

Governing Digital Health for Noncommunicable Diseases Equity Gender and Sustainable Health Systems in Developing Economies

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Abstract

The challenge of non-communicable diseases (NCDs) is greater now than ever before for many healthcare systems in the developing world; at the same time, digital transformation is becoming a crucial aspect of NCD prevention and control, surveillance and health system governance. This paper examines how governance arrangements shape the introduction of digital health into NCD policies and how digital health relates to health equity, gender, and the sustainability of healthcare systems' development. To achieve this purpose, we conducted a qualitative document analysis of 40 NCD documents published between 2010–2026. An 18-variable coding framework examined NCD governance, digital health and data governance, health equity, capabilities and access, gender, sustainability, and alignment with the Sustainable Development Goals (SDGs). Overall, the results show the growing importance of digital technologies in NCD governance; however, they also highlight barriers to implementing these technologies in practice. Diabetes, CVD/hypertension and cancer are the most frequently encountered NCDs. Although the materials examined addressed equity extensively, gendered governance was far less common: gender appeared in only 8 documents (20%), while SDG 5 appeared in only 2 documents (5%). In contrast, SDG 3 appeared in the majority of documents 40, while SDG 10 and SDG 17 appeared in 38 documents each. Therefore, although digitalisation produces some NCD-related outcomes, it does not necessarily guarantee equitable or sustainable results. The value of digital processes depends on governance, accessibility, integration into institutional practices, workforce and funding capacity, and considerations of gender and related inequalities. Thus, digital health should be considered within the framework of sustainable health systems development rather than as a series of open technological innovations.

1. Introduction

Non-communicable diseases (NCDs) are among the largest challenges to modern medical systems. According to the World Health Organisation (WHO), NCDs, which include diseases of the circulatory system, oncology, respiratory system diseases, and diabetes, are responsible for roughly 41 million deaths a year and account for about 74% of deaths around the globe (1). However, the impact of NCDs is uneven. According to estimates made by WHO, a large number of premature deaths caused by NCDs are reported in low- and middle-income countries, which are experiencing health system crises and have to tackle the challenges of chronic diseases and communicable diseases, the lack of finances, and limited access to healthcare (2, 3). Thus, the challenge is not only the increasing incidence of chronic diseases, but also the need for health systems to be ready to address them.

Non-communicable diseases illustrate the inadequacy of overly narrow definitions of health policies and programs. Preventing and controlling them requires coordinated action across primary healthcare, population approaches, prevention efforts, and the social determinants of risk and access to healthcare (2–5). Consequently, these illnesses are often seen as a governance and policy issue. Practical implementation requires cross-sector and cross-institutional efforts and involves translating international commitments into national policies and locally feasible systems (6). Even when national

policies are developed, they may not be fully implemented on time because of fragmentation, lack of resources, failed information systems, and competition among health priorities (7).

In this context, digital transformation has increasingly played an important role in health system development. Digital technologies can improve health information systems, monitor outbreaks, enable telemedicine, facilitate continuity of care, improve communication with patients, and provide information for planning and resource allocation (8–10). These roles are especially important for non-communicable diseases, which require long-term monitoring and repeated contact between patients and the health system. Therefore, WHO's Global Strategy for Digital Health 2020–2025, together with other organisational initiatives on digital health for NCDs, provides a strong argument for using digital technologies to improve public health conditions worldwide (11).

The promise of digital health policies is particularly enticing in the developing world context. Digital platforms are expected to mitigate the effects of geographical distance, extend reach beyond conventional facilities, improve information continuity, and support health systems with workforce deficits and fragmented infrastructure (9, 10, 12). Recent developments confirm that digital health has entered LMICs to a great extent and can potentially be a very useful tool for service provision and health system strengthening. However, this raises a significant policy question: does incorporating digital technologies require creating more equitable health systems? The answer is not necessarily positive. Access to digital health depends on various factors, which are unevenly distributed across and within societies. Effective connectivity, economic accessibility, access to appropriate devices, digital and health literacy, language use, disability inclusion, trust, and responsiveness all affect how much people can use digital health services (8, 13–15). At the institutional level, effective application of digital technologies also depends on workforce competence, financing, interoperability, regulatory issues, and data governance (16). Therefore, digitalisation may remove some barriers while reproducing others.

This issue is especially important in the context of the relationship between digital health and health equity. Health inequities occur not only because services are unavailable but also because of unequal allocation of power, resources, opportunities, and the conditions that enable people to achieve and maintain health (17–19). Digital technologies operate not apart from established social structures but within them, so individuals already disadvantaged by poverty, location, education, gender relations, physical disability, or limited political influence may also struggle to access health services as digital access becomes more important (13–15, 20). Data inequity implies that we must consider not only inequality in access to technology, but also who gets represented, seen, and benefits from digital data (21). These issues highlight governance as an important link between technology and health equity. Digital methods do not operate in healthcare systems as neutral or self-sufficient tools. Their development and implementation involve decisions about responsibility, funding sources, regulation, interoperability, privacy, data ownership, and accountability (8, 16, 22). Decisions of this kind influence the populations, institutions, and health priorities that technology will transform. Likewise, integrating digital technologies into NCD responses should involve policy coherence across all health-system operations, not just implementing across separate applications or platforms.

The other assumption used to analyse the presented process is the capability-based viewpoint. The existence of a technological resource or a formal policy does not automatically mean individuals or organisations have meaningful resources to affect their health or achieve health-related goals. The capability framework highlights the distinction between creating resources and people's real opportunities to use them to achieve positive outcomes in areas that matter to them (23, 24). This distinction applies to digital health technologies and offers insight into the factors that make the link between technology and health effective. For instance, a telehealth platform may make the services available, but certain populations may lack connectivity, digital knowledge, privacy, financial support or faith in the digital world. The capability perspective is especially pertinent to NCD governance, since preventing and treating chronic illness involves continuity, participation, and access to resources over prolonged periods. Responding to NCDs effectively means navigating different health systems over long periods, while health institutions must provide and maintain information flows, personnel, funding, medicines, and the capacity to deliver services (3, 6, 7). Digital transformation can strengthen these processes; however, it may highlight or worsen existing disparities if only some institutions and personnel have the capabilities needed to engage.

Gender is an important dimension of equity problems. Gender differences in access to resources, education, technologies, mobility, decision-making, and services may influence exposure to NCD-related risks and the ability to benefit from digital initiatives. These effects will likely overlap with other factors such as economic status, geography, age, disability, etc. Therefore, digital health and NCD governance should address gender issues. This analysis, however, highlights gender as an intersectional aspect of equity. Although many studies have addressed NCD prevention, digital health, health system strengthening, and health equity, these fields have developed independently (18, 21, 25).

NCD policy research has focused mainly on prevention, treatment, service delivery, and implementation obstacles, while digital technology research has concentrated on technology acceptance, intervention effectiveness, infrastructure, and implementation (2–7, 9, 10, 12). Researchers have shown that social determinants shape health equity and that access to digital resources is unequal, but comparatively little research has examined the connections between health equity and governance (8, 13–15, 17–19, 21, 26). Understanding the relationship between global and national priorities in NCDs, digital health strategy, institutional capacity, and equity is important. Exploring these relationships matters because policies or digital strategies alone provide only a limited understanding of the conditions needed for technological transformation to advance fair and sustainable health systems.

Thus, this research aims to bridge this gap by comparing qualitative analyses of specially gathered documents produced between 2010 and 2026. The study corpus consists of international and national policies, regional documents and policies on non-communicable diseases (NCD) and digital health, government documents related to the topic, and selected scholarly works. Rather than measuring the success of each technological device, this research tracks how policy documents explain the connections among NCD-related governance, digitisation, health equity, and the capacities needed for successful implementation and participation. This study compares how different forms of governance

address the incorporation of digital health technologies in NCD governance and the implications for health equity and sustainable health-system development in different developing economies. In addressing these objectives, the study is guided by the following overarching research question: How do governance arrangements shape the integration of digital health within NCD policy, and under what conditions may such integration contribute to, or constrain, equitable and sustainable health-system development in developing-economy contexts?

In this way, the research adds a new perspective to discussions on the governance of NCD policies, digitalisation, and health equity. Its main thesis argues that evaluating digital health only through the lenses of technology availability and policy adoption is wrong, because equity depends on governance structures and technical and institutional capacities. Consequently, the research highlights the conditions under which digital transformations can improve equity in NCD policies, as well as the governance and structural challenges that may make this impossible.

2. Literature Review and Analytical Framework

2.1. NCD Governance and the Challenge of Policy Integration

Non-communicable diseases (NCDs) continue to be a difficult problem for health systems as their prevention and management go beyond clinical care. Effective approaches require coordinated action on prevention, primary health care, surveillance, financing, human resource development, access to medicines, and social determinants of health (2, 6, 27). As a result, NCD governance is increasingly viewed as a multisectoral policymaking issue rather than merely a matter for ministries of health (28). Even with national strategies or formal commitments, these processes may be implemented ineffectively. Research studies in different low- and middle-income countries identified institutional fragmentation, limited capabilities, human resource shortages, weak coordination, and competing priorities as barriers to effective NCD policy implementation (29). The barriers posed by these problems are even more pronounced in the case of health systems, which have to simultaneously cope with the issues related to infectious diseases, maternal and child health, and the growing number of chronic diseases.

As a result, digital health has become an important component of health-system transformation. Digital technologies can improve surveillance, facilitate continuity of care, enable information flow, provide remote services, and enhance monitoring of NCD risk factors and outcomes (8–10). However, the impact of digital technologies will depend on governance processes for selecting, regulating, integrating, and sustaining these technologies.

2.2. Digital health governance and health equity

The digital health strategy will increasingly emphasise interoperability, data systems utilisation, telehealth, artificial intelligence, and the digitisation of service delivery practices (8). These opportunities

are especially significant in conditions with geographical barriers, lack of healthcare specialists, and poorly functioning healthcare information systems. However, recent reviews of digital health in low- and middle-income countries reveal that digital health expansion is uneven and shaped by existing infrastructure, the financial environment, labour capacity, governance, and regulatory processes (9, 30). This lack of uniformity creates critical equity issues. While some groups may have better access to health services through digital initiatives, inconsistent internet connectivity, limited access to appropriate devices, limited digital skills, and limited ability to use digital health services may exclude others from accessing health services. Moreover, data-related inequality may also occur because underprivileged groups are insufficiently represented in health information systems and/or governance of data access, ownership, security, and accountability is insufficient. These differences raise the following policy question: the issue is not whether digital technology implementation should take place, but what governance frameworks should be used in the digital transformation process to ensure equitable access to health services. Digital health governance involves decisions about institutional responsibilities, regulatory frameworks, data management, and accountability (14).

The connection between digitalisation and fairness is consequently conditional rather than guaranteed. Digital infrastructure can increase formal access to health services but does not necessarily mean people have the economic, social, or structural conditions to benefit. This point matters when analysing developing economies, where significant differences can exist in Internet accessibility, health system resources, income, education level, gender relations, and geographical accessibility.

2.3. Capability vs access and the translation of policies into equity

A serious drawback of technology-oriented policy analysis is that it treats access to an intervention as the same as the ability to benefit from it. The broader concept of capability highlights the real possibilities for people and communities to transform resources into desired outcomes (23, 24). In the context of digital health, this means that the availability of a digital service alone is not enough to ensure equal benefits. People may face obstacles related to money, digital literacy, language, disabilities, infrastructure, social position, and trust in institutions. Similarly, health organisations can officially adopt digital methods but lack compatible systems, trained personnel, sustainable financing, or the regulatory capacity needed to implement them. Thus, capabilities connect, rather than policy accessibility, to outcomes in terms of health equity. This approach is particularly relevant to the governance and management of noncommunicable diseases (NCDs), since controlling chronic diseases usually entails regular engagement with health care systems. New technologies can facilitate this engagement; however, their effectiveness depends on people's and organisations' ability to use them accordingly.

This approach does not assume technological determinism. Rather than claiming that technological innovation leads to progress, it examines the hypersocial institutions and conditions that shape the relationship between technological innovation and health equity.

2.4. Health equity, gender, and intersecting inequalities

Health inequities emerge from the unequal distribution of power, resources, opportunities, and access to health-related conditions (17, 18). Health inequalities intersect with social inequalities of several other types, including gender, income, education, geography, disability, age, etc. Gender represents an important aspect of technology and NCD management since unequal access may have an impact on who can benefit from health intervention programs. Nevertheless, gender should never be seen in isolation or as a single, homogeneous category. Gender's influence depends on its intersection with other social processes and circumstances (31).

In this work, gender is treated as a relevant component of health equity rather than assumed to be the main determining factor in every policy context. This conclusion is supported by the chosen corpus, where gender-related information is present but unevenly distributed. Therefore, the analysis focuses on how governance structures acknowledge, address, or ignore differentiated barriers to participation.

2.5. Sustainable health systems and the gap in the analysis

The sustainability of digital health and non-communicable disease (NCD) policy responses relies on more than adopting new technologies and making political commitments; sustainable change requires institutional capacity, sustainable funding, workforce development, integration with other services, accountability, and the ability to adjust to changing population needs (8, 28). The available literature already provides substantial information on NCD preventive measures, digital health implementations, health equity, and health system strengthening. However, scientific research usually studies these areas in isolation. For example, studies on NCD policies may focus mainly on prevention, implementation, and service delivery, while digital health studies tend to explore technology implementation, infrastructure, or specific interventions (6, 9, 10). In contrast, equity research has focused on social determinants and digital divides that affect access but has less often supported the rigorous comparative framework needed to examine governance interactions between NCD policymaking and digital transformation (17, 32).

This leads to an integration and governance gap. Understanding how NCD issues, digital health plans, capacity constraints, and equity interact across governance levels. This approach is particularly relevant in developing-economy contexts, where global policy plays out through different institutional capacities and social conditions.

3. Methods

3.1. Research Design

This research adopted a comparative qualitative document analysis approach to examine governance frameworks and their influence on the role of digital health in policies on non-communicable diseases and health equity in developing economies. Document analysis is an appropriate method for policy research, as formal documents reflect institutional priorities, problem framing, governance frameworks, and the nature of interventions undertaken (33, 34). The research is comparative and does not involve

any statistical analysis. The work examined similarities, differences, and recurring trends in documents produced at the global, regional, or national levels, as reported in the academic literature.

The research employed a combination of deductive and inductive approaches to data analysis. Initially, the researcher developed codes based on the content areas captured in the extraction matrix (35–37). Through the iterative analysis, the researcher generated themes and concepts based on the documents analysed. The analysis revealed not only evidence of policies but also their links to governance, digital transformation, capability deficiencies, and equity issues.

3.2. Data Corpus and Sampling

This research analysed a deliberately curated set of 40 publicly available documents using a predefined 18-variable coding matrix in Excel. The documents comprised international and regional reports, national and state-level NCD policy documents, digital health strategies, government documents, and other relevant publicly accessible sources. The documents cover 2010–2026 and include international and regional reports, state-level reports on non-communicable diseases (NCD), documents highlighting trends in digital health and public policies, and other sources relevant to the research. To select information-rich literature that met the research objectives, we used purposeful, criterion-based sampling (38). The selected works had to present substantial evidence on NCD prevention or governance issues; digital health or data governance development; health equity or factors influencing it; accessibility-related limitations preventing active participation; or sustainable health systems.

The sample was analytical but not statistically representative in terms of countries and document types. In other words, the aim was not to ensure equal representation of countries or document types. The purpose of using different types of works was to enable comparative analysis. Therefore, the findings can provide valuable insights into the policy framing and governance trends rather than provide generalisations for the entire population.

3.3. Data Extraction and Analysis

A total of 40 documents were analysed by means of an 18-variable coding framework where bibliographical as well as analytical information was available, including information related to document characteristics, geographical area, sustainability goals, facts collected on digital governance, relation to NCDs, equity matters, constraints in building capabilities, governance mechanisms, half of the findings, statistics, quotations, and thematic mapping.

The analysis followed three steps. Initially, the documents were reviewed to identify variations in document type, source organisation, geographical area, and policy direction. Then, in the second stage, the findings extracted were examined through the prism of six interconnected areas, namely: 1) governance and policy coordination; 2) digital health and digital governance; 3) NCD prevention and health-system response; 4) health equity and social determinants; 5) capabilities, access and inclusion; and 6) sustainability and resilience of the healthcare systems.

In the third step, we compared evidence across documents to identify recurring patterns, divergent accounts, and tensions. In particular, we singled out situations in which policies or technologies advanced while obstacles remained in infrastructure, affordability, digital literacy, institutional capacity, and social disadvantages. The comparison used traditional thematic analysis and framework analysis (35–37, 39). Recurrence was interpreted as an indication of a pattern rather than as evidence of significance, and interpretations were drawn from the content and context of the documents. Gender was treated as a key issue in health equity when the documents explicitly mentioned it. Because gender was not represented evenly in the reviewed corpus, its importance was not assumed in every document.

3.4. Rigour and Limitations

The analysis was made rigorous through a uniform extraction framework across all documents, a structured evaluation of evidence, and the inclusion of primary details, quotations, and statistics in coding tables to ensure traceability between the original information and its interpretation (39–41). The hybrid approach also helped reduce dependence on predetermined categories and pure grounding. Some limitations are worth mentioning here. The purposive, variously structured corpus is not representative of all emerging economies, and both country and organisational coverage is uneven. Furthermore, documents vary in the level of evidence; policy commitments do not equal implementation or observable results. Over time, documentary sources may also reflect informal governance practices, implementation challenges, and points of view not included in official documents. Because the research was based on documentary and secondary materials and did not involve human behaviour, it did not involve human-subject participation.

4. Results and Findings

Analysis of the 40 documents shows a clear trend: while the elements of digital transformation, NCD governance, and health equity are well integrated into policy discourse, their implementation varies across countries and levels of governance. The analysis does not support the simplistic view that technological innovations produce an equitable-earning health system. Instead, the documents indicate that several conditions are needed to realise the benefits of digital transformation and NCDs, including state governance capacity, health systems, access to certain technologies and services, and societal inequalities.

The findings have been structured into the four analytical dimensions: (1) the structure of the corpus and its development over time; (2) the level of governance and integration of policy agendas; (3) technological development and the potential limitations in abilities; and (4) alignment with equity and gender approaches. This reflects insights derived from the coding matrix rather than previous work.

4.1. The collection and growth of the body of evidence

The collection comprised 40 documents published from 2010 to 2026. The distribution was heavily skewed toward the evidence: 21 documents (52.5%) were published from 2024 to 2026, including 14

published in 2025. Compared with older texts, which mostly covered foundational documents on NCD action plans and multisectoral strategies, more recent documents focused more on digital health, data governance, artificial intelligence, equity, and sustainability in health systems (8, 27, 42–47).

This chronological trend reflects a significant shift in policy-framing approaches. While earlier documents on NCDs focused on prevention, risk factor mitigation, monitoring, primary health care, and multisectoral coordination, recent documents began linking these to digital health infrastructure, interoperable information systems, digital screening, data-led decision-making, and artificial intelligence (8, 27, 42–44, 46, 48–59). Therefore, the transformation was not substitution but addition: digitalisation was generally framed as a way to strengthen current health system functions rather than replace traditional methods of prevention and se, service delivery, as shown in Table 1 and Figs. 1 and 2.

Table 1
Temporal composition of the 40-document corpus

Publication Period	Documents, n	% of Corpus	Dominant Analytical Emphasis
2010–2014	4	10.0	Foundational NCD burden, governance and multisectoral action
2015–2019	8	20.0	National NCD strategies, digital health foundations and implementation
2020–2023	7	17.5	Health-system strengthening, digital strategy and renewed NCD governance
2024–2026	21	52.5	Digital transformation, AI, equity, SDG monitoring and implementation
Total	40	100.0	Comparative policy and governance corpus
Note: The temporal distribution reflects the publication years of the 40 documents included in the comparative policy and governance corpus.			

Likewise, the distribution across geographic areas is incomplete and uneven, reflecting the dataset's intentional construction. Overall, 18 (45%) of the documents were published in the context of the global or regional situation, while eight (20%) of the documents were devoted to India, three documents were authored in Indonesia, two in South Africa, and other country-level documents were published for Brazil, Bangladesh, Bhutan, Maldives, Myanmar, Nepal, Sri Lanka, and Thailand. The WHO South-East Asia Region was also involved in the present analysis.

4.2. Transitioning from the governance of NCDs through multiple sectors to digitised health systems

A major conclusion revealed the power of multi-sector governance in supporting NCD policy. NCD prevention is seen as covering aspects beyond clinical care, as emphasised in national policies worldwide, including risk reduction, food, physical activity, tobacco and alcohol control, surveillance,

primary care, and other important factors referred to as social determinants (1, 27, 49, 60–63). The WHO Global Action Plan began by incorporating ideas on NCD prevention and control into its documents, linking them to surveillance, multisectoral action, universal health coverage, and health systems strengthening efforts (27, 59, 60). Evidence of this inclusion appears in the documents of countries such as Bangladesh, Bhutan, Maldives, Myanmar, Nepal, Sri Lanka, Thailand, South Africa, Brazil, and Indonesia, where many national policies include cross-sector governance (49, 58, 63–65).

The extent to which digital governance has been incorporated into NCD frameworks has varied significantly. Some older national action plans have focused mainly on traditional public health coordination and risk factors, without sufficiently addressing digital systems (48, 49, 54, 63). Today, more advanced strategies present digital infrastructure as an essential component of governance processes that support prevention, screening, care continuity, surveillance, and data-driven decision-making. Among national advancements, India showed the highest concentration of evidence. National findings linked NP-NCD to population-wide screening, digital health systems, AI-assisted cancer screening, and digital service delivery (55, 56, 66). The Chhattisgarh example was particularly illustrative because it went beyond national ambition and showed how digital systems integrate in real life through NCD management, including population screening and continuity of care.

However, the evidence suggests that digitalisation varied across the examples. For instance, while South Africa's National Digital Health Strategy and Indonesia's digital transformation framework declared aims for system-wide digitalisation, some NCD action plans in South and Southeast Asia appear to have focused more on multisectoral prevention than on digital governance. In essence, this represents a transition from multisectoral NCD governance to digitally mediated health system governance, without replacing the former altogether. Digital systems were integrated into existing governance models, and the degree of integration depended on institutional capacity, policy development, infrastructure levels, and government priorities, as shown in Table 2.

Table 2
Comparative pattern of governance integration

Governance Level/Context	Dominant Policy Mechanism	Digital Governance Emphasis	Principal Equity Implication
Global/WHO	Norm-setting, monitoring, UHC, NCD targets	Increasingly prominent	Unequal national capacity to implement commitments
Regional	Adaptation and coordination	Moderate and variable	Regional differences in institutional and health-system capacity
National NCD plans	Multisectoral prevention and service strengthening	Variable; stronger in recent strategies	Unequal access to prevention, diagnosis and treatment
National digital strategies	Data systems, interoperability, digital services	High	Risk of digital exclusion
Subnational/programme cases	Screening, outreach and implementation	High where operationalized	Potential to improve reach but dependent on infrastructure and literacy
Note: The table synthesises comparative patterns identified across global, regional, national and subnational/programmatic documents in the corpus.			

4.3. Digital Transformation has Increased Policy Capacity but has not Eliminated Implementation Challenges

One striking, consistent finding is the dual function of digital transformation. Technology has increased the speed of information transfer and communication, surveillance, population screening, telemedicine, health data interoperability, continuity of care, and more focused service delivery (8, 42–45, 55–59, 67). Under the WHO Digital Global Health Strategy, digital transformation was defined as a component of health system strengthening. Likewise, digital intervention guidelines guided the use of digital tools within the service delivery and health system framework. Newly published global monitoring reports followed this line, asserting the vital role of modern information systems and data infrastructure in monitoring health development.

At the national level, both the Indonesian Blueprint for Digital Health Transformation and the South African National Digital Health Strategy show efforts to institutionalise digital health through strategic planning and coordinated action (58, 68). India's newly published policy documents strongly emphasised the relationship between digital health innovation and non-communicable disease screening, AI-empowered cancer detection, and health system improvement (55, 56). However, nearly all significant digital opportunities recognised in the corpus were matched by corresponding capability limitations. These included infrastructure deficiencies, limited connectivity, affordability issues, low digital literacy,

workforce deficits, fragmented information systems, poor interoperability, financing constraints, and varying institutional capacities.

As a result, the evidence revealed a recurring analytical tension. Evolving technology increased the potential of health care systems, while multiplying limitations that determined who would actually benefit from these enhancements. This was observed in international and national documents. The 2025 World Report of Social Determinants of Health Equity was especially clear in connecting digital transformation to both possibilities and exclusions. The same applies to the 2025 Human Development Report, which defined a source of widening inequalities in development as unequal access to new technologies and AI. Transform Health Indonesia also highlighted inclusive governance and digital access (59). This leads us to conclude that the key analytical distinction is not between digital and non-digital health systems. The key distinction, however, is between the availability of digital systems and the real possibility of their use.

4.4. The main focus of NCDs was on specific chronic diseases.

The disease-specific coding highlighted a significant overlap between NCDs. Diabetes was mentioned 27 times, heart disease or hypertension 26 times, cancer 23 times, chronic respiratory disease 20 times, and mental or neurological diseases 6 times. The overlap occurred because different countries and international organisations mentioned several diseases at the same time, as shown in Table 3 and Fig. 3.

Table 3
Disease-related emphasis in the corpus

Disease Category	Documents Explicitly Referencing Category, n*	Interpretation
Diabetes	27	Strongly embedded in prevention, screening and long-term management
Cardiovascular disease/hypertension	26	Central to population screening and primary-care strategies
Cancer	23	Increasingly associated with screening and AI-enabled detection
Chronic respiratory diseases	20	Frequently included within core NCD frameworks
Mental/neurological conditions	6	Present but less consistently integrated
General/multiple NCDs	16	Documents addressing NCDs as an integrated policy domain

*Categories are non-exclusive; individual documents may explicitly reference more than one disease category.

Note Frequencies are derived from the coding of the 40-document comparative policy and governance corpus.

Diabetes and cardiac disease are significant because they play a central role in screening and managing populations. The NP-NCD of India directly connected diabetes and hypertension screening with population coverage (69, 70). The term “cancer” is especially important in the context of digital policy because of the use of AI and digital screening (55, 56).

At the same time, the document corpus showed an inconsistency between disease and technology. For example, while applications that use AI for screening processes are actively discussed in the news, limiting factors such as human resources, follow-up systems, treatment process continuity, cost, and access to services remain barriers to service delivery (42–44, 60, 64, 71, 72). So, having technology does not guarantee it can be fully utilised. The findings imply that introducing digital innovations will enhance the effectiveness of NCD strategies if the relevant systems for screening, referrals, treatment, monitoring, and aftercare are already working properly.

4.5 Much attention was paid to equity, but gender equity was not always present in the database

Equity was a common issue for the articles analysed. In our case, the dataset frequently mentioned issues related to income, place of living, rurality, education, poverty, service availability, vulnerable social groups, disabilities, and digital exclusion (42–44, 46, 56, 59, 64, 71, 73). WHO global health statistics and social determinants reports provided a broader understanding of this problem. These reports show a contradiction between high aggregate indicators and persistent inequalities, both countrywide and regionally. The 2025 social determinants report was particularly relevant to this study because it indicated that inequity results from structural, economic, political, and social conditions, not just limited access to medical services. The WHO 2021 global health statistics and social determinants of health reports provided the broadest overview of the issue, indicating that positive changes in health statistics occur alongside existing inequalities, both globally and locally. The 2025 social-determinants report was especially relevant in defining inequity as connected to the structural, social, and economic roots of the problem, rather than merely unequal access to healthcare.

The country-specific materials confirmed this point. Documents that discussed India as a focus country repeatedly highlighted the challenges of including the rural population, affordability, limited access to specialists, and barriers to screening and continuous treatment (56, 69–71). Documents from South Africa and Indonesia showed similar concern about the unfair distribution of resources and the importance of addressing health systems reform issues (58, 59, 64, 68). Nonetheless, gender was mentioned in only 8 of 40 coding sheets (20%). When gender was mentioned, it was largely part of the discussion of other disadvantages. The strongest manifestation of the gender issue appears in the global equity and human development reports, where gender inequality has been linked to inequality in opportunities, access to technology, and social participation (44, 46).

This discrepancy is noteworthy in itself. The corpus acknowledges health disparities, yet it does not consistently translate gender into specific governance mechanisms, indicator types, responsibility

structures, and digital inclusion practices, as the analysis shows. The concept of gender was used at the level of principle, while evidence on how gender-related policy implementation would look in practice was inconsistent. This difference matters when interpreting policy declarations. A framework of actions addressing a certain population may be universal but yield different outcomes if processes for enabling accessibility to people through technologies, services, and decision-making are unequal.

4.6. SDG framing of the actions taken was broad, but the focus was on implementation.

The analysis demonstrated significant overall alignment of the corpus with the SDGs. All documents were linked to SDG 3, while SDG 10 and SDG 17 appeared 38 times and SDG 16 appeared 34 times. SDG 9 appeared in 9 documents, while SDG 5 appeared in only 2 documents, as shown in Table 4 and Fig. 4.

Table 4
SDG alignment in the corpus

SDG	Documents Coded, n	%
SDG 3: Good Health and Well-being	40	100.0
SDG 10: Reduced Inequalities	38	95.0
SDG 17: Partnerships for the Goals	38	95.0
SDG 16: Peace, Justice and Strong Institutions	34	85.0
SDG 11: Sustainable Cities and Communities	10	25.0
SDG 9: Industry, Innovation and Infrastructure	9	22.5
SDG 5: Gender Equality	2	5.0
SDG 13: Climate Action	2	5.0
Note: SDG categories are not mutually exclusive; individual documents may be coded as relevant to multiple Sustainable Development Goals. Frequencies are based on the 40-document corpus.		

The framework is very illustrative after analysis. The relationship between NCD policy and health, inequality reduction, institutional governance, and partnership is evident. In contrast, explicit gender equality and gender-responsive governance are less distinctive. This suggests a contrast between general equity rhetoric and operational implementation. Although SDG 10 was applied in the policy context, SDG 5 was not widely recorded. As a result, inequality was stated as a broad issue, while gender-specific mechanisms were barely mentioned.

4.7. The key finding: policies and technology were growing with continuous inequalities

The strongest tendency within the coding framework was the so-called governance-equity tension. All documents include evidence of successes, reforms, increasing technologies, or other governmental

documentation, while also noting barriers to equality, including ineffective access, infrastructure problems, costs, capacity, staffing, missing data, and broader social issues. The latest WHO reports provide the clearest examples of this trend. The 2025 and 2026 World Health Statistics documents confirm progress in monitoring health and developing systems while stressing ongoing failures to achieve health-related SDGs (42, 43). The World Report on Social Determinants of Health Equity also shows that breakthroughs in health and technology go hand in hand with severe structural inequalities (44). This trend is evident in countries as well. In India, digital healthcare infrastructure, population screening, and the use of Artificial Intelligence have improved significantly. However, the same literature also highlights urban-rural gaps, affordability barriers, and unequal access to doctors (56, 71). Similarly, Indonesia and South Africa have suggested ambitious digitalisation programs while recognising existing infrastructure and access issues in their countries (58, 59, 68).

Consequently, the evidence does not suggest a simple conclusion regarding the success or failure of digital transformation. Rather, we can conclude that policy advances coincide with the continuation of certain inequities. The main question remains whether the governance systems are strong enough to overcome traditional barriers to converting technologies into health outcomes, as shown in Table 5.

Table 5
Comparative synthesis of the principal findings

Analytical Dimension	Dominant Evidence	Main Tension
NCD governance	Strong multisectoral and UHC orientation	Policy commitment versus implementation capacity
Digital transformation	Rapid growth in data systems, screening and digital services	Technological availability versus unequal access
Institutional capacity	Greater strategic attention to digital governance	Financing, workforce and interoperability constraints
Health equity	Persistent recognition of disadvantaged populations	Broad commitments versus uneven operationalisation
Gender	Present as a cross-cutting equity concern	Limited explicit gender-responsive mechanisms
Sustainability	Strong SDG and system-strengthening alignment	Long-term institutional and financial capacity remains uneven
Disease management	Strong focus on diabetes, cardiovascular disease and cancer	Advanced screening requires continuity of downstream care
Note: The table provides a comparative synthesis of the principal patterns and tensions identified across the 40-document corpus.		

4.8. The synthesis of results

In summary, the 40 documents reflect the evolution of a health governance landscape in which NCD policies, digitalisation, and sustainability are becoming increasingly intertwined in how health systems are governed. However, this evolution is not uniform across the world and across different governance levels. There are three important insights.

First, digital health has become more entrenched in NCD and health governance systems, as shown by various global and national documents produced in the past year (8, 42–44, 55, 56, 58, 67, 68). Second, capability constraints appear to mediate digitalisation's implications for equity. Factors such as infrastructure availability, affordability, literacy levels, workforce capacity, institutional readiness, and social inequalities seem to determine whether technology and policy innovations translate into real access (46, 59, 71). Third, while the corpus was closely aligned with SDG 3, SDG 10, SDG 16, and SDG 17, it placed much less emphasis on gender as a policy issue. This finding indicates that general commitments to equity can exist, yet they hardly guarantee gender-sensitive governance.

Consequently, the findings show that the main problem is not only increasing technology use or strengthening NCD policies. Rather, it is developing governance arrangements that connect technology, institutional capacity, access, equity, and long-term health-system sustainability. The Discussion develops the implications of this pattern.

5. Discussion

5.1. The path from commitment to capacity for implementation

The results indicate a significant advancement in governing non-communicable diseases (NCDs). Earlier materials in the corpus mainly focused on acknowledging NCDs as the key policy challenge, multisectoral cooperation, and universal health coverage. However, more recent documents published from 2024 to 2026 represent a major shift toward greater engagement with concepts such as digital transformation, data systems, artificial intelligence (AI), and interoperability. This indicates that digital health is no longer merely a tool but is becoming more integrated into broader health systems and governance agendas.

Nevertheless, the findings show that policy adoption and implementation capacity do not move at the same speed. In the corpus, commitments to multisectoral NCD prevention, universal health coverage, and digital transformation were much more visible than implementation mechanisms related to financing, human resources, interoperability, and institutionalisation. The mere existence of a national strategy or digital health policy does not automatically indicate readiness for implementation (14, 30, 74, 75). Recent studies further highlight that organisational capacity, sustainable financing, technical capacity, governance arrangements, and workforce capacity also play a role in determining whether a digital health initiative goes beyond the pilot stage. The principal claim from the analysis is that governance links technology availability to population health benefits. Digital systems can improve

monitoring, screening, continuity of care, and access to specialist services, but success depends on integration within institutional systems. Therefore, the growing importance of digital transformation in documents does not mean implementation has improved equally.

This finding is highly relevant in regard to non-communicable diseases. Unlike episodic health interventions, effective management of non-communicable diseases involves continuity in prevention, risk identification, diagnosis, treatment, monitoring, and long-term care. The mention of diabetes, cardiovascular diseases and hypertension, and cancer by a large number of sources reflects this need for continuous care provision. Digital screening, or AI-based detection, can help identify disease earlier, but its public health value is limited in areas with inadequate treatment options, diagnostic capabilities, and post-treatment care systems. If so, we should assess digital developments not only as stand-alone innovations but also within the broader landscape of NCD management systems.

5.2. Digital Change and the Dilemma of Health Equity

Another significant observation is a disconnect between the strong emphasis on equity in the documents and the disparity in conditions linked to access to and use of digital health services. Efforts to achieve SDG 10 appear to be on the agenda of 95% of the corpus, while vulnerable groups, rural spaces, and other disadvantaged communities are repeatedly recognised as problematic for policy planning. However, in many cases, priorities in national digital policies depend directly on resource availability. This creates a paradoxical situation. The same digital method may improve accessibility for some communities but deepen barriers for others. For instance, populations with limited internet access, lower digital literacy, financial constraints, or restricted access to personal devices may be least able to benefit. Recent findings on digital health in low- and middle-income countries confirm that inequitable access to infrastructure, skills, and knowledge about data poses major risks to fair implementation (14, 74, 75).

This means that equity should not be perceived as a subsequent result of digital growth. Equity should be a criterion when designing and managing a policy. The question here is not whether digital technologies make it possible to provide more services. Rather, it is about who can access and use them, what data are used, and whether those selected through digital screening can receive treatment. This is crucial for universal health care. A formally universal digital service does not guarantee equality, which may fail when populations differ in their ability to use equipment, technical resources, knowledge, or health services. Therefore, it is time to move from a technology-driven conception of digital health to one based on capabilities, so effective access becomes a product of interaction among individual capacities, institutional elements, and social conditions.

5.3. The gender gap: from cross-cutting principle to operational governance

A crucial equity-related finding concerned gender. While the corpus covered equity well, only two of 40 documents (5%) engaged clearly with SDG 5: Gender Equality, and only eight documents (20%) showed

explicit interest in gender. This point matters because it shows that although gender is recognised as part of the broader equity discourse, it has not translated into governance. The results suggest a difference between gender awareness and gender responsiveness. A policy may acknowledge that women are vulnerable to gender issues without implementing sex- or gender-disaggregated indicators, gender-sensitive design in IT projects, approaches to developing digital competences, anti-algorithmic bias measures, and monitoring mechanisms for unequal use and outcomes.

This result aligns with new literature recommending gender-sensitive approaches in digital health (76). Gender influences several factors related to technology use. Lacking gender consideration can be critical in digital NCDs, where much work remains, and ongoing engagement is required.

This means that the low degree of direct references to SDG 5 in the corpus does not indicate a lack of concern about this issue. Instead, it reveals the current governance model's inability to operationalise gender. Future strategies related to NCD and digital health should consider gender across all stages of the policy cycle: problem identification, technology design, implementation, and evaluation. Relevant indicators are needed to show whether digital transformation improves or worsens the current situation.

5.4. Sustainability as institutional continuity and not technological advancement

The findings on sustainability extend this argument. The analysis showed considerable compliance with SDGs 3, 10, 16, and 17, demonstrating progress in health, reduced inequality, governance capacity, and partnerships. However, sustainability must not be confused with applying innovative technologies. Implementing an innovative digital health tool alone does not ensure its sustainability. Effective digital health solutions require ongoing funding, regular updates, skilled human resources, compatibility with existing information technologies, effective data management, and organisational responsibility. Recent publications also highlight that digital initiatives often fail because they depend on temporary funding, inconsistent infrastructure, and parallel systems (14, 30, 74, 75).

The above indicates the institutional perspective on sustainability. The sustainability of using information technologies in NCD governance depends on how fully ICT systems are incorporated into service delivery. ICT systems must be sustainable beyond pilot projects, remain up to date, and have the necessary expertise. This also highlights the importance of SDGs 16 and 17 to the subject. Good governance and strong partnership frameworks are vital to sustaining digital transformations. However, rather than relying on foreign support, it should build up its own capacity.

5.5. Disease priorities and the continuity-of-care impediment

In terms of disease type, diabetes (n = 27), cardiovascular disease/hypertension (n = 26), and cancer (n = 23) are prominent. These diseases can benefit from technology-enabled monitoring, screening, and management. The trend towards associating cancer with AI technologies and digital devices reflects the

technological shift noted in continuously updated documents. At the same time, the analysis suggests a significant policy contradiction: improved detection doesn't guarantee better outcomes. Screening devices can be beneficial only when linked to existing referral systems, diagnostic services, treatment, and long-term follow-up programs. In resource-limited systems, increasing the likelihood of detecting disease without expanding capacity to treat people who develop it can create new problems.

Thus, the discussion emphasises the need for a model of digital governance in NCDs. Investments in this area should target the whole care pathway rather than prioritising specific technological stages, such as screening or AI-assisted detection.

5.6. Policy implications

The comparative results suggest five policy implications. First, digital health should be treated as part of health-system infrastructure, not simply as a set of separate technological projects. The national NCD and digital health strategies should better align on implementation objectives, financing mechanisms, and accountability. Second, introduce equity impact evaluations before launching large-scale initiatives. Governments should explore how geography, income, gender, age, disability, and digital connectivity affect access to digital health. Third, measure gender responsiveness. Digital NCD policies should use gender-disaggregated indicators of access to digital health, treatment implementation, sustainability of digital devices, and exclusion from digital health. Fourth, link screening investments and AI to capacity. To achieve the desired effects, introduce new technologies into primary care, referral systems, drug supply, and diagnostic systems. Finally, sustainability assessments should be made through institutionalisation. Evaluating the policy means assessing whether digital systems are financially sustainable, usable, staff are trained, and governance is within public health systems.

5.7. Limitations

Several limitations should be considered while interpreting the findings of the analysis. First, the study uses a purposively constructed corpus of 40 documents related to policies, strategies, and programs, rather than a statistically representative sample of all digital health and NCD policies worldwide. As such, the results should be viewed as an analytical comparison of the corpus, rather than as a reflection of the prevalence of digital health and NCD policies worldwide. Second, document analysis can identify policy commitments and declared governance priorities, but it does not independently assess how fully these policies are implemented. Thus, a policy can declare intentions in areas such as digital transformation, gender, or equity and still fail to translate those words into relevant actions. Third, codes assigned to various concepts such as equity, sustainability, or SDG alignment necessarily involve some analysis. Structured coding enhances consistency, but different documents may use different amounts and types of terminology. Fourth, the corpus primarily consists of documents published in recent years, with 52.5% published between 2024 and 2026. Such temporal concentration reflects the rapid development of digital health policies but may make contemporary policy priorities more visible than earlier governance approaches.

5.8. Future research

Future research on this topic could take three paths, one of which is shifting focus away from documentary comparisons. First, studies should also conduct thorough research to ensure that the governance commitments specified in national policies lead to measurable changes in NCD prevention and treatment. Second, it is time to implement gender-responsive research that analyses how women, as well as other gender groups, experience digital NCD services and how those services affect access, confidentiality, and usability. Third, it would be beneficial to conduct longitudinal research and analyse whether digital health research is being institutionalised or occurring only during pilot implementation stages. An additional priority is to establish widely used indicators to assess digital maturity, NCD outcomes, equity, and sustainability. This type of framework would enable policymakers to evaluate not just the implementation of health technology, but also its equitable and sustainable impact on health.

The results indicate a shift from traditional NCD governance to technology-driven approaches to prevention, monitoring, testing, and service delivery. However, the problem is not just introducing technology. The difference is not using technology, but how effectively, fairly, and sustainably governments implement digital transformation. The main point of this article is that the relationship between NCD policies and digital transformation is, in fact, an institutional matter. While committed to equitable and sustainable approaches to NCD governance, governments still struggle with implementation issues related to digital access, inequality, and gender considerations. Digital transformation of NCD governance can help advance policy implementation, provided appropriate investments are made in governance institutions, workforce capabilities, equal access, etc.

6. Conclusion

The research investigated changes in the connections among governance for non-communicable diseases (NCDs), digital transformation of health systems, equity, gender, and sustainability by analysing documents related to policies, strategies, and programs issued in 2010–2026. The results indicate a radical shift from traditional NCD policies to new digital approaches, including health information systems, digital service delivery, EHR screening, interoperability, and new-generation AI solutions. However, the study shows that technological progress alone does not guarantee good NCD outcomes. Across the documents analysed, commitment to multi-sectoral cooperation and improved access to health services is evident. Nevertheless, considerable obstacles related to funding, infrastructure, personnel capacity, and implementation in practice remain. The research predictably highlights a significant equity contradiction. Although the term “equity” recurs throughout the text, unequal access to connectivity, devices, digital literacy, and healthcare raises questions about whose interests digital innovation serves. Gender issues are addressed much less thoroughly: only 2 out of 40 papers explicitly refer to SDG 5, suggesting that equity commitments are not necessarily accompanied by gender-sensitive governance practices. Similar conclusions apply to sustainability, which appears to be an institutional rather than purely technical issue. Digital NCD innovations are likely to work only when other supportive components, including proper financing, supportive systems, a skilled workforce, and good governance practices, are properly implemented. As a result, the key message of the current research is that good governance enables organisations to use digital innovation sustainably and equitably.

Therefore, future policies should focus on the institutional aspects of digital systems and distinguish between technologies that have been adapted and integrated into practice and those that exist only formally.

Declarations

Ethics approval and consent to participate

This article is based on secondary analysis of existing policy, strategy, and programme documents from publicly available sources, and it does not involve human participants, human biological material, personal data, or any identifiable information. Therefore, ethical approval and consent for participation were not required.

Consent for publication

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Competing interests

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Author contributions

Neha Agarwal conceptualised and designed the study, developed the methodology, conducted data collection, data extraction, data coding and data analysis, interpreted the findings, prepared the visualisations, and wrote the original draft of the manuscript. Dr Govind Kumar contributed to the conceptualisation and design of the study, interpretation of the findings, critical review and revision of the manuscript, and supervision of the research process. Suryansh Saxena contributed to interpreting the findings and reviewing and editing the manuscript. All authors contributed to developing the manuscript and approved the final version for submission. All authors have read and approved the final version of the paper.

Data Availability

The researcher-generated dataset used for the extraction and coding of 40 publicly available documents is provided in Supplementary File 1, deposited in Zenodo at <https://doi.org/10.5281/zenodo.22911478>. Supplementary File 1 includes the 18-variable coding matrix, source verification information, direct web links to the underlying sources, and supporting information.

The original source documents are publicly available through the respective institutional and governmental websites. No restricted or proprietary dataset was used.

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Use of AI technologies

No generative AI was used to create, analyse, or interpret the study data or findings. **Grammarly was used after completion of the manuscript solely for grammar, spelling, punctuation, and language correction.** The authors reviewed and approved the final manuscript.

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Figures

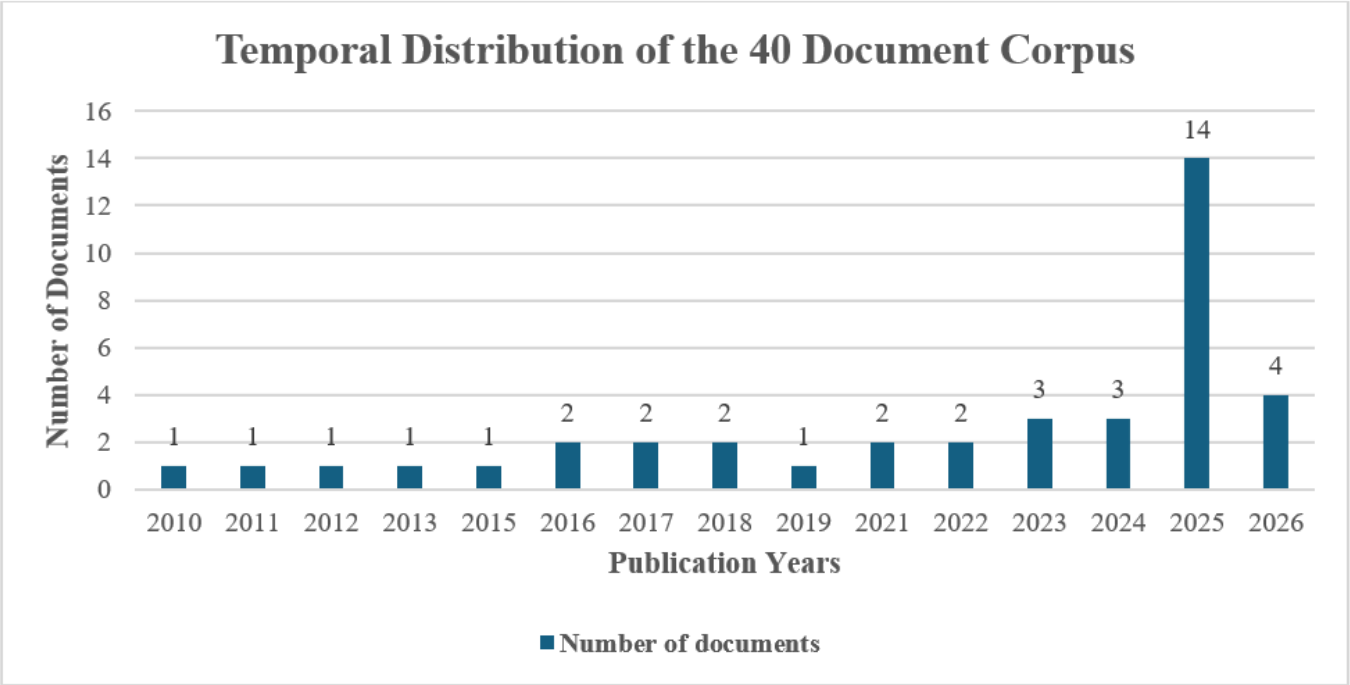


Figure 1

Temporal distribution of the 40-document corpus

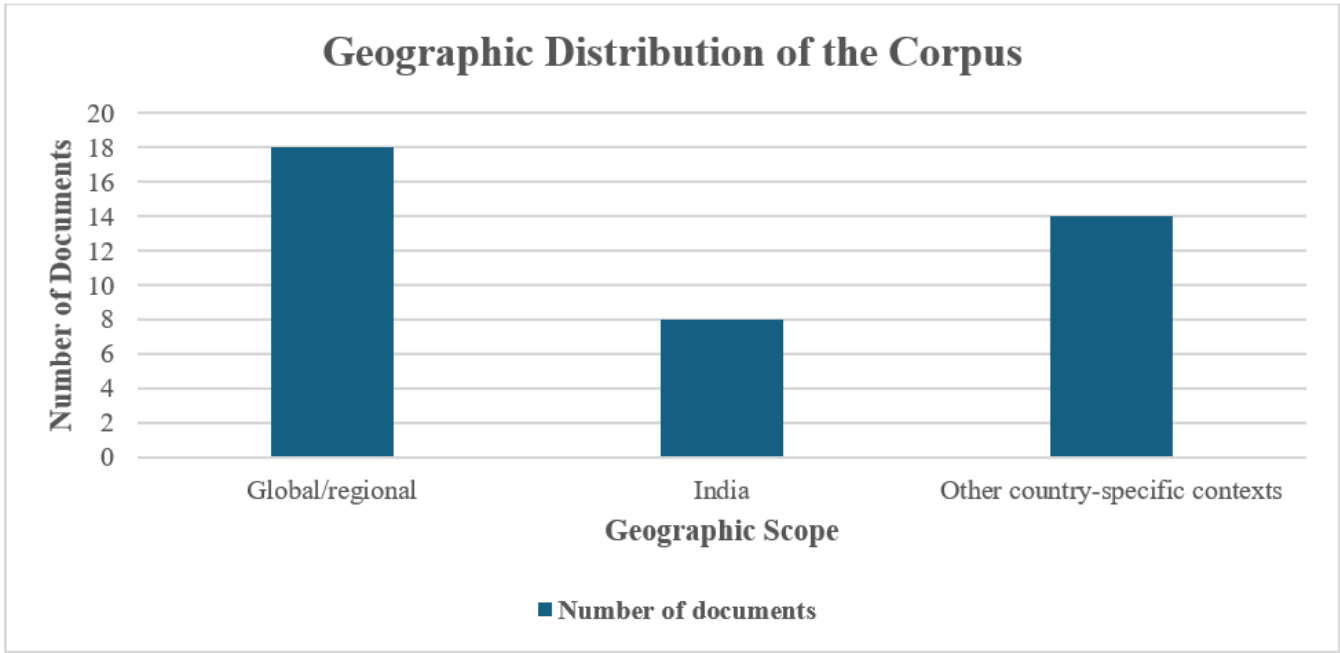


Figure 2

Geographic distribution of the corpus

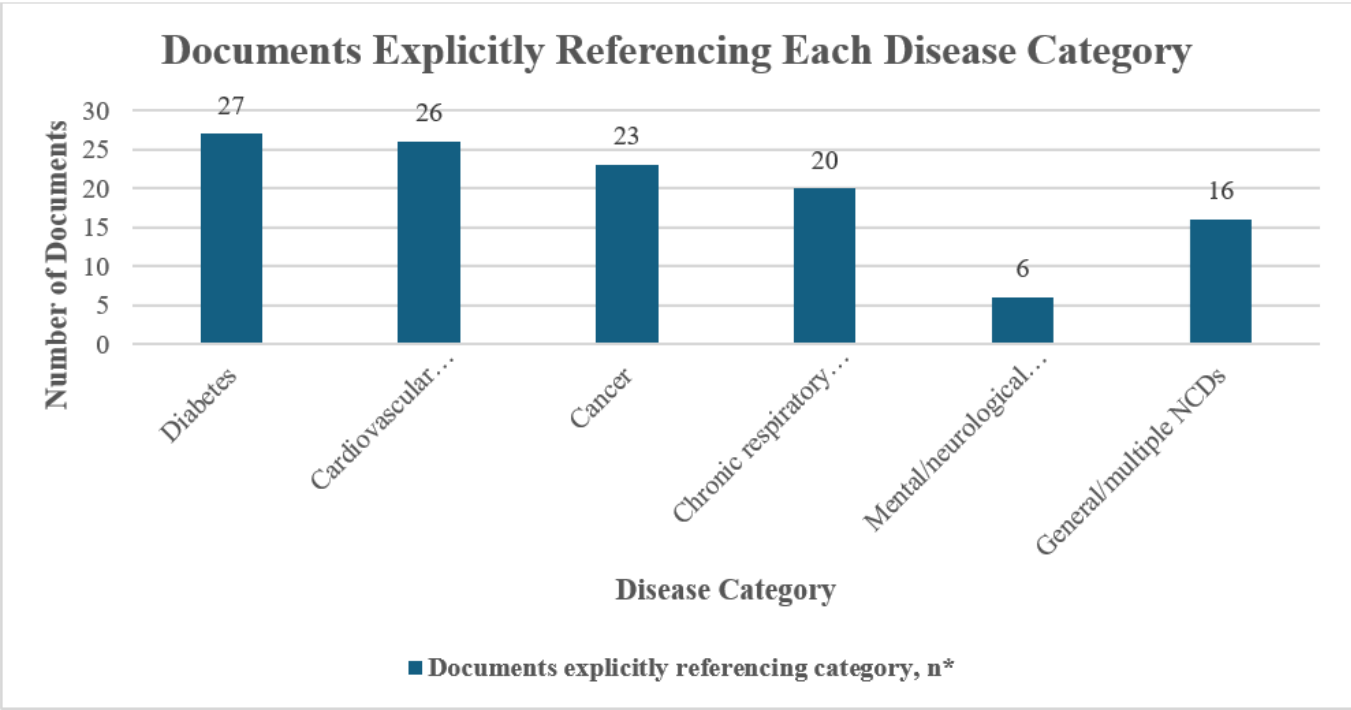


Figure 3

Distribution of Disease Categories Explicitly Referenced Across the 40-Document Corpus

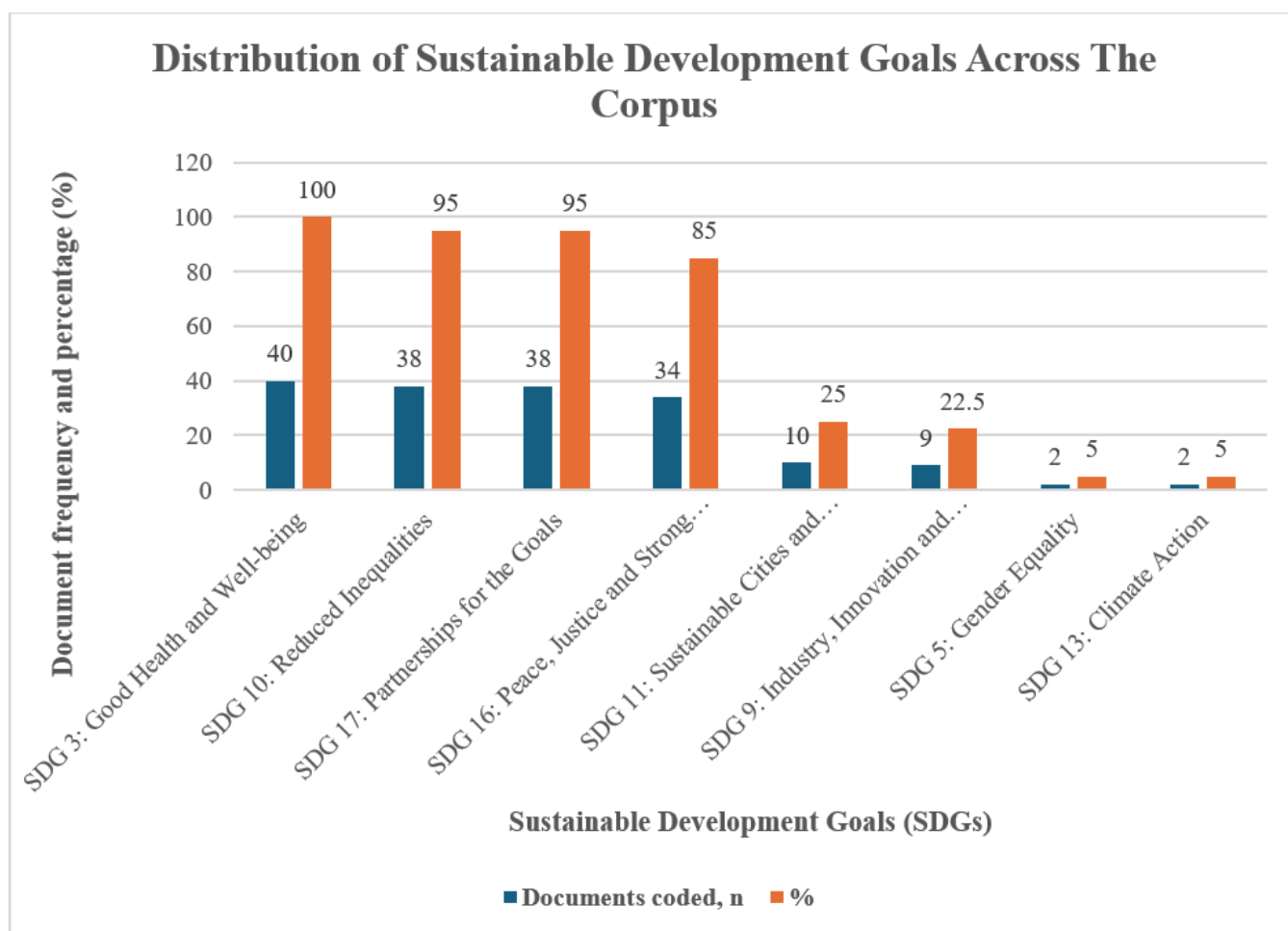


Figure 4

Sustainable Development Goal (SDG) Alignment Across the 40-Document Corpus

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