Cross-sectional Comparison") AND ("Self-Management" OR "Medication Adherence" OR "Dietary Management" OR "Glycemic Control")	2
Semantic Scholar	("Adult Patients" OR "Type 2 Diabetes" OR "Diabetes Mellitus Type 2") AND ("Education Level" OR "Educational Background" OR "Literacy Level") AND ("Low vs High Education" OR "Educational Categories" OR "Cross-sectional Comparison") AND ("Self-Management" OR "Medication Adherence" OR "Dietary Management" OR "Glycemic Control")	259
Springer	("Adult Patients" OR "Type 2 Diabetes" OR "Diabetes Mellitus Type 2") AND ("Education Level" OR "Educational Background" OR "Literacy Level") AND ("Low vs High Education" OR "Educational Categories" OR "Cross-sectional Comparison") AND ("Self-Management" OR "Medication Adherence" OR "Dietary Management" OR "Glycemic Control")	20
Google Scholar	("Adult Patients" OR "Type 2 Diabetes" OR "Diabetes Mellitus Type 2") AND ("Education Level" OR "Educational Background" OR "Literacy Level") AND ("Low vs High Education" OR "Educational Categories" OR "Cross-sectional Comparison") AND ("Self-Management" OR "Medication Adherence" OR "Dietary Management" OR "Glycemic Control")	9,250
Wiley Online Library	("Adult Patients" OR "Type 2 Diabetes" OR "Diabetes Mellitus Type 2") AND ("Education Level" OR "Educational Background" OR "Literacy Level") AND ("Low vs High Education" OR "Educational Categories" OR "Cross-sectional Comparison") AND ("Self-Management" OR "Medication Adherence" OR "Dietary Management" OR "Glycemic Control")	48

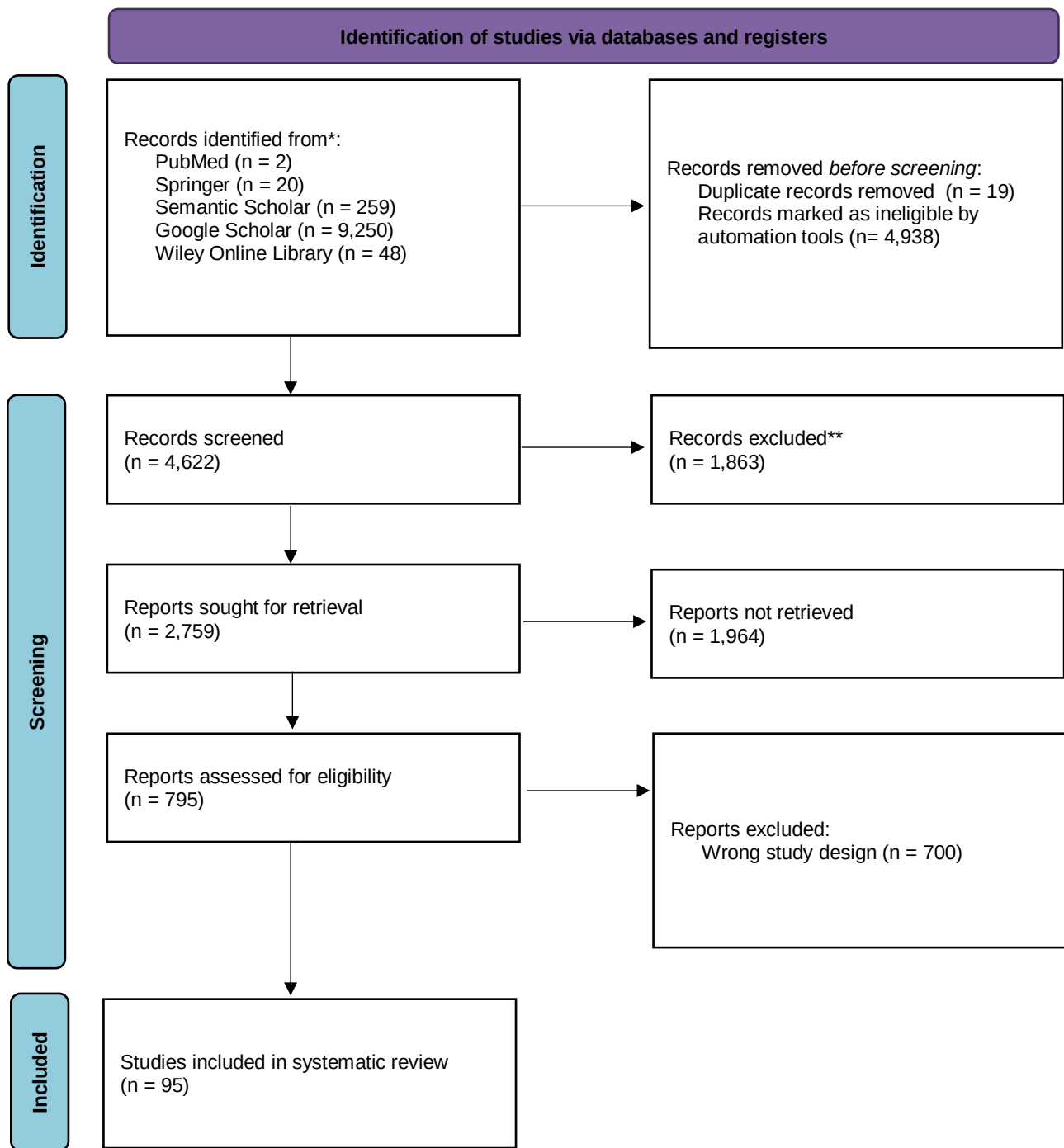


Figure 1. Article search flowchart

JBI Critical Appraisal									
Study	Bias related to temporal precedence Is it clear in the study what is the “cause” and what is the “effect” (ie, there is no confusion about which variable	Bias related to selection and allocation Was there a control group?	Bias related to confounding factors Were participants included in any comparisons similar?	Bias related to administration of intervention/exposure Were the participants included in any comparisons receiving similar treatment /care, other than the exposure or intervention of interest?	Were there multiple measurements of the outcome, both pre and post the intervention/exposure?	Were the outcomes of participants included in any comparisons measured in the same way?	Were outcomes measured in a reliable way?	Bias related to participant retention Was follow-up complete and, if not, were differences between groups in terms of their follow-up adequately described and analyzed?	Statistical conclusion validity Was appropriate statistical analysis used?

	comes first)?								
Neni Rahmani et al. (2024)									
A. Syahidah et al. (2024)									
Chusun Chusun et al. (2025)									
Yusuf Jauhar et al. (2017)									
Okta Mustipah et al. (2019)									
Surya Kristiani Gulo et al. (2020)									
Anif Maghfiroh									

et al. (2013)									
Hertuida Clara et al. (2018)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Tita Puspita Ningrum et al. (2019)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Ida Farida et al. (2018)	✓	✓	✓	✗	✓	✗	✓	✓	✓
S. Wulan et al. (2020)	✓	✓	✓	✗	✓	✗	✓	✓	✓
S. Wulan et al. (2020a)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Asna Fania Ramadhan i et al. (2024)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Agata Della et al. (2023)	✓	✓	✓	✗	✓	✗	✓	✓	✓

Tria Nurhayyu Fadilah et al. (2023)									
Wahyu Adhitya Prawirasat ra et al. (2017)									
Asdiniyati Manalu et al. (2022)									
Hertuida Clara et al. (2018a)									
Auly Adhea Fadilla et al. (2023)									
Mayang Aditya Ayuning Siwi et al. (2025)									
Djoko Darbiyono									

et al. (2011)									
Nian Afrian Nuari et al. (2015)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Dewi G B Sosilowati et al. (2018)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Yayuk Ratnasari Dewi Anggreni et al. (2019)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Ester Yuli Giawa et al. (2025)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Aurelia Elvina Damayanti et al. (2023)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Azwar Azwar et	✓	✓	✓	✗	✓	✗	✓	✓	✓

al. (2025)									
Sonia Buyung et al. (2024)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Anis Prabowo et al. (2015)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Vivi Nur Fadhila et al. (2025)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Feri Armansya h et al. (2025)	✓	✓	✓	✗	✓	✗	✓	✓	✓
La Rakhmat Wabula et al. (2023)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Zainab Zainab et al. (2024)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Verawaty Melisa et al. (2023)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Yuli Setyaningr	✓	✓	✓	✗	✓	✗	✓	✓	✓

um et al. (2019)									
Luh Putri et al. (2019)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Pingkan Cindy Virgy Kawulusan et al. (2014)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Sylfia Pernanda et al. (2012)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Henni Kusuma et al. (2013)	✓	✓	✓	✗	✓	✗	✓	✓	✓
H. Hartono et al. (2024)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Kurniati Prihatin et al. (2019)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Fidella Ifariani	✓	✓	✓	✗	✓	✗	✓	✓	✓

Putri et al. (2022)									
Rina Safitri et al. (2022)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Ida Farida et al. (2024)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Hefa Aghna Fauzia et al. (2018)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Eni G B Lutfiyanti et al. (2018)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Fitri Sulistyanin grum et al. (2008)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Anjanie Medyawati Utami et al. (2017)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Muhamma d Basri et	✓	✓	✓	✗	✓	✗	✓	✓	✓

al. (2021)									
Y. Sari et al. (2023)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Pande Made Desy Ratnasari et al. (2022)	✓	✓	✓	✗	✓	✗	✓	✓	✓
N. Laili et al. (2023)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Nutrisia Nu'im Haiya et al. (2020)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Diabetes Melitus Tipe et al. (2024)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Ni Kadek Mei Yunitasari et al. (2025)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Novia Rizana et	✓	✓	✓	✗	✓	✗	✓	✓	✓

al. (2025)									
Christine Elizabeth Lumbantoruan et al. (2024)	✓	✓	✓	✗	✓	✗	✓	✓	✓
S. Kusumawardani et al. (2014)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Rajindra Eka Rajasari Randu Wandana et al. (2013)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Ratna Herawati Prabowo et al. (2018)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Ceria Nurhayati et al. (2022)	✓	✓	✓	✗	✓	✗	✓	✓	✓

Afresa Bias Putri Enarga et al. (2023)									
Fitrianur Laili et al. (2019)									
Eka Rora Suci Wisudawat i et al. (2023)									
Anindya Widianingt yas et al. (2021)									
Lilmawati Lilmawati et al. (2022)									
Wigutomo Gozali et al. (2024)									
Wahyu Riniasih et al. (2020)									

Ulfa Azizati A A Warda et al. (2018)									
Yeni Umi Qoni'ah et al. (2017)									
Rifke Debora Malamtiga et al. (2017)									
Salma Setya Dewi et al. (2025)									
Nikita Sari et al. (2025)									
Sari Wahyuni Mustarim et al. (2019)									

Santi Damayanti et al. (2014)									
Dede Arpiyana Nugraha et al. (2020)									
I. Faridah et al. (2019)									
Alfina Unhanisya h et al. (2023)									
Alfani Mandowen et al. (2024)									
D. Mandasari et al. (2017)									
D. Mandasari et al.									

(2017a)									
Siti Shofiyah et al. (2014)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Waode Azfari Azis et al. (2020)	✓	✓	✓	✗	✓	✗	✓	✓	✓
S. Junianty et al. (2012)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Yusni Ainurrahmah et al. (2022)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Shintia Rosdina et al. (2024)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Ainun Wulandari et al. (2018)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Evi Lusiana et al. (2019)	✓	✓	✓	✗	✓	✗	✓	✓	✓

M. Muzdalifa h et al. (2023)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Melda Suryana et al. (2024)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Yuanita Syaiful et al. (2013)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Geraldine Nenggar Riadisty et al. (2019)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Arie Syaeful Bachri et al. (2016)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Abdullah Salam et al. (2012)	✓	✓	✓	✗	✓	✗	✓	✓	✓
Yeni Rahma Dwijayanti et al. (2017)	✓	✓	✓	✗	✓	✗	✓	✓	✓

RESULTS

Study Characteristics

The included studies predominantly utilized observational designs, with the vast majority being cross-sectional studies. Several studies were described as correlational or descriptive correlational, which align with cross-sectional approaches. A smaller number of studies employed quasi-experimental, pre-experimental, or prospective designs. One study was identified as a literature review. Sample sizes varied widely, ranging from 30 to 310 participants, with most studies including between 40 and 150 respondents. Sampling methods were diverse, including purposive, accidental/consecutive, and total/saturated sampling. Research settings were predominantly in Indonesia, spanning hospitals, primary care facilities (Puskesmas), and community settings. Data were primarily collected via questionnaires, with some studies also using interviews and medical record reviews. Statistical analyses commonly included chi-square tests and various forms of correlation analysis, such as Spearman's rank correlation.

Study	Sample Size	Setting	Data Collection Method	Primary Statistical Analysis Approach
Neni Rahmani et al. (2024)	106	Hospital	Questionnaire	Not mentioned
A. Syahidah et al. (2024)	45	Primary care	Questionnaire	Chi-square test
Chusun Chusun et al. (2025)	134	Hospital	Medical records and interviews	Chi-square test

Study	Sample Size	Setting	Data Collection Method	Primary Statistical Analysis Approach
Yusuf Jauhar et al. (2017)	100	Hospital pharmacy	Questionnaire	Somers'd test
Okta Mustipah et al. (2019)	Not specified	Primary care	Questionnaire	Chi-square test
Surya Kristiani Gulo et al. (2020)	60	Primary care	Questionnaire	Spearman rank and Chi-square tests
Anif Maghfiroh et al. (2013)	48	Community setting	Not mentioned	Spearman rank correlation
Hertuida Clara et al. (2018)	112	Not specified	Questionnaires	ANOVA and t-test
Tita Puspita Ningrum et al. (2019)	76	Primary care	Questionnaires	Spearman rank correlation
Ida Farida et al. (2018)	70	Primary care	Not mentioned	Structural Equation Modeling (SEM)
S. Wulan et al. (2020)	104	Primary care	Questionnaire	t-tests
S. Wulan et al. (2020a)	104	Healthcare services	Questionnaire	t-tests

Study	Sample Size	Setting	Data Collection Method	Primary Statistical Analysis Approach
Asna Fania Ramadhani et al. (2024)	47	Primary care	Questionnaires and medical records	Spearman-rank test
Agata Della et al. (2023)	60	Hospital	Questionnaires	Chi-square test
Tria Nurhayyu Fadilah et al. (2023)	188	Hospital	Questionnaire	Descriptive analysis
Wahyu Adhitya Prawirasatra et al. (2017)	74	Primary care	Not mentioned	Chi-square, Mann Whitney, and Mentel-Haenszel tests
Asdiniyati Manalu et al. (2022)	40	Hospital	Interviews and medical records	Spearman correlation
Hertuida Clara et al. (2018a)	112	Not mentioned	Questionnaires	Not specified
Auly Adhea Fadilla et al. (2023)	100	Primary care	Questionnaire	Not mentioned
Mayang Aditya Ayuning Siwi et al. (2025)	100	Primary care	Questionnaires	Spearman's rho correlation

Study	Sample Size	Setting	Data Collection Method	Primary Statistical Analysis Approach
Djoko Darbiyono et al. (2011)	37	Hospital	Not mentioned	Spearman correlation and regression
Nian Afrian Nuari et al. (2015)	32	Primary care	Questionnaires	Spearman's test
Dewi G B Sosilowati et al. (2018)	25	Hospital	Interviews, Questionnaires, and medical records	Paired t-test and ANOVA
Yayuk Ratnasari Dewi Anggreni et al. (2019)	138	Community setting	Questionnaires	Spearman rho analysis
Ester Yuli Giawa et al. (2025)	90	Primary care	Questionnaires	Chi-square test
Aurelia Elvina Damayanti et al. (2023)	106	Primary care	Questionnaires	Correlation analysis
Azwar Azwar et al. (2025)	60	Hospital	Questionnaires	Chi-square test
Sonia Buyung et al. (2024)	109	Primary care	Questionnaires	Spearman correlation

Study	Sample Size	Setting	Data Collection Method	Primary Statistical Analysis Approach
Anis Prabowo et al. (2015)	64	Primary care	Questionnaires	Chi-square test
Vivi Nur Fadhila et al. (2025)	75	Primary care	Not mentioned	Spearman Rank test
Feri Armansyah et al. (2025)	42	Hospital	Interviews using questionnaires	Chi-square test
La Rakhmat Wabula et al. (2023)	93	Community setting	Questionnaires	Spearman rank test
Zainab Zainab et al. (2024)	40	Hospital	Not mentioned	Chi-square test
Verawaty Melisa et al. (2023)	67	Primary care	Not mentioned	Statistical tests
Yuli Setyaningrum et al. (2019)	38	Hospital	Not mentioned	Spearman Rho test
Luh Putri et al. (2019)	78	Primary care	Questionnaire and blood glucose measurement	Chi-square test
Pingkan Cindy Virgy Kawulusan et al. (2014)	50	Hospital	Questionnaires	Chi-square test

Study	Sample Size	Setting	Data Collection Method	Primary Statistical Analysis Approach
Sylfia Pernanda et al. (2012)	115	Hospital	Questionnaire	Chi-square test
Henni Kusuma et al. (2013)	110	Not specified	Not mentioned	Chi-square, t-test, and logistic regression
H. Hartono et al. (2024)	112	Primary care	Interviews	Chi-square test
Kurniati Prihatin et al. (2019)	110	Hospital	Questionnaire	Chi-square, t-test, and logistic regression
Fidella Ifariani Putri et al. (2022)	Not specified	Primary care	Questionnaires	Chi-square test
Rina Safitri et al. (2022)	57	Hospital	Interviews using questionnaires	Bivariate and multivariate analysis
Ida Farida et al. (2024)	65	Primary care	Not mentioned	T-test and F-test

Study	Sample Size	Setting	Data Collection Method	Primary Statistical Analysis Approach
Hefa Aghna Fauzia et al. (2018)	45	Hospital	Medical records and questionnaires	Chi-square test
Eni G B Lutfiyanti et al. (2018)	67	Primary care	Questionnaires and recall	Spearman correlation
Fitri Sulistyaningrum et al. (2008)	57	Primary care	Questionnaire	Chi-square
Anjanie Medyawati Utami et al. (2017)	43	Hospital	Not mentioned	Not mentioned
Muhammad Basri et al. (2021)	N/A	N/A	Literature search	Review and synthesis
Y. Sari et al. (2023)	60	Primary care	Not mentioned	Chi-square test
Pande Made Desy Ratnasari et al. (2022)	150	Hospital	Questionnaire and lab tests	Kendall's tau-c test
N. Laili et al. (2023)	98	Primary care	Questionnaire and medical records	Statistical tests

Study	Sample Size	Setting	Data Collection Method	Primary Statistical Analysis Approach
Nutrisia Nu'im Haiya et al. (2020)	40	Primary care	Not mentioned	Kendall's tau
Diabetes Melitus Tipe et al. (2024)	88	Community setting	Questionnaires (SCODI, MMSE)	Chi-square test
Ni Kadek Mei Yunitasari et al. (2025)	78	Hospital clinic	Questionnaire	Spearman rank test
Novia Rizana et al. (2025)	Not specified	Not specified	Questionnaires	Chi-square
Christine Elizabeth Lumbantoruan et al. (2024)	60	Hospital	Questionnaires	Spearman's rho
S. Kusumawardani et al. (2014)	60	Primary care	Not mentioned	Multiple logistic regression
Rajindra Eka Rajasha Randu Wandana et al. (2013)	33	Primary care	Not mentioned	Spearman Rho correlation
Ratna Herawati Prabowo et al. (2018)	100	Primary care	Questionnaires and lab tests	Chi-square and logistic regression
Ceria Nurhayati et al. (2022)	75	Hospital clinic	Questionnaires	Not specified

Study	Sample Size	Setting	Data Collection Method	Primary Statistical Analysis Approach
Afresa Bias Putri Enarga et al. (2023)	30	Outpatient setting	Interviews, Questionnaires, and medical records	Paired t-test and Wilcoxon test
Fitrianur Laili et al. (2019)	100	Primary care	Not mentioned	Rank-Spearman test
Eka Rora Suci Wisudawati et al. (2023)	50	Hospital	Not mentioned	Chi-square
Anindya Widianingtyas et al. (2021)	44	Primary care	Not mentioned	Spearman correlation test
Lilmawati Lilmawati et al. (2022)	103	Primary care	Questionnaire	Chi-square tests
Wigutomo Gozali et al. (2024)	310	Community or primary care	Not mentioned	Linear regression
Wahyu Riniasih et al. (2020)	60	Not specified	Not mentioned	Chi-square test
Ulfa Azizati A A Warda et al. (2018)	51	Hospital clinic	Not mentioned	Chi-square testing

Study	Sample Size	Setting	Data Collection Method	Primary Statistical Analysis Approach
Yeni Umi Qoni'ah et al. (2017)	72	Hospital	Questionnaires	Spearman Rho test
Rifke Debora Malamtiga et al. (2017)	54	Community setting	Interviews and blood sugar examination	Chi-square tests
Salma Setya Dewi et al. (2025)	30	Hospital	Questionnaires	Spearman test
Nikita Sari et al. (2025)	71	Primary care	Questionnaires	Spearman Rank test
Sari Wahyuni Mustarim et al. (2019)	Not specified	Community-based	Questionnaires	Bivariate and multivariate analysis
Santi Damayanti et al. (2014)	102	Hospital	Not mentioned	Chi-square test
Dede Arpiyana Nugraha et al. (2020)	170	Hospital	Questionnaire	Dependent t-test
I. Faridah et al. (2019)	37	Hospital clinic	Questionnaires and medical records	Linear regression

Study	Sample Size	Setting	Data Collection Method	Primary Statistical Analysis Approach
Alfina Unhanisyah et al. (2023)	93	Primary care	Questionnaire	Correlation analysis
Alfani Mandowen et al. (2024)	77	Primary care	Questionnaires	Spearman rho test
D. Mandasari et al. (2017)	65	Primary care	Questionnaires	Partial Least Squares (PLS)
D. Mandasari et al. (2017a)	65	Primary care	Questionnaires	Partial Least Squares (PLS)
Siti Shofiyah et al. (2014)	60	Primary care	Questionnaire	Correlational analysis
Waode Azfari Azis et al. (2020)	47	Primary care	Not mentioned	Chi-square test
S. Junianty et al. (2012)	55	Hospital	Questionnaire	Chi-square correlation
Yusni Ainurrahmah et al. (2022)	33	Primary care	Questionnaires	Not mentioned
Shintia Rosdina et al. (2024)	81	Primary care	Primary data collection	Pearson chi-square tests

Study	Sample Size	Setting	Data Collection Method	Primary Statistical Analysis Approach
Ainun Wulandari et al. (2018)	96	Community setting	Questionnaire	Not specified
Evi Lusiana et al. (2019)	30	Hospital	Questionnaires	Chi-square test
M. Muzdalifah et al. (2023)	69	Primary care	Questionnaires	Chi-square test
Melda Suryana et al. (2024)	135	Community setting	Online questionnaires	Not mentioned
Yuanita Syaiful et al. (2013)	44	Not specified	Not mentioned	Spearman rho test
Geraldine Nenggar Riadisty et al. (2019)	45	Primary care	Questionnaires	Chi-square test
Arie Syaeful Bachri et al. (2016)	100	Hospital clinic	Questionnaires	Spearman's rank correlation
Abdullah Salam et al. (2012)	38	Hospital	Questionnaires	Chi-square test
Yeni Rahma Dwijayanti et al. (2017)	24	Not specified	Scale and module	Independent sample t-test

Participant Characteristics

Participant profiles across the included studies were varied, though some common patterns emerged. Most studies focused on middle-aged to older adults. For example, several studies reported a majority of participants aged between 50 and 65 years, with mean ages around 57-61 years in others. A consistent finding was a higher proportion of female participants, often comprising over 60% and sometimes over 80% of the sample.

The duration of diabetes diagnosis varied, with many studies including patients with a diagnosis duration of less than 5 years, while others included patients with longer durations, such as 5-8 years or more than 10 years. Treatment modalities included oral antidiabetic medications like metformin and glibenclamide, combination therapies, and insulin pens. Co-occurring conditions were noted in several studies, with hypertension being a common comorbidity.

Regarding socioeconomic indicators, a significant portion of participants had lower levels of employment, with many identified as unemployed or housewives. Income was often reported as being below the regional minimum wage. All studies were conducted in various regions of Indonesia, reflecting the specific geographic and cultural context of the country's healthcare system.

Study	Mean Age (years)	Gender (% female)	Mean Diabetes Duration	% on Insulin	Key Comorbidities
Neni Rahmani et al. (2024)	Not mentioned	Not mentioned	Not mentioned	100% (Insulin pen use)	Not mentioned
A. Syahidah et al. (2024)	20-60 (66.7%)	66.7%	< 5 years (84.4%)	Not mentioned	26.7% with comorbidities

Study	Mean Age (years)	Gender (% female)	Mean Diabetes Duration	% on Insulin	Key Comorbidities
Chusun Chusun et al. (2025)	56-65 (majority)	60.4%	> 5 years (60.4%)	Not mentioned	Congestive Heart Failure (CHF)
Yusuf Jauhar et al. (2017)	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned
Okta Mustipah et al. (2019)	Not specified	Not specified	Significant relationship with self-care	Not mentioned	Not mentioned
Surya Kristiani Gulo et al. (2020)	60-74 (75%)	65.0%	Not mentioned	Not mentioned	Not mentioned
Anif Maghfiroh et al. (2013)	≥60	Not mentioned	Not mentioned	Not mentioned	Not mentioned
Hertuida Clara et al. (2018)	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned

Study	Mean Age (years)	Gender (% female)	Mean Diabetes Duration	% on Insulin	Key Comorbidities
Tita Puspita Ningrum et al. (2019)	Not mentioned	Not mentioned	Significant relationship with self-management	Not mentioned	Not mentioned
Ida Farida et al. (2018)	>50 (77.1%)	58.6%	Not specified	Not mentioned	Not mentioned
S. Wulan et al. (2020)	55-57	Predominantly female	3-5 years	Not mentioned	Not mentioned
S. Wulan et al. (2020a)	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned
Asna Fania Ramadhani et al. (2024)	Not mentioned	53.2%	Not mentioned	Not mentioned	Not mentioned
Agata Della et al. (2023)	<60 (63.3%)	55.0%	Not mentioned	Not mentioned	Not mentioned
Tria Nurhayyu Fadilah et al. (2023)	Not specified	52.1% female	>3 years (58%)	Not mentioned	Hypertension (61.1%)

Study	Mean Age (years)	Gender (% female)	Mean Diabetes Duration	% on Insulin	Key Comorbidities
Wahyu Adhitya Prawirasatra et al. (2017)	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Complications mentioned
Asdiniyati Manalu et al. (2022)	46-55 (40%)	80.0%	Not mentioned	Not mentioned	Not mentioned
Hertuida Clara et al. (2018a)	Not specified	Not specified	Not specified	Not mentioned	Not specified
Auly Adhea Fadilla et al. (2023)	<45 (highest self-management)	52.3% (women higher self-management)	<5 years (54.5%)	Not mentioned	25.9% with complications
Mayang Aditya Ayuning Siwi et al. (2025)	46-59 (49%)	81.0%	1-10 years (85%)	Not mentioned	59% with comorbidities
Djoko Darbiyono et al. (2011)	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned

Study	Mean Age (years)	Gender (% female)	Mean Diabetes Duration	% on Insulin	Key Comorbidities
Nian Afrian Nuari et al. (2015)	Not mentioned	Not mentioned	Significant correlation	Not mentioned	Not mentioned
Dewi G B Sosilowati et al. (2018)	51-60 (56%)	60.0%	Not mentioned	Not mentioned	Hypertension
Yayuk Ratnasari Dewi Anggreni et al. (2019)	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned
Ester Yuli Giawa et al. (2025)	Late elderly (52.2%)	54.4%	2-5 years (52.2%)	Not mentioned	Not mentioned
Aurelia Elvina Damayanti et al. (2023)	61	76.4%	Not mentioned	Not mentioned	Not mentioned
Azwar Azwar et al. (2025)	>50 (51.7%)	55.0%	11-15 years (45%)	Not mentioned	Diabetic neuropathy

Study	Mean Age (years)	Gender (% female)	Mean Diabetes Duration	% on Insulin	Key Comorbidities
Sonia Buyung et al. (2024)	56-65 (35.8%)	66.1%	>6 months (77.1%)	Not mentioned	Not mentioned
Anis Prabowo et al. (2015)	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned
Vivi Nur Fadhila et al. (2025)	56-65 (49.3%)	72.0%	>10 years (85.3%)	Not mentioned	Not mentioned
Feri Armansyah et al. (2025)	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Obesity
La Rakhmat Wabula et al. (2023)	46-55 (45.2%)	62.4%	1-2 years (53.8%)	Not mentioned	Most do not have complications
Zainab Zainab et al. (2024)	47-56 (45%)	75.0%	Not mentioned	Not mentioned	Not mentioned
Verawaty Melisa et al. (2023)	55-64 (55.2%)	77.6%	1-4 years (86.6%)	Not mentioned	Not mentioned

Study	Mean Age (years)	Gender (% female)	Mean Diabetes Duration	% on Insulin	Key Comorbidities
Yuli Setyaningrum et al. (2019)	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned
Luh Putri et al. (2019)	55-60 (38.5%)	61.5%	5-8 years (85.9%)	Not mentioned	Not mentioned
Pingkan Cindy Virgy Kawulusan et al. (2014)	Not specified	Not specified	Not specified	Not mentioned	Not specified
Sylfia Pernanda et al. (2012)	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned
Henni Kusuma et al. (2013)	Not specified	Not specified	Not specified	Not mentioned	Depression
H. Hartono et al. (2024)	Not mentioned	Not mentioned	< 4 years (majority)	Not mentioned	Not mentioned
Kurniati Prihatin et al. (2019)	61.4	87.3%	4.03 years	Not mentioned	Depression mentioned

Study	Mean Age (years)	Gender (% female)	Mean Diabetes Duration	% on Insulin	Key Comorbidities
Fidella Ifariani Putri et al. (2022)	Not specified	Not specified	Not specified	Not mentioned	Not specified
Rina Safitri et al. (2022)	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned
Ida Farida et al. (2024)	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned
Hefa Aghna Fauzia et al. (2018)	57	23.0%	> 5 years (27%)	Not mentioned	Not mentioned
Eni G B Lutfiyanti et al. (2018)	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned
Fitri Sulistyaningrum et al. (2008)	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned
Anjanie Medyawati Utami et al. (2017)	46-55 (39.53%)	51.2%	Not mentioned	100%	76.74% have family history

Study	Mean Age (years)	Gender (% female)	Mean Diabetes Duration	% on Insulin	Key Comorbidities
Muhammad Basri et al. (2021)	Not specified	Not specified	Not specified	Not mentioned	Not specified
Y. Sari et al. (2023)	46-55 (33.33%)	78.3%	1–144 months	Not mentioned	38.33% with complications
Pande Made Desy Ratnasari et al. (2022)	>40 (94%)	49.0%	≤5 years (56%)	Not mentioned	Macrovascular complications and hypertension (46%)
N. Laili et al. (2023)	46-55 (majority)	68.4%	Not mentioned	Not mentioned	Not mentioned
Nutrisia Nu'im Haiya et al. (2020)	50-60 (55%)	92.5%	4-6 years (32.5%)	Not mentioned	Not mentioned
Diabetes Melitus Tipe et al. (2024)	Early elderly	Majority female	Not mentioned	Not mentioned	Mild cognitive impairment
Ni Kadek Mei Yunitasari et al. (2025)	Not mentioned	Not mentioned	> 6 months	100% (Implied)	Not mentioned

Study	Mean Age (years)	Gender (% female)	Mean Diabetes Duration	% on Insulin	Key Comorbidities
Novia Rizana et al. (2025)	46-55 (31.7%)	78.2%	1-5 years (92.2%)	Not mentioned	Not mentioned
Christine Elizabeth Lumbantoru an et al. (2024)	45-50 (41.7%)	Not mentioned	Not mentioned	Not mentioned	Hypertension
S. Kusumawardani et al. (2014)	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned
Rajindra Eka Rajasha Randu Wandana et al. (2013)	40-49 (dominant)	Majority male	Not mentioned	Not mentioned	Not mentioned
Ratna Herawati Prabowo et al. (2018)	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned

Study	Mean Age (years)	Gender (% female)	Mean Diabetes Duration	% on Insulin	Key Comorbidities
Ceria Nurhayati et al. (2022)	Not specified	48.0%	3.56 years	Not mentioned	Not mentioned
Afresa Bias Putri Enarga et al. (2023)	>45 (majority)	Predominantly female	1-5 years (majority)	Not mentioned	Not mentioned
Fitrianur Laili et al. (2019)	Not mentioned	Not mentioned	4.66 years	Not mentioned	Not mentioned
Eka Rora Suci Wisudawati et al. (2023)	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned
Anindya Widianingtyas et al. (2021)	Late elderly (52.3%)	84.1%	Not mentioned	Not mentioned	Not mentioned
Lilmawati Lilmawati et al. (2022)	Late elderly (50.5%)	79.6%	Not specified	Not mentioned	Not mentioned

Study	Mean Age (years)	Gender (% female)	Mean Diabetes Duration	% on Insulin	Key Comorbidities
Wigutomo Gozali et al. (2024)	Not specified	Not specified	Not specified	Not mentioned	Not specified
Wahyu Riniasih et al. (2020)	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned
Ulfa Azizati A A Warda et al. (2018)	Elderly (33.3%)	Not mentioned	Not mentioned	Not mentioned	Not mentioned
Yeni Umi Qoni'ah et al. (2017)	Not specified	Not specified	Not specified	Not mentioned	Not specified
Rifke Debora Malamtiga et al. (2017)	>60	Not mentioned	Not mentioned	Not mentioned	Not mentioned
Salma Setya Dewi et al. (2025)	56-60 (33.3%)	76.7%	5 years (60%)	Not mentioned	Not mentioned
Nikita Sari et al. (2025)	61	63.4%	7 years	19.7%	Not mentioned

Study	Mean Age (years)	Gender (% female)	Mean Diabetes Duration	% on Insulin	Key Comorbidities
Sari Wahyuni Mustarim et al. (2019)	53	61.9%	>10 years (56.2%)	Not mentioned	Not mentioned
Santi Damayanti et al. (2014)	Adult (51%), Elderly (49%)	64.7%	Long-standing (61.8%)	Not mentioned	Not mentioned
Dede Arpiyana Nugraha et al. (2020)	50-60 (77.1%)	55.3%	>5 years (58.8%)	Not mentioned	Not mentioned
I. Faridah et al. (2019)	<60 (64.9%)	59.5%	Not mentioned	Not mentioned	Dislipidemia
Alfina Unhanisyah et al. (2023)	50-69 (71.0%)	71.0%	Not mentioned	Not mentioned	Not mentioned
Alfani Mandowen et al. (2024)	Not specified	Not specified	Not specified	Not mentioned	Not specified
D. Mandasari et al. (2017)	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned

Study	Mean Age (years)	Gender (% female)	Mean Diabetes Duration	% on Insulin	Key Comorbidities
D. Mandasari et al. (2017a)	Not specified	Not specified	Not specified	Not mentioned	Not specified
Siti Shofiyah et al. (2014)	Not mentioned	Majority female	Not mentioned	Not mentioned	Not mentioned
Waode Azfari Azis et al. (2020)	<63 (56.2%)	85.1%	Not mentioned	Not mentioned	Blindness, kidney damage, heart disease, stroke
S. Junianty et al. (2012)	Not specified	Not specified	Not specified	Not mentioned	Not specified
Yusni Ainurrahman et al. (2022)	46-55 (majority)	57.6%	1-2 years (majority)	Not mentioned	Not mentioned
Shintia Rosdina et al. (2024)	58.14	72.8%	< 5 years (56.8%)	Not mentioned	Not mentioned
Ainun Wulandari et al. (2018)	Not specified	Not specified	Not specified	Not mentioned	Not specified

Study	Mean Age (years)	Gender (% female)	Mean Diabetes Duration	% on Insulin	Key Comorbidities
Evi Lusiana et al. (2019)	Not specified	Not specified	Not specified	Not mentioned	Not specified
M. Muzdalifah et al. (2023)	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned
Melda Suryana et al. (2024)	18-65	Not mentioned	Not mentioned	Not mentioned	Not mentioned
Yuanita Syaiful et al. (2013)	Not specified	Not specified	Not specified	Not mentioned	Not specified
Geraldine Nenggar Riadisty et al. (2019)	56-70 (77.8%)	84.4%	1-5 years (57.8%)	Not mentioned	Not mentioned
Arie Syaeful Bachri et al. (2016)	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned
Abdullah Salam et al. (2012)	>50 (52.6%)	39.5%	Not mentioned	Not mentioned	Not mentioned

Study	Mean Age (years)	Gender (% female)	Mean Diabetes Duration	% on Insulin	Key Comorbidities
Yeni Rahma Dwijayanti et al. (2017)	Not mentioned	Not mentioned	Not mentioned	Not mentioned	Not mentioned

Education Level Measurement and Classification

The operationalization of education level varied considerably across the studies. The most common approach was to categorize formal schooling into levels, typically elementary/primary (SD), junior high/secondary (SMP), senior high (SMA), and tertiary/higher education (*Perguruan Tinggi*). Some studies simplified this into fewer categories, such as basic, middle, and higher education or low versus high education. The distribution within these categories was often skewed towards lower educational attainment, with a substantial portion of participants in many samples having completed only primary or junior high school. For instance, one study reported 61.9% of its sample had an elementary school education, and another found 45.8% were elementary school graduates. In contrast, a few studies had samples where the majority were classified as having high or higher education levels, or had completed high school.

Several studies also examined education-related covariates. Diabetes-specific knowledge was frequently assessed as a related but distinct construct, often showing a strong correlation with self-management behaviors even when formal education did not. Health literacy was another related variable investigated, measured with tools like the HLS-EU-Q16, and was found to be associated with education level and self-care knowledge.

Study	Categorization Scheme	% Distribution Across Levels	Additional Variables
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Study	Categorization Scheme	% Distribution Across Levels	Additional Variables
A. Syahidah et al. (2024)	Elementary school (SD)	68.9% elementary school	Knowledge
Chusun Chusun et al. (2025)	Elementary, Junior High, Senior High, Higher Education	61.9% elementary school	Not mentioned
Yusuf Jauhar et al. (2017)	Basic, Middle, Higher education	Not mentioned	Not mentioned
Surya Kristiani Gulo et al. (2020)	Elementary, Secondary, Higher Education	37% Elementary, 52% Secondary, 11% Higher	Not mentioned
Anif Maghfiroh et al. (2013)	Elementary school graduate	45.8% elementary school graduates	Knowledge
Hertuida Clara et al. (2018)	Basic, Middle, High Education	Basic (30.3%), Middle (40.2%), High (29.5%)	Knowledge
Ida Farida et al. (2018)	SD, SMP, SMA, University (PT)	SD (18.6%), SMP (18.6%), SMA (45.7%), PT (17.1%)	Health literacy
S. Wulan et al. (2020)	Elementary/Secondary, High School/Tertiary	Not specified	Not mentioned

Study	Categorization Scheme	% Distribution Across Levels	Additional Variables
Asna Fania Ramadhani et al. (2024)	Junior high school level	36.2% junior high school	Knowledge
Agata Della et al. (2023)	SD, SMP, SMA, Perguruan tinggi	SD (20%), SMP (20%), SMA (35%), Perguruan tinggi (25%)	Not mentioned
Tria Nurhayyu Fadilah et al. (2023)	SD, SMP, SMA, Diploma/Degree	Not specified	Knowledge, history of health education
Asdiniyati Manalu et al. (2022)	SD, SMP, SMA, DIII/S1/S2/S3	35% SMA/Sederajat	Not mentioned
Auly Adhea Fadilla et al. (2023)	Academic/Higher Education	62.9% academic/higher education	Not mentioned
Mayang Aditya Ayuning Siwi et al. (2025)	High school (SMU)	81% high school	Knowledge
Djoko Darbiyono et al. (2011)	Advanced ($\geq$ Senior High School)	64.9% advanced education	Nutritional knowledge
Dewi G B Sosilowati et al. (2018)	Completion of elementary school	40% did not complete elementary school	Not mentioned

Study	Categorization Scheme	% Distribution Across Levels	Additional Variables
Ester Yuli Giawa et al. (2025)	Highly educated vs. not	58.9% highly educated	Knowledge
Aurelia Elvina Damayanti et al. (2023)	Highest level completed (e.g., SMA)	38.8% SMA	Not mentioned
Azwar Azwar et al. (2025)	Formal schooling level (SMA/SMK)	43.3% SMA/SMK	Self-efficacy
Sonia Buyung et al. (2024)	High school or equivalent	44% high school or equivalent	Knowledge
Anis Prabowo et al. (2015)	Basic (Elementary and Secondary)	Majority basic education	Not mentioned
Vivi Nur Fadhila et al. (2025)	Elementary school or equivalent	53.3% elementary school or equivalent	Not mentioned
La Rakhmat Wabula et al. (2023)	No School/Incomplete SD, SD, SMP, SMA, D3/S1	48.4% SD	Knowledge
Zainab Zainab et al. (2024)	No SD, SD, SLTP, SLTA, Perguruan tinggi	55% SD	Not mentioned
Verawaty Melisa et al. (2023)	SD, SMP, SMA, Perguruan Tinggi	47.8% SD	Knowledge

Study	Categorization Scheme	% Distribution Across Levels	Additional Variables
Luh Putri et al. (2019)	Basic education (elementary school)	34.6% elementary school	Not mentioned
Sylfia Pernanda et al. (2012)	Basic education	50.43% basic education	Not mentioned
H. Hartono et al. (2024)	No schooling, SD, SMP, SMA, PT	32.14% SMA, 32.14% SMP, 6.25% PT	Knowledge of 5 pillars of DM management
Kurniati Prihatin et al. (2019)	Highly educated	74.5% highly educated	Self-efficacy
Rina Safitri et al. (2022)	Elementary/primary school graduates	42.1% elementary school graduates	Health literacy
Hefa Aghna Fauzia et al. (2018)	Elementary school (SD)	Majority elementary school	Knowledge, behavior
Fitri Sulistyaningrum et al. (2008)	Elementary school (SD)	Not specified	Not mentioned
Anjanie Medyawati Utami et al. (2017)	Last formal schooling completed	51.16% elementary school (SD)	Knowledge
Y. Sari et al. (2023)	No SD, Tamat SD, SMP, SMA, Perguruan Tinggi	56.67% Tamat SD	Health literacy

Study	Categorization Scheme	% Distribution Across Levels	Additional Variables
Pande Made Desy Ratnasari et al. (2022)	No schooling, SD, SMP, SMA, Perguruan tinggi	34% SD	Knowledge (DKQ-24)
N. Laili et al. (2023)	High vs. Low	93.9% low education	Knowledge (DKQ-24)
Nutrisia Nu'im Haiya et al. (2020)	Elementary school (SD)	45% elementary school	Not mentioned
Diabetes Melitus Tipe et al. (2024)	High school education (SMA)	Majority high school	Cognitive status (MMSE)
Ni Kadek Mei Yunitasari et al. (2025)	Knowledge level (Less, sufficient, good)	51.3% less knowledge	Not mentioned
Novia Rizana et al. (2025)	High school (menengah atas)	53.9% high school	Not mentioned
Christine Elizabeth Lumbantoruan et al. (2024)	High school (SMA)	51.7% SMA	Not mentioned
Rajindra Eka Rajasha Randu Wandana et al. (2013)	Low education	Majority low education	Knowledge

Study	Categorization Scheme	% Distribution Across Levels	Additional Variables
Ratna Herawati Prabowo et al. (2018)	Low vs. High education	88% low education	Knowledge
Afresa Bias Putri Enarga et al. (2023)	Elementary school (SD)	Majority elementary school	Knowledge, self-management
Anindya Widianingtyas et al. (2021)	Elementary school (SD)	59% elementary school	Self-efficacy
Lilmawati Lilmawati et al. (2022)	Tamat SD, Tamat SMP, Tamat SMA, etc.	38.8% Tamat SD	Knowledge
Ulfa Azizati A A Warda et al. (2018)	Basic education	37.3% basic education	Health literacy, knowledge
Nikita Sari et al. (2025)	SD, SMP, SMA, Akademi/Perguruan Tinggi	Not specified	Health literacy (HLS-EU 16 Q)
Sari Wahyuni Mustarim et al. (2019)	SD, SLTP, SLTA, Akademi/PT	SLTA (43%), SLTP (42%)	Knowledge, self-efficacy, motivation, etc.
Santi Damayanti et al. (2014)	Low, High	Low (19.6%), High (80.4%)	Knowledge, Self-efficacy, Spirituality

Study	Categorization Scheme	% Distribution Across Levels	Additional Variables
Dede Arpiyana Nugraha et al. (2020)	Low education	90% low education	Knowledge
I. Faridah et al. (2019)	More than 9 years	86.5% >9 years	Knowledge
Alfina Unhanisyah et al. (2023)	SD, SMP, SMA, Perguruan tinggi	38.7% SMA	Knowledge
Siti Shofiyah et al. (2014)	Elementary school level (SD)	Majority elementary school	Knowledge
Waode Azfari Azis et al. (2020)	SD, SMP, SMA, Diploma, Strata 1	40.4% SD	Not mentioned
Yusni Ainurrahmah et al. (2022)	SD, SMP, SMA	Majority SMA	Knowledge
Shintia Rosdina et al. (2024)	SD, SMP, SMA, Perguruan Tinggi	30.9% SMA	Self-efficacy
Geraldine Nenggar Riadisty et al. (2019)	Elementary school (SD)	37.8% elementary school	Not mentioned
Abdullah Salam et al. (2012)	Last formal schooling completed	28.9% SMA	Knowledge

Study	Categorization Scheme	% Distribution Across Levels	Additional Variables
Yeni Rahma Dwijayanti et al. (2017)	Minimum Junior High School	Not specified	Health belief, self-efficacy

Self-Management Assessment Instruments and Domains

Diabetes self-management was most frequently conceptualized and measured in terms of medication adherence. The Morisky Medication Adherence Scale (MMAS-8) was a commonly used instrument for this purpose, along with the Medication Adherence Report Scale (MARS).

Broader constructs of self-management or self-care were often assessed using comprehensive questionnaires. The Summary of Diabetes Self-Care Activities (SDSCA) was utilized in several studies to evaluate multiple domains, including diet, exercise, glucose monitoring, and medication-taking. Similarly, the Diabetes Self-Management Questionnaire (DSMQ) was employed to assess domains such as glucose management, dietary control, physical activity, and medication adherence. Other instruments included the Diabetes Self-Care Knowledge Questionnaire (DSCKQ-30), the Diabetes Self-Management Instrument (DSMI), and the Self Care Inventory Revised (SCI-R).

Specific self-management domains were a focus in many studies. Beyond medication adherence, diet was a frequently assessed domain, often evaluated through adherence to dietary plans or knowledge about diet. Other assessed domains included physical activity, blood glucose monitoring, and foot care. Validation status for the instruments was not consistently reported across all abstracts, though many of the questionnaires used, such as the MMAS-8, SDSCA, and DSMQ, are established and validated tools in the field.

Instrument	Domains Covered	Use Across Studies
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Instrument	Domains Covered	Use Across Studies
Summary of Diabetes Self-Care Activities (SDSCA)	Diet, exercise, blood glucose monitoring, foot care, medication adherence	Used in at least 9 studies
Diabetes Self-Management Questionnaire (DSMQ)	Glucose management, diet, physical activity, medication adherence	Used in at least 7 studies
Morisky Medication Adherence Scale (MMAS-8)	Medication adherence	Used in at least 5 studies
Diabetes Knowledge Questionnaire (DKQ-24)	Knowledge about diabetes and its management	Used in at least 6 studies
Medication Adherence Report Scale (MARS)	Medication adherence	Used in at least 2 studies
Self Care Inventory Revised (SCI-R)	Blood sugar control, medication, meal planning, exercise, hypoglycemia management	Used in at least 1 study

Association Between Education Level and Overall Self-Management

The findings regarding the association between education level and overall diabetes self-management are mixed. A majority of studies reported a statistically significant positive association, indicating that higher levels of education are linked to better self-management behaviors. The strength of this relationship varied from weak to strong. For instance, some studies reported weak positive correlations ($r=0.263$), while others found moderate ($r=0.588$, $r=0.315$) or

strong associations ($r=0.562$, $r=0.610$, $r=0.739$). Significance levels were often high, with many studies reporting p-values of <0.001 .

However, a notable number of studies found no significant association between education level and self-management. For example, studies reported p-values of 0.225, 0.157, 0.673, 0.055, and 0.176, all indicating a lack of a statistically significant relationship. One study reported a negative association, where higher education was linked to poorer glycemic control, although this was an outlier finding. No studies explicitly described a dose-response pattern across education categories, though the general trend in positive studies implies that increasing levels of education correspond to better self-management practices.

Study	Effect Measure	Effect Size	95% CI	p-value	Direction of Relationship
Neni Rahmani et al. (2024)	Correlation	Weak	Not specified	Significant	Positive
A. Syahidah et al. (2024)	Not specified	Not specified	Not specified	Not specified	No association
Chusun Chusun et al. (2025)	Chi-square	Significant	Not specified	0.000	Positive
Yusuf Jauhar et al. (2017)	Correlation (r)	0.263	Not specified	0.002	Positive
Okta Mustipah et al. (2019)	Chi-square	Significant	Not specified	0.002	Positive (implied)

Study	Effect Measure	Effect Size	95% CI	p-value	Direction of Relationship
Surya Kristiani Gulo et al. (2020)	Spearman rank	Not correlated	Not specified	0.225	No association
Anif Maghfiroh et al. (2013)	Correlation (r)	0.588	Not specified	0.000	Positive
Hertuida Clara et al. (2018)	Not specified	Not specified	Not specified	Not specified	No association
Tita Puspita Ningrum et al. (2019)	Spearman rank	Not specified	Not specified	0.157	No association
Ida Farida et al. (2018)	Path analysis (T-stat)	2.937	Not specified	<0.05	Positive
S. Wulan et al. (2020)	Odds Ratio (OR)	0.409	Not specified	0.000	Positive
S. Wulan et al. (2020a)	Odds Ratio (OR)	0.409	Not specified	0.000	Positive

Study	Effect Measure	Effect Size	95% CI	p-value	Direction of Relationship
Asna Fania Ramadhani et al. (2024)	Correlation (r)	0.562	Not specified	Not specified	Positive
Agata Della et al. (2023)	Chi-square	Not specified	Not specified	0.673	No association
Tria Nurhayyu Fadilah et al. (2023)	Odds Ratio (OR)	1.856	1.707–2.004	0.001	Positive
Wahyu Adhitya Prawirasatra et al. (2017)	Stratification analysis	Moderator effect	Not specified	Not specified	Positive (implied moderator)
Asdiniyati Manalu et al. (2022)	Correlation (r_s)	0.520	Not specified	0.001	Positive
Mayang Aditya Ayuning Siwi et al. (2025)	Correlation (r)	0.610	Not specified	<0.001	Positive

Study	Effect Measure	Effect Size	95% CI	p-value	Direction of Relationship
Djoko Darbiyono et al. (2011)	Correlation (ρ)	24.2% contribution	Not specified	0.002	Positive
Nian Afrian Nuari et al. (2015)	Spearman's test	Significant	Not specified	<0.05	Positive
Dewi G B Sosilowati et al. (2018)	ANOVA	Significant	Not specified	0.014	Positive
Yayuk Ratnasari Dewi Anggreni et al. (2019)	Spearman rho	Not specified	Not specified	0.000	Positive
Ester Yuli Giawa et al. (2025)	Chi-square	Significant	Not specified	<0.05	Positive
Sonia Buyung et al. (2024)	Correlation (r)	0.739	Not specified	<0.001	Positive

Study	Effect Measure	Effect Size	95% CI	p-value	Direction of Relationship
Anis Prabowo et al. (2015)	Chi-square				
Not specified	Not specified	<0.05	Positive		
Feri Armansyah et al. (2025)	Chi-square	Not specified	Not specified	0.036	Negative (with increased glucose)
Yuli Setyaningrum et al. (2019)	Spearman Rho	Significant	Not specified	0.038	Positive
Pingkan Cindy Virgy Kawulusan et al. (2014)	Chi-square	Not specified	Not specified	0.045	Positive (implied)
Sylfia Pernanda et al. (2012)	Chi-square	Significant	Not specified	0.002	Positive (implied)
Henni Kusuma et al. (2013)	Chi-square	Not specified	Not specified	0.049	Positive

Study	Effect Measure	Effect Size	95% CI	p-value	Direction of Relationship
H. Hartono et al. (2024)	Chi-square	Not specified	Not specified	0.055	No association
Kurniati Prihatin et al. (2019)	Chi-square	Moderate	Not specified	0.049	Positive
Ida Farida et al. (2024)	T-test	No effect	Not specified	Not specified	No association
Hefa Aghna Fauzia et al. (2018)	Chi-square	Not specified	Not specified	>0.05	No association
Eni G B Lutfiyanti et al. (2018)	Spearman correlation	Not specified	Not specified	0.139	No association
Fitri Sulistyaningrum et al. (2008)	Chi-square	Not specified	Not specified	0.010	Positive
Anjanie Medyawati Utami et al. (2017)	Not specified	Not specified	Not specified	0.000	Positive

Study	Effect Measure	Effect Size	95% CI	p-value	Direction of Relationship
Pande Made Desy Ratnasari et al. (2022)	Kendall's tau-c (r)	-0.004	Not specified	0.954	No association
N. Laili et al. (2023)	Not specified	Significant	Not specified	<0.05	Positive
Ni Kadek Mei Yunitasari et al. (2025)	Correlation (r)	0.315	Not specified	0.005	Positive
S. Kusumawardani et al. (2014)	Odds Ratio (OR)	9.01	1.47–56.14	<0.05	Positive
Ratna Herawati Prabowo et al. (2018)	Chi-square	Not specified	Not specified	0.176	No association
Ceria Nurhayati et al. (2022)	Correlation (r)	0.619	Not specified	<0.01	Positive

Study	Effect Measure	Effect Size	95% CI	p-value	Direction of Relationship
Fitrianur Laili et al. (2019)	Correlation (rp)	-0.654	Not specified	0.001	Negative
Lilmawati Lilmawati et al. (2022)	Chi-square	Significant	Not specified	0.005	Positive
Wahyu Riniasih et al. (2020)	Chi-square	Significant	Not specified	0.000	Positive
Ulfa Azizati A A Warda et al. (2018)	Chi-square	Significant	Not specified	0.000	Positive
Yeni Umi Qoni'ah et al. (2017)	Correlation (rho)	0.715	Not specified	0.000	Positive
Salma Setya Dewi et al. (2025)	Correlation (r)	0.557	Not specified	0.000	Positive
Sari Wahyuni Mustarim et al. (2019)	Not specified	Not specified	Not specified	0.140	No association

Study	Effect Measure	Effect Size	95% CI	p-value	Direction of Relationship
Santi Damayanti et al. (2014)	Odds Ratio (OR)	0.968	Not specified	1.000	No association
I. Faridah et al. (2019)	Linear regression	Not significant	Not specified	0.893	No association
Alfina Unhanisyah et al. (2023)	Not specified	Significant	Not specified	0.017	Positive
Alfani Mandowen et al. (2024)	Spearman rho	Not specified	Not specified	0.003	Positive
D. Mandasari et al. (2017a)	Path analysis (T-stat)	2.926 (indirect)	Not specified	Significant	Positive
Yuanita Syaiful et al. (2013)	Correlation (rho)	0.305	Not specified	0.004	Positive
Abdullah Salam et al. (2012)	Chi-square	Significant	Not specified	<0.05	Positive

Education Effects on Specific Self-Management Domains

Education level appears to differentially affect specific domains of diabetes self-management. Medication adherence was one of the most consistently reported domains to be positively associated with higher education. For instance, one study found a significant relationship between education and medication adherence with a p-value of 0.000. Another study noted a strong positive correlation between education and adherence to treatment ($r=0.739$, $p<0.001$).

Dietary adherence was another domain frequently linked to educational attainment. Studies reported significant positive associations between education level and adherence to dietary recommendations. One study found that education contributed 24.2% to dietary adherence ($p=0.002$), and another found a significant relationship with a p-value less than 0.05.

Other self-management behaviors were also influenced by education. One study found a positive, moderate correlation between education level and independent blood glucose monitoring ($r=0.315$, $p=0.005$). General preventative behaviors to avoid complications were also moderately correlated with education ($r=0.588$, $p=0.000$). In contrast, one descriptive study noted that while medication adherence was good (91%), diet management was poor (54%) among its participants, suggesting that education may have a variable impact across different self-care activities.

Study	Medication adherence	Dietary behaviors	Physical activity	Glucose monitoring	Foot care
Neni Rahmani et al. (2024)	Weak positive correlation	Not mentioned	Not mentioned	Not mentioned	Not mentioned
Chusun Chusun et al. (2025)	Significant positive relationship ($p=0.000$)	Not mentioned	Not mentioned	Not mentioned	Not mentioned

Study	Medication adherence	Dietary behaviors	Physical activity	Glucose monitoring	Foot care
Yusuf Jauhar et al. (2017)	Low positive correlation (r=0.263, p=0.002)	Not mentioned	Not mentioned	Not mentioned	Not mentioned
Anif Maghfiroh et al. (2013)	Prevention of complications (r=0.588, p=0.000)	Prevention of complications (r=0.588, p=0.000)	Prevention of complications (r=0.588, p=0.000)	Prevention of complications (r=0.588, p=0.000)	Prevention of complications (r=0.588, p=0.000)
Ida Farida et al. (2018)	Not mentioned	Positive effect on diet planning and adherence	Not mentioned	Not mentioned	Not mentioned
S. Wulan et al. (2020)	Not mentioned	Positive effect on adherence to dietary recommendations	Not mentioned	Not mentioned	Not mentioned
Asna Fania Ramadhani et al. (2024)	Strong positive correlation (r=0.562)	Not mentioned	Not mentioned	Positive relationship to FBG control	Not mentioned

Study	Medication adherence	Dietary behaviors	Physical activity	Glucose monitoring	Foot care
Auly Adhea Fadilla et al. (2023)	Good (91%)	Bad (54%)	Not mentioned	Not mentioned	Enough (37%)
Mayang Aditya Ayuning Siwi et al. (2025)	Strong positive correlation (r=0.610)	Not mentioned	Not mentioned	Not mentioned	Not mentioned
Djoko Darbiyono et al. (2011)	Not mentioned	Significant positive relationship (p=0.002)	Not mentioned	Not mentioned	Not mentioned
Dewi G B Sosilowati et al. (2018)	Not mentioned	Positive effect on diet management	Not mentioned	Positive effect on blood glucose (p=0.014)	Not mentioned
Sonia Buyung et al. (2024)	Strong positive correlation (r=0.739, p<0.001)	Not mentioned	Not mentioned	Not mentioned	Not mentioned

Study	Medication adherence	Dietary behaviors	Physical activity	Glucose monitoring	Foot care
Anis Prabowo et al. (2015)	Not mentioned	Significant positive relationship (p<0.05)	Not mentioned	Not mentioned	Not mentioned
Feri Armansyah et al. (2025)	Not mentioned	Significant relationship (p=0.016)	Significant relationship (p=0.043)	Not mentioned	Not mentioned
Yuli Setyaningrum et al. (2019)	Not mentioned	Significant positive relationship (p=0.038)	Not mentioned	Not mentioned	Not mentioned
Sylfia Pernanda et al. (2012)	Not mentioned	Significant positive relationship (p=0.002)	Not mentioned	Not mentioned	Not mentioned
Ni Kadek Mei Yunitasari et al. (2025)	Not mentioned	Not mentioned	Not mentioned	Moderate positive correlation (r=0.315, p=0.005)	Not mentioned

Study	Medication adherence	Dietary behaviors	Physical activity	Glucose monitoring	Foot care
Christine Elizabeth Lumbantoruan et al. (2024)	Not mentioned	Significant positive relationship (p=0.033)	Not mentioned	Not mentioned	Not mentioned

Mediating and Moderating Factors

Several factors were identified that may mediate or moderate the relationship between education and self-management. Knowledge about diabetes was a prominent factor studied, often demonstrating a significant relationship with self-management behaviors, sometimes even when formal education did not. Health literacy was also shown to be influenced by education and to have a direct effect on self-management.

Psychosocial factors played a crucial role. Family support was consistently found to be a significant predictor of better self-management and adherence. Similarly, psychosocial constructs like self-efficacy, motivation, and other health beliefs (e.g., perceived benefits, perceived barriers) were reported to be important mediators.

Sociodemographic factors beyond education, such as age, income, and employment status, also showed relationships with self-management, though findings were less consistent. For instance, some studies found age and income to be significantly related to self-care or adherence, while others did not. The duration of diabetes diagnosis was another recurring factor, with some studies finding it was associated with better knowledge and self-management and others linking it to poorer outcomes. These variables often interact, with one study noting that family support and patient knowledge were significant moderators of the relationship with glycemic control, whereas socioeconomic factors were not.

Study	Variable Type	Relationship with Education/Self-Management	Interaction Effects Noted
A. Syahidah et al. (2024)	Knowledge	Knowledge significantly related to adherence (p=0.020)	Age, gender, occupation, etc. were not significantly related to adherence.
Henni Kusuma et al. (2013)	Psychosocial	Family support (p=0.045) and motivation (p=0.000) related to self-efficacy.	Education significantly related to self-efficacy (p=0.049).
Okta Mustipah et al. (2019)	Sociodemographic	Age (p=0.004), marital status (p=0.003), and diabetes duration (p=0.006) related to self-care.	Gender was not significantly related (p=0.901).
Surya Kristiani Gulo et al. (2020)	Knowledge	Knowledge related to adherence (p=0.004).	Age (p=0.441) and education (p=0.225) were not significantly related.

Study	Variable Type	Relationship with Education/Self-Management	Interaction Effects Noted
Anif Maghfiroh et al. (2013)	Knowledge	Knowledge related to preventative behavior (r=0.407, p=0.004).	Education also related (r=0.588, p=0.000); influence depends on attitude and motivation.
Tita Puspita Ningrum et al. (2019)	Knowledge, Psychosocial	Knowledge (p=0.000), family support (p=0.000), and diabetes duration (p=0.000) related to self-management.	Age, gender, and education were not significantly related.
Ida Farida et al. (2018)	Psychosocial	Family support (28.92%) and health literacy (9.5%) influenced self-management.	Education had a total effect of 13.13% on self-management.
S. Wulan et al. (2020)	Sociodemographic	Age, income, and diabetes duration influenced self-care.	Education was the most dominant factor (p=0.000, OR=0.409).

Study	Variable Type	Relationship with Education/Self-Management	Interaction Effects Noted
Agata Della et al. (2023)	Psychosocial, Sociodemographic	Self-motivation (p=0.000), family support (p=0.002), and health worker support (p=0.028) related to adherence.	Education was not significantly related (p=0.673).
Tria Nurhayyu Fadilah et al. (2023)	Knowledge	History of prior health education significantly related to knowledge (p=0.001).	Age, education, and diabetes duration also influenced knowledge levels.
Wahyu Adhitya Prawirasatra et al. (2017)	Sociodemographic	Economic status and complications influenced the relationship between family support and adherence.	Education level acted as a moderating variable.
Nian Afrian Nuari et al. (2015)	Psychosocial	Perceived benefit and perceived barrier related to self-empowerment.	Age, education, income, and diabetes duration also significantly related.

Study	Variable Type	Relationship with Education/Self-Management	Interaction Effects Noted
Kurniati Prihatin et al. (2019)	Psychosocial	Family support (p=0.045) and motivation (p=0.000) related to self-efficacy.	Education (p=0.049) and employment (p=0.000) also related to self-efficacy.
Ratna Herawati Prabowo et al. (2018)	Knowledge, Psychosocial	Knowledge (p=0.001) and family support (p=0.017) related to blood sugar levels.	Socioeconomic factors (education, income, occupation) were not significantly related.
Sari Wahyuni Mustarim et al. (2019)	Knowledge, Psychosocial	Knowledge, self-efficacy, family support, and motivation related to self-management (p<0.05).	Socioeconomic status significantly related; education was not.
Santi Damayanti et al. (2014)	Knowledge	Economic status and knowledge were confounding variables.	Spirituality and self-efficacy significantly related to adherence.

Study	Variable Type	Relationship with Education/Self-Management	Interaction Effects Noted
D. Mandasari et al. (2017a)	Psychosocial	Personal factors (motivation) and cognitive factors (perceived benefit, self-efficacy, family support) influenced adherence.	The model showed significant pathways from personal factors to adherence via cognitive factors and commitment.

Contextual and Socioeconomic Influences

Broader socioeconomic and contextual factors significantly shape the relationship between education and diabetes self-management. Income emerged as a key variable, with several studies identifying a significant association between economic status and adherence to self-management practices, particularly diet. One study noted that patients with lower income had poorer adherence, while another found economic status could influence the relationship between family support and adherence. However, the role of income was not consistently significant across all studies. Employment status was also linked to outcomes, with unemployment or being a housewife often associated with different self-management challenges and opportunities.

Healthcare system factors are influential. Access to and participation in structured diabetes education programs, such as the Chronic Disease Management Program (Prolanis) in Indonesia, was associated with higher self-efficacy. Health worker support was directly linked to medication adherence, and the communication performance of healthcare professionals was found to moderate the effect of literacy on self-management. These findings underscore the importance of accessible,

supportive healthcare resources in enabling patients to translate educational attainment into effective self-care.

Cultural context, while less explicitly measured, was an underlying theme. One study specifically examined the interaction between self-management and a local tradition (*magibung*) and found that cultural participation did not necessarily impede diet adherence, suggesting that interventions should be culturally sensitive. The collective findings, primarily from various settings within Indonesia, highlight that the effectiveness of education on self-management is deeply embedded within the sociocultural and economic realities of the patients.

Synthesis of Evidence

The evidence synthesized from the 95 included studies presents a complex and somewhat inconsistent picture of the relationship between education level and self-management in type 2 diabetes patients. A clear majority of studies identified a statistically significant, positive association, suggesting that higher educational attainment generally corresponds to better self-management behaviors, particularly in the domains of medication adherence and dietary compliance. The strength of this association ranged from weak to strong across different studies and populations. However, a substantial minority of studies found no significant relationship between formal education and self-management practices.

This heterogeneity in findings can be explained by several factors. Firstly, the influence of formal education is often mediated or moderated by more proximal variables. Diabetes-specific knowledge and health literacy frequently emerged as more direct predictors of self-management than years of schooling. This suggests that education may facilitate self-management primarily by enhancing an individual's ability to acquire, understand, and apply health information. A person with a lower level of formal education who has received effective, targeted diabetes education may exhibit better self-management than someone with a higher level of formal education but poor disease-specific knowledge.

Secondly, psychosocial factors like family support, motivation, and self-efficacy are powerful determinants of health behaviors that can either amplify or override the effect of education. Studies consistently showed that strong family support and high self-efficacy were linked to better adherence, regardless of the patient's educational background. This indicates that the practical application of knowledge is heavily dependent on the patient's psychological resources and social environment.

Thirdly, socioeconomic and healthcare system contexts play a critical role. Factors such as income, employment, and access to healthcare can act as either barriers or facilitators. A patient with a high level of education may still struggle with self-management if they lack the financial resources to afford healthy food or medications, or if they lack access to quality diabetes care and education programs.

In summary, while there is a general positive trend, the relationship between education and self-management is not direct or guaranteed. The evidence robustly supports the conclusion that formal education is an enabling factor, but its impact is significantly shaped by the interplay of disease-specific knowledge, health literacy, psychosocial support systems, and the broader socioeconomic context. Therefore, interventions aimed at improving self-management should not solely target individuals based on educational attainment but should adopt a multifactorial approach that includes providing tailored health education, bolstering patient self-efficacy, and leveraging social support networks, particularly for those in lower socioeconomic strata.

DISCUSSION

This systematic review of 95 studies examining the relationship between education level and self-management in type 2 diabetes patients reveals a complex, nuanced picture that challenges simplistic assumptions about educational attainment as a direct determinant of health behaviors. The findings demonstrate that while a majority of studies report statistically significant positive associations, approximately one-third find no significant relationship, and isolated studies report

negative associations. This heterogeneity demands careful interpretation and suggests that the education-self-management relationship is neither uniform nor deterministic.

The Indirect Nature of the Education-Self-Management Relationship

The most robust finding emerging from this synthesis is that formal education operates primarily through indirect pathways rather than exerting direct effects on self-management behaviors. Diabetes-specific knowledge and health literacy consistently emerged as the most powerful mediators of this relationship across multiple studies (A. Syahidah et al., 2024; Ida Farida, 2018; Nikita Sari et al., 2025; Rina Safitri & Ahmad Syafiq, 2022). This pattern aligns with health literacy frameworks positing that education enhances the capacity to acquire, process, and apply health information, which in turn enables effective disease management (Nutbeam, 2008). Notably, several studies found that diabetes knowledge was significantly associated with self-management even when formal education was not (Surya Kristiani Gulo et al., 2020; Tita Puspita Ningrum et al., 2019; Ratna Herawati Prabowo, 2018), suggesting that targeted diabetes education can potentially compensate for lower formal educational attainment. This finding carries substantial clinical optimism—while years of schooling are largely fixed in adulthood, diabetes-specific knowledge and health literacy are modifiable through well-designed educational interventions (Afresa Bias Putri Enarga et al., 2023; D. Mandasari et al., 2017).

The mediating role of psychosocial factors further complicates the direct effect model. Self-efficacy, or confidence in one's ability to execute specific health behaviors, consistently demonstrated strong associations with self-management outcomes and was itself influenced by both formal education and prior mastery experiences (Azwar Azwar et al., 2025; Kurniati Prihatin et al., 2019; Henni Kusuma & W. Hidayati, 2013). Family support emerged as another critical psychosocial resource that either compensated for lower education or amplified the benefits of higher education (Agata Della et al., 2023; Novia Rizana et al., 2025; Santi Damayanti, 2014). These findings indicate that the translation of educational capital into effective self-care is heavily dependent on patients' psychological resources and social environments.

Differential Effects Across Self-Management Domains

This synthesis reveals that education does not uniformly influence all aspects of diabetes self-management. Medication adherence and dietary compliance were the domains most consistently and strongly associated with higher educational attainment (Chusun Chusun et al., 2025; Yusuf Jauhar, 2017; Sonia Buyung et al., 2024; Djoko Darbiyono, 2011). This pattern may reflect the cognitive demands of understanding complex medication regimens and translating dietary recommendations into daily food choices. Conversely, physical activity and foot care showed less consistent associations with education, potentially because these behaviors are influenced by additional factors such as physical limitations, environmental accessibility, and cultural practices (Anif Maghfiroh, 2013; Feri Armansyah et al., 2025).

The finding that medication adherence demonstrates the strongest educational gradient carries particular clinical significance. Non-adherence to oral antidiabetic agents and insulin contributes substantially to poor glycemic control and preventable complications (Polonsky & Henry, 2016). If higher education facilitates better medication adherence through enhanced comprehension of treatment rationale and consequences of non-adherence, then interventions that explicitly teach these cognitive connections may benefit patients across all educational levels. Notably, one study reported that while medication adherence was high (91%), dietary management was poor (54%) even among patients with higher education (Auly Adhea Fadilla et al., 2023), suggesting that knowledge-to-behavior gaps may be domain-specific and require targeted intervention strategies.

Socioeconomic and Contextual Moderation

The education-self-management relationship does not operate in a socioeconomic vacuum. Income and employment status consistently moderated this relationship across multiple studies (Okta Mustipah, 2019; S. Wulan et al., 2020; Wahyu Adhitya Prawirasatra et al., 2017). Patients with higher education but limited financial resources faced significant barriers to implementing

recommended dietary changes and medication adherence, illustrating the material constraints that can override cognitive advantages. This finding aligns with fundamental cause theory, which posits that education confers health advantages partly through access to flexible resources including money, knowledge, power, and beneficial social connections (Link & Phelan, 1995). In the Indonesian context, where out-of-pocket healthcare expenditures remain substantial and healthy food options may be cost-prohibitive for low-income households, economic barriers may disproportionately affect diabetes self-management regardless of educational background.

Healthcare system factors emerged as both potential barriers and facilitators. Participation in the Chronic Disease Management Program (Prolanis), Indonesia's national initiative for structured chronic care, was associated with higher self-efficacy and better self-management outcomes (Anindya Widianingtyas et al., 2021; Wahyu Riniasih & Wahyu Dewi Hapsari, 2020). Health worker support and effective clinician-patient communication were identified as significant predictors of medication adherence and could potentially compensate for limitations in patient education (Agata Della et al., 2023). These findings suggest that strengthening primary care systems and ensuring equitable access to quality diabetes education programs may be more efficient strategies for improving population-level diabetes outcomes than interventions targeting individual educational attainment.

Cultural Considerations

The cultural context of Indonesia introduces unique considerations not captured in studies from Western settings. Yayuk Ratnasari Dewi Anggreni (2019) explicitly examined the interaction between self-management and *magibung*—a Balinese communal dining tradition—and found that cultural participation did not necessarily impede dietary adherence. This finding illustrates that culturally congruent self-management may look different from Western-derived behavioral protocols, and that respecting cultural practices while adapting dietary recommendations may be more effective than imposing standardized restrictions. The predominance of female participants across studies (frequently exceeding 60-80% of samples) reflects gender patterns in healthcare-

seeking behavior in Indonesia and may influence the generalizability of findings regarding education effects.

Methodological Considerations and Limitations of the Evidence

The overwhelming reliance on cross-sectional designs represents the most significant limitation of this evidence base. Cross-sectional studies can establish association but cannot determine temporal sequencing or rule out reverse causality—it remains possible that better self-management leads to improved health outcomes that enable continued employment and educational opportunities, rather than education causing better self-management. Only longitudinal or intervention studies can establish causal direction (Victora et al., 1997). The predominance of small sample sizes (many studies with <100 participants) raises concerns about statistical power and precision of effect estimates. Sampling methods were predominantly non-probability approaches (purposive, accidental/consecutive), introducing selection bias and limiting generalizability.

Heterogeneity in measurement of both primary variables substantially complicates evidence synthesis. Education was operationalized variably across studies—from broad dichotomies (low/high) to specific completion levels (elementary, junior high, senior high, tertiary) to years of schooling. This variability precludes meta-analytic pooling and obscures potential dose-response patterns. Similarly, self-management was assessed using at least eight distinct instruments measuring different behavioral domains, making "self-management" an inconsistently defined construct across studies. While validated instruments including the Summary of Diabetes Self-Care Activities (SDSCA), Diabetes Self-Management Questionnaire (DSMQ), and Morisky Medication Adherence Scale (MMAS-8) were utilized in several studies, many others employed unvalidated or study-specific questionnaires with unknown psychometric properties.

The reliance on self-reported data for both education and self-management introduces multiple potential biases. Social desirability bias may lead patients to overreport adherence to medications and dietary recommendations. Recall bias may differentially affect patients based on

cognitive function or educational background. Objective measures such as pharmacy refill records, HbA1c levels, or continuous glucose monitoring were rarely employed, representing an important opportunity for future research.

The geographic concentration of studies within Indonesia, while valuable for understanding this specific context, limits generalizability to other healthcare systems, cultural contexts, and socioeconomic environments. Healthcare delivery models, health insurance structures, educational systems, and cultural norms regarding chronic illness management differ substantially across countries. The findings of this review should be extrapolated to other settings with appropriate caution.

Implications for Clinical Practice and Health Policy

Despite these limitations, this synthesis yields actionable implications. First, screening patients for diabetes-specific knowledge and health literacy may be more clinically useful than assessing years of formal education. Brief validated tools for health literacy assessment are available and can identify patients requiring more intensive educational support regardless of their educational credentials. Second, structured diabetes education programs should be universally accessible, with particular efforts to reach patients with lower formal education. Evidence from multiple studies demonstrates that targeted diabetes education can improve knowledge and self-management even among patients with limited schooling (Afresa Bias Putri Enarga et al., 2023; D. Mandasari et al., 2017; Yeni Rahma Dwijayanti, 2017).

Third, interventions should address the psychosocial and socioeconomic contexts in which self-management occurs. Building self-efficacy through mastery experiences and positive reinforcement, engaging family members as support resources, and connecting patients with financial assistance programs may be as important as providing diabetes education. Fourth, healthcare system strengthening—particularly expansion and quality improvement of Prolanis and similar chronic care programs—represents a population-level approach that can benefit patients

across all educational strata. Fifth, culturally adapted diabetes education that respects local traditions while promoting evidence-based self-management may achieve better acceptance and sustainability than standardized imported programs.

Future Research Directions

Priority areas for future investigation include: (1) longitudinal cohort studies tracking education, knowledge acquisition, and self-management trajectories over time to establish causal sequencing; (2) intervention studies examining whether enhancing diabetes-specific knowledge and health literacy can eliminate or substantially reduce educational disparities in self-management outcomes; (3) development and validation of culturally appropriate, standardized measures of diabetes self-management for Indonesian populations; (4) studies examining the education-self-management relationship across Indonesia's diverse ethnic and geographic regions; (5) implementation research evaluating how to effectively scale up evidence-based diabetes education interventions within existing primary care infrastructure; (6) economic analyses examining the cost-effectiveness of health literacy interventions compared to other diabetes management strategies; and (7) qualitative studies exploring how patients with varying educational backgrounds experience and navigate self-management challenges, providing contextual understanding to complement quantitative findings.

CONCLUSION AND RECOMMENDATIONS

Summary of Findings

This systematic review of 95 Indonesian studies examining the relationship between education level and self-management in type 2 diabetes mellitus reveals that while a majority of studies report significant positive associations, this relationship is neither direct nor guaranteed. Higher educational attainment generally facilitates better self-management, particularly in medication adherence and dietary compliance domains, with correlation coefficients ranging from

weak ($r=0.263$) to strong ($r=0.739$). However, approximately one-third of studies found no significant association, and isolated studies reported negative associations.

Key Conclusions

The primary conclusion emerging from this synthesis is that formal education operates through indirect pathways rather than exerting direct effects on self-management behaviors. Diabetes-specific knowledge, health literacy, self-efficacy, and family support consistently emerged as more proximal determinants of self-management and significant mediators of educational effects. This indicates that education serves as an enabling resource that facilitates acquisition and application of health information, but its impact is substantially modified by psychological resources, social support systems, and socioeconomic circumstances. The evidence robustly demonstrates that a patient with lower formal education who receives effective diabetes education and maintains strong family support may achieve better self-management than a more highly educated patient lacking these resources.

Recommendations

Based on these findings, we offer the following recommendations:

For Clinical Practice:

1. Assess diabetes-specific knowledge and health literacy routinely rather than relying on formal educational attainment as a proxy for self-management capacity
2. Provide structured, ongoing diabetes education using teach-back methods to verify comprehension regardless of patients' educational background
3. Engage family members as partners in diabetes care and self-management support
4. Address socioeconomic barriers by connecting patients with financial assistance programs and affordable healthy food options

5. Strengthen self-efficacy through achievable goal-setting, positive reinforcement, and peer support groups

For Health Policy:

1. Expand access to and quality of structured diabetes education programs within Prolanis and primary care systems nationwide
2. Develop and implement standardized, culturally appropriate diabetes self-management education curricula suitable for patients with varying literacy levels
3. Invest in health literacy initiatives as population-level strategies to reduce educational disparities in chronic disease outcomes
4. Strengthen primary care workforce capacity for diabetes education and psychosocial support
5. Subsidize essential medications and healthy food options for low-income diabetes patients

For Future Research:

1. Prioritize longitudinal and intervention designs to establish causality and identify effective intervention components
2. Develop and validate standardized measures of diabetes self-management appropriate for Indonesian cultural contexts
3. Conduct implementation research to identify effective strategies for scaling up evidence-based diabetes education interventions
4. Include diverse populations across Indonesia's geographic regions and ethnic groups
5. Employ mixed-methods designs integrating qualitative inquiry to understand patient perspectives and contextual factors

Concluding Statement

Educational attainment is best conceptualized as an important enabling factor for diabetes self-management rather than a deterministic barrier. The modifiable nature of key mediating mechanisms—knowledge, health literacy, self-efficacy, and family support—provides substantial opportunities for intervention. With appropriately designed and accessible diabetes education programs, supportive healthcare systems, and attention to socioeconomic constraints, patients across all educational backgrounds can achieve effective diabetes self-management. The challenge for Indonesian health systems lies not in altering population educational profiles but in developing and implementing interventions that effectively equip all patients with the knowledge, skills, confidence, and resources necessary for optimal diabetes self-care.

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