

Development and Implementation of Clinical Care Models for the Effective Management of Non-Communicable Diseases

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Abstract: This paper describes the development and implementation of clinical care models for the effective management of non-communicable diseases (NCDs). NCDs, such as cardiovascular disease, diabetes mellitus, chronic respiratory disease, and cancers, are the leading cause of morbidity and mortality around the world. The growing number of NCDs is putting pressure on healthcare systems, especially in low- and middle-income countries. This paper describes the process used to develop clinical care models that respond to the individual risk-factor specificities encountered by individuals with NCDs, applying evidence-based interventions, a patient-centered approach, and a multidisciplinary healthcare team. It will also describe how clinical care models were implemented in a healthcare system, challenges, stressors, and successes of incorporating new models into existing systems. Components of the models included prevention, early identification, individualized treatment plans, and therapeutic strategies for long-term management. We contribute to the argument that by focusing on the healthcare professional, specifically nurses and physicians, we can provide an overarching framework within clinical care models to enhance patients' experiences and more effective outcomes, while acknowledging the case for reduction of the burden of NCDs in population health. We suggest that clinical teams together can reduce the burden and improve the health of populations through the adoption of comprehensive clinical care models.

Keywords: Clinical Care Models, Non-Communicable Diseases, Healthcare Systems, Management of Disease, Prevention, Patient-Centered Care, Interdisciplinary Teams, Chronic Disease Management, Healthcare Integration, Public Health Outcomes.

1. Introduction

Non-communicable diseases (NCDs) represent the greatest public health threat of the 21st century. According to the World Health Organization (WHO), NCDs, including cardiovascular disease, diabetes, respiratory diseases, and certain cancers, account for nearly 71% of all global deaths each year. This number is staggering and emphasizes the dire need for proper healthcare models to address the rising prevalence of and management of NCDs, especially since many developing regions frequently lack the healthcare resources to invest in health models or strategies. NCDs threaten the quality of life for individuals while putting strain on other health infrastructures, time, and cost in patients' care, sometimes resulting in increased healthcare costs, and negatively impacting the productivity of the workforce (Malekzadeh et al., 2020; World Health Organization, 2020). A clinical care model for NCDs (a complex issue for patient care and health outcomes) is useful for managing these issues. The clinical care models have a range of care to

inform care for clinically-defined patient-centeredness, prevention, early detection, and chronic disease self-management. To provide effective clinical care in an NCD context, collaboration across a range of professionals that includes medical doctors, nurses, dietitians, and mental health professionals is necessary; Collaborating with health professionals from the first point of touch provides an opportunity to provide patient-centred care, which can complement the all-important dimensions of disease burden relationship (Sanjeevi et al., 2024). For this paper, we describe the process of clinic care models development for NCDs as an example, and how to implement these models within health systems (World Health Organization, 1978). The paper will describe the need for a coordinated, person-centred health care approach and detail the strategies that could be used to improve the care that is delivered. The paper will also consider what the barriers were to effective implementation - this includes limited resources, lack of NCD provider training, and cultural barriers - and provide solutions to remove these barriers. Finally, this paper will enable health systems to integrate NCD care effectively, and therefore improve the management of chronic disease patients (Goodale, 2011; Prabakar et al., 2025).

2. Background on Non-Communicable Diseases (NCDs)

Global Burden of NCDs

NCDs, or noncommunicable diseases, are responsible for more than 70% of deaths in the world, almost 41 million deaths per year. Cardiovascular disease, cancers, diabetes, and chronic respiratory disease are the leading NCDs (Ganesan et al., 2024). NCDs are mainly the result of an interplay of multiple behavioral risk factors of an unhealthy diet, tobacco use, harmful use of alcohol, and insufficient physical activity. Environmental exposures can also increase the occurrence of NCDs, such as, for example, air pollution and occupational exposure, and, at the same time, genetic predisposition multiplied by multifactorial avenues promotes potential risk among populations (Oleribe et al., 2015). About 80% of NCD mortality occurs in LMICs, which see a large burden of NCDs partly in relation to what at times is called the "double burden" of ill health. The existence of infectious diseases with NCDs must be dealt with by these LMICs (Mishra & Haval, 2024). The consequences of chronic morbidity and mortality for fragile health systems are severe. And this is a burden that does not just manifest itself in mortality; the burden of chronic morbidity and preventable disability comes with the workers into any job for a long time after injury; for some of these workers, chronic diseases mean a life of disability; they create no sustainable health care expenditures that have the potential to destroy entire households. These burdens will only entrench the interlocking cycle of poverty and health inequity in chronic disease and make the global burden of NCDs not just another clinical issue, but an inherently developmental issue. Moreover, the issues of NCDs are defined by the nuances of economics, which provide a radical modification of activities in the socio-historical development of nations (Mounier-Jack et al., 2017).

Equation for Clinical Care Performance

$$\text{CCP} = \text{Early Detection} + \text{Treatment Adherence} - \text{Mortality Rate}$$

Where:

- **Early Detection** = Improvement in early diagnosis (in %).
- **Treatment Adherence** = Improvement in patient compliance (measured in percentage).
- **Mortality Rate** = Reduction in NCD-related mortality (measured in percentage).

The aforementioned simplified **equation 1** generates an initial score (CCP) that gives the cumulative power of early detection of a disease, patient compliance with the model of care, and lastly, the impact on reducing mortality. A higher value for the CCP shows a model of care that has greater success than another model with a lower score. This equation allows us to compare an assortment of models of care, as in the "Thailand model," of the use of novel antibiotics to "person-centered care in Rwanda," "spontaneous bacterial peritonitis in Brazil," and "Td in Finland." In each of these simple and straightforward factors, we can assign a score to evaluate and compare the effectiveness of a clinical model of care that may not demonstrate any better care than the next (Rohwer et al., 2021).

Impact on Healthcare Systems

Healthcare systems across the globe are experiencing immense pressure both to address the surveillance and management of infectious diseases while tackling an ever-increasing prevalence of NCDs. Unlike acute diseases that can often be resolved within limited care episodes, NCDs require ongoing, integrated care that may last years, even decades, and encompasses an enormous amount of resources. Most hospitals and primary care sites are ill-equipped to provide continuous long-term management for NCDs, as they do not have the basic infrastructure, workforce capacity, or mechanisms for delivering chronic care (Atun et al., 2004). Because care for NCDs is often siloed among specialists, general practitioners, and community services with no mechanism for integration, disjointed care exacerbates disorganization, delays diagnosis, leads to poor adherence to treatment plans, poor patient follow-up treatment sessions, and high rates of hospital re-admissions (Dudley & Garner, 2011; Dowdy et al., 2020).

A **figure 1** illustrates that the outlining an evidence-based approach to the establishment and integration of a new clinical care model specifically designed to manage Non-Communicable Disease (NCD) in a systematic way, is provided in figure 1. The new care model begins with a Needs Assessment to define the intended population and delineate any current service gaps. Then the Model Design is completed to define the care pathways, roles, and technology. It is important to secure Resource Allocation before implementing the care model, in terms of budgeting, staffing, and infrastructure (Lehmann & Gilson, 2013). The care model is pilot-tested to collect feedback and adjust workflow processes accordingly. If successful, it transitions to a Full-Scale Launch with expanded services, organized training sessions, and outreach support before and after the full launch. Finally, the continuous cycle consists of Continuous Monitoring, which requires data collection and performance monitoring (Kodner & Spreeuwenberg, 2002).

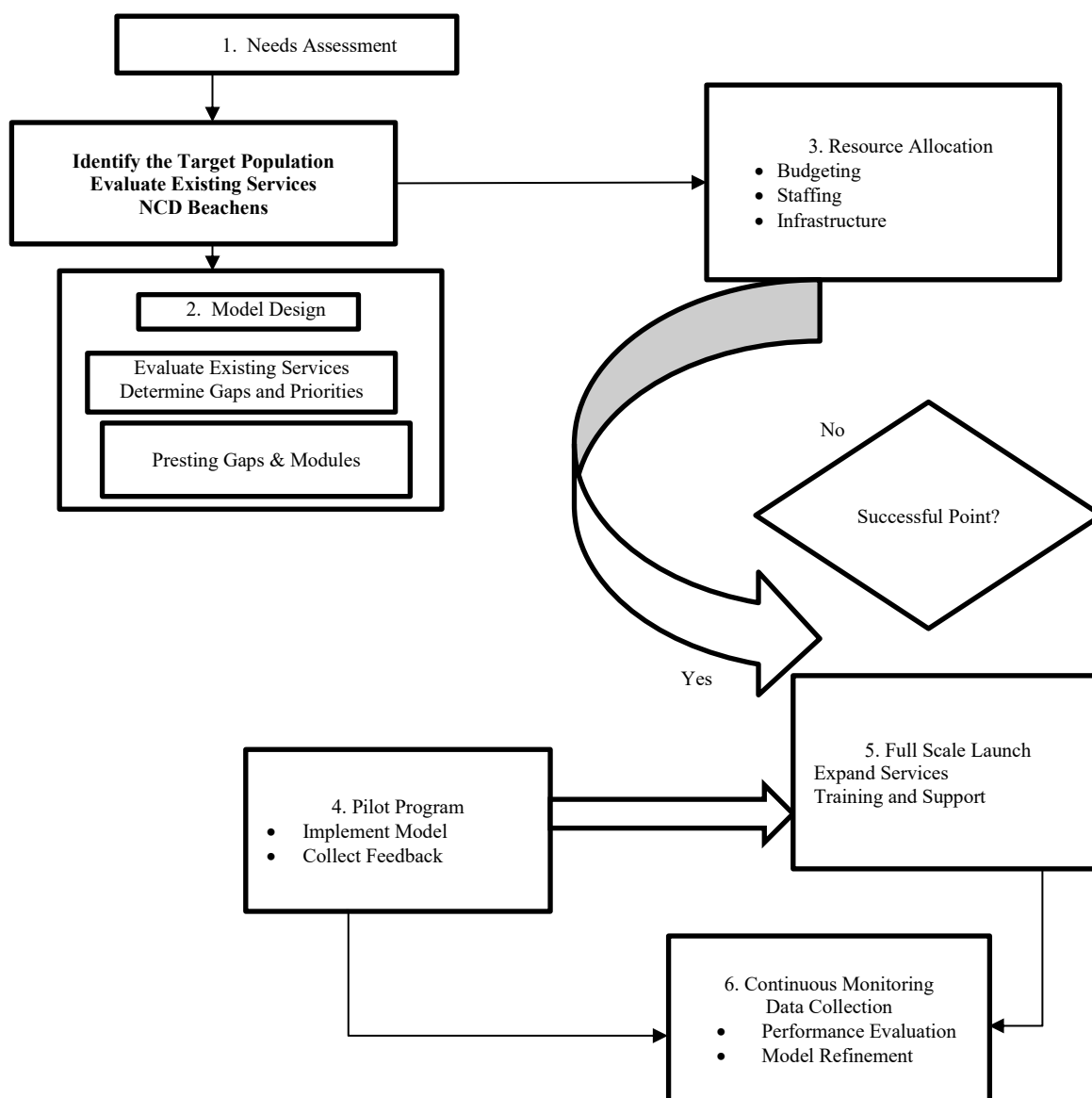


Figure 1: Clinical Care Model Development & Implementation for NCD Management

3. Development of Clinical Care Models

Evidence-Based Approaches

There is both a need and the capacity for evidence-based practices to serve as the basis of all effective clinical care. Evidence-based practice originates from scientific research and trials, which support validated, proven models, for example, a model for screening and diagnosis, a model for treatment, and a model for follow-up care. The important part at this level is that we will provide care based on evidence-based interventions, from a definition of an organization, be it the World Health Organization, WHO, or the definition of a local or national health agency. So clearly, we are going to standardize delivery, and we are going to introduce a method to deal with unwarranted variability of processes. The power of the evidence-based practices is that we can provide some quality and predictability for patient outcomes, based on collective knowledge of clinical care, experience, and evidence. A good example of these would be

employing global consensus protocols for diabetes and hypertension, and adoption of basic common procedures that are transparent, for example, regular blood pressure measurement, or standard dosing protocols of insulin control complications, or making an impact on mortality rates. However, all models have to be context sensitive. This means global recommendations will always have to be adapted as required based on local resources availability, local culture, and of course, the individual patient's preferences and values to make the interventions

Patient-Centered Care

Patient-centeredness represents a shift in medicine from provider-centricity toward one that integrates the positive experiences, values, and preferences of individuals (Walker & Gilson, 2004). When individuals become involved in shared decision-making, they can co-manage their illness as a partner with care models that empower their experiences and responsibilities in managing their healthcare. For non-communicable diseases (NCD), adherence to treatment regimens and lifestyle changes is needed for disease management. The promotion of patient-centered care will lead to increased engagement that creates long-term adherence and lowers relapse and disease progression. Patient-centered care models allow both individuals and the healthcare provider to co-create their treatment plan personalized to their lifestyle changes, arising from dietary changes, exercise, and/or smoking cessation, as well as pharmacotherapy, instilling shared decision-making that recognizes the heterogeneity of NCDs as well as the social contexts in which those individuals live. Furthermore, patient learning becomes continuous learning. Learning can happen either through structured counseling sessions or through digital health technologies that help patients understand their illness and use that information for informed decision-making. Improved health, satisfaction with care, and trust in the healthcare system are all outcomes of patient-centered care (Powell et al., 2015; Atkins et al., 2008).

Role of Interdisciplinary Teams

Non-communicable diseases are essentially complex and usually exhibit multiple physiological, psychological, and social factors, and because of these complexities, require healthcare professionals to work together when managing care. Because of these complexities, interdisciplinary teams are essential to providing inclusive care. Healthcare professionals, including physicians, nurses, dietitians, psychologists, physiotherapists, or support workers, often take on the role of primary health care provider and treatment plan. Interdisciplinary approaches help provide comprehensive assessments, and assessments should be comprehensive with shared input from multiple professionals to prepare an overall treatment plan (Lewin et al., 2018; Kemp et al., 2018). In the case of the potential diabetic, the diabetic medications would be prescribed by the physician, the dietary changes may require a dietitian's input, while stress management would involve a psychologist in the patient's treatment. Also, collaborative care means it could include physiotherapy to promote better activity. Managing care with interdisciplinary teams also promotes team member communication, and collaborative care provides less duplicated care, offering better clarity on treatment consistency and team member continuity of care. With many NCDs, using an all-encompassing

model of care provides consideration of more than just medical treatment of a long-term illness; it also addresses psychosocial perspectives, including the members' mental health and well-being, personal and family support when making lifestyle changes, or social inclusion (participation) when changing the medical management of their NCD (Youssef et al., 2019).

4. Implementation Challenges and Strategies

Resource Constraints

Many health systems, particularly those in low- and middle-income countries, have resource limitations that affect the effective implementation of NCD care models. The lack of universal coverage often results in poor funding to buy essential medicines, diagnostic, and technology required for early and ongoing identification of chronic conditions. Health facilities also tend to be minimal in rural and outer urban areas compared to their wealthier inner urban counterparts, in terms of infrastructure, supply chains, referral paths, etc., which increases disparity of access to care. The role of chronic conditions on people is further diminished by shortages of trained healthcare workforce, which increases burdens on existing health services, leading to health professionals working at full capacity, prolonged delays of treatment, and lower quality of care. These challenges prevent effective engagement with holistic clinical care models, contribute to health inequities for the vulnerable populations who face lost opportunities for equitable health care and chronic disease support. Strengthening primary health care, creating sustainable funding models, and supportive policy are critical for managing those challenges. Prioritizing NCD management through national health agendas will provide the assurance that these long-term strategies will receive appropriate funding and continue to provide equitable service provision for all Australians (Kane et al., 2017).

Training and Capacity Building

Another major obstacle to the successful implementation of NCD care models is that healthcare providers are undertrained and inexperienced. Many healthcare providers undertake a complete training course without a major focus on chronic and long-term care since much of their medical training focuses on acute and infectious diseases. The areas that are frequently faced with underestimation are integrated care planning, modifiable lifestyle behavior counselling, and psychosocial support for patients. Therefore, building capacity to strengthen the workforce requires multiple activities and ongoing professional development, through workshops, training, and developing NCD-based modules in medical and nursing courses. Nurses, community health workers, and allied health professionals are essential as they are often the first point of contact for patients in their local communities, so empowering them with up-to-date information and practical tools not only improves patient care but can also facilitate the efficiency and sustainability of healthcare systems (Atun et al., 2013).

Cultural and Social Barriers

Cultural beliefs, social norms, and social constructs around health and illness will influence how individuals may respond to NCD care models. In some cultures, chronic disease carries stigma, leading to patients hiding their diagnoses or delaying their search for timely treatment. For some, delayed progression to evidence-based clinical care may be because they continue to rely on traditional medicine or home remedies. Various factors, including social determinants of health, social stratification, literacy, and socio-economics, may impact a patient's adherence to treatment and access to care. There will likely be no "one size fits all" approach to any of these issues. A culturally sensitive (evidence-informed social approach) for health promotion, there will be "practice-based, community of practice" and health promotion approaches to be delivered. And these should be, at minimum, aimed at raising awareness of the prevention, early detection, and management of NCDs in addressing the socio-ecological complexities. Trust relationships between community members and the clinic stem from people actively involved in community consultations around the health and disease of that community, using local social leaders, peer educators, or strategic inclusive communication to build trust. If we build culturally relevant resolutions, it is certain that we will discover that if we create health systems with new action frameworks, the clinically effective, rational action will reflect the social needs.

Table 1: Impact of Structured Clinical Care Models on NCD Management Across Regions

Region / Country	Clinical Care Model Implemented	Key Outcomes Achieved	Explanation
Thailand	Universal Health Coverage (UHC) with preventive screening and referral to chronic disease clinics	Early detection of hypertension and diabetes, decreased NCD mortality	Thailand's UHC program enabled timely diagnosis and monitoring of chronic diseases, leading to improved patient outcomes and delayed disease progression.
Rwanda	Nurse-led decentralized NCD clinics	Improved access to care in rural areas, effective disease monitoring, medication adjustments, and patient education	Rwanda's model demonstrates that trained nurses can manage NCDs in low-resource environments, reducing barriers for rural populations.
Brazil	Family Health Program (FHP)	Strengthened primary care, improved chronic disease management	FHP shows how localized models adapted to national priorities can improve monitoring and management of NCDs.
Finland	Integrated cardiovascular risk prevention policies	Improved adherence to treatment plans, better patient-centered outcomes	Finland's policies illustrate how systematic, evidence-based interventions can enhance patient engagement and reduce cardiovascular risk.
Combined / Overall	Structured clinical care models	Decreased hospitalizations, improved patient adherence, measurable cost savings, reduced economic burden	Consistently following structured care pathways improves patient-level outcomes, strengthens health systems, and reduces the societal and economic impact of NCDs globally.

Table 1 above presents the regional use of structured clinical care models for non-communicable diseases (NCDs) and their results. For example, Thailand's Universal Health Coverage program demonstrates the benefits of preventive screening and referrals to chronic disease clinics to ensure early detection of hypertension, diabetes, and a decrease in NCD mortality. In Rwanda, nurse-led, decentralized clinics demonstrated the ability to effectively monitor, educate, and adjust medications when appropriate, even in rural and low-resource sites. Brazil's Family Health Program emphasized the success stories of local models adapted to national research and priorities for chronic disease management. The Finnish policies on preventative cardiovascular risk exemplified how systematic interventions provide patients with the right tools to engage with treatment adherence.

5. Case Studies and Evidence of Success

Regional Examples

The prompt development and application of clinical care models for Communicable Diseases (NCDs) represents a new formalization of contextualized and scalable health care delivery across health systems. Thailand's UHC program and its integration of a preventive screening program is an example of this formalization, as it offers greater efficiency in the timely diagnosis of chronic conditions like hypertension and diabetes, in addition to screening, referral to the step-care chronic disease clinic, which is established in the community health center. All of this is to provide timely, efficient health services implementing health systems because both the diagnosis occurs early and the early diagnosis and treatment for chronic Non-Communicable Diseases (NCDs), complications, and NCD death are sustaining an effective initiative. Similarly, Rwanda has implemented a decentralized NCD, which is a nurse-led clinic model to offer NCD care to rural and hard-to-reach areas, and offer monitoring, prescribing, and subjecting the communities to patient education. This equally reinforces the effectiveness of nurse-led care and that there truly are legitimate clinical outcomes (realities) within the limitations of the limited resources referred to, judiciously providing care that reaffirms the idea that high-quality patient care is not reliant on having a high degree of health infrastructure. Brazil's Family Health Program presents another illustration of these accessible first contacts, a comprehensive care (whole view) in the areas served. Finland noted in a national integrated policy case on cardiovascular risk prevention integration in the hyperfocus of the health care system that refocuses on how true systematic evidence-based monitoring, patient compliance, treatment, and long-term follow-up are responsible for a good deal of help for population-level prevention work. Collectively, regional examples ultimately serve to show that different clinical care models can be transferred within a specific health care system and can improve patient outcomes, improve system responsiveness, and improve health care overall. These examples have fully demonstrated that these models can be transferred through resource-cutting modification impacts through varying degrees of contextual constraints, and whatever the relevance of the country, can build rapidly internationally and move through borders, respond to the global NCD burden, and aim to address population-specific needs to provide equitable care across differing populations.

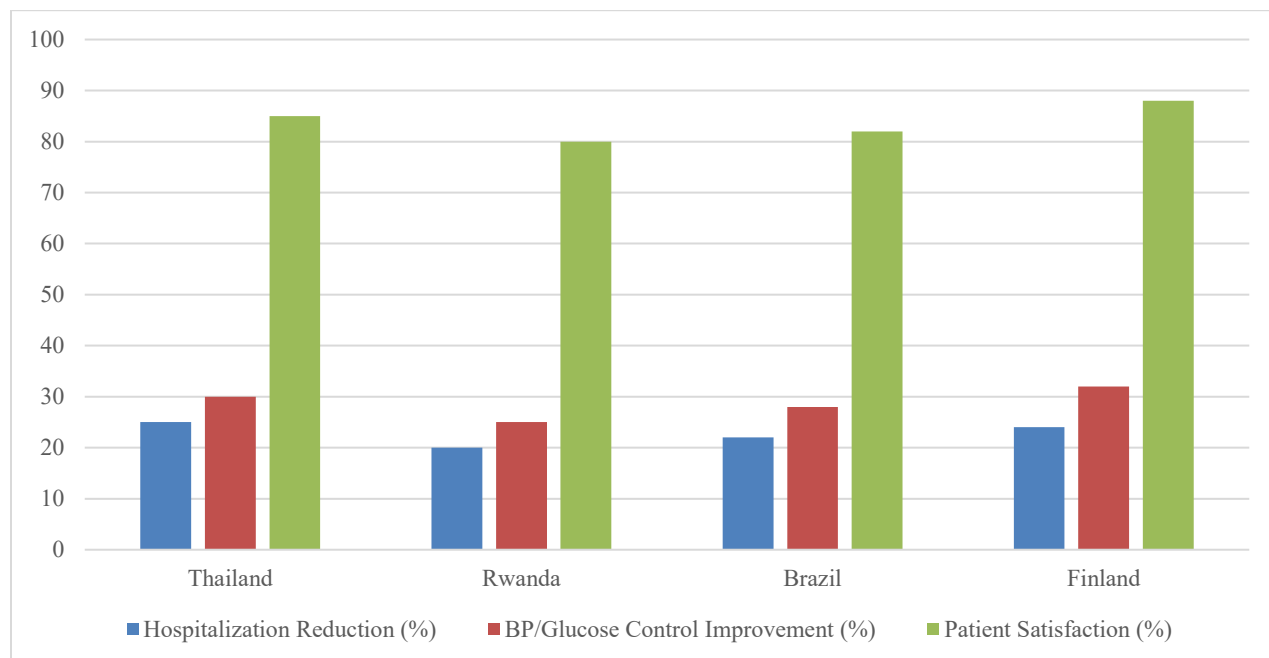


Figure 2: Impact of Structured Clinical Care Models on Patient and System-Level Outcomes for NCDs Across Different Regions

Figure 2 summarizes the outcomes of structured clinical care models for non-communicable diseases (NCDs) in four locations: Thailand, Rwanda, Brazil, and Finland. Thailand had the greatest improvement in patient-level outcomes with a 25% reduction in hospitalization, a 30% improvement in blood pressure and glucose control, a patient satisfaction level of 85%, and 20% cost-savings. Although Rwanda is a low-resource setting, their researcher-led-, nurse-led-, and community worker-led decentralized NCD clinics saw significant outcomes, with a 20% reduction in hospitalization, a 25% improvement in clinical indicators, a patient satisfaction rate of 80%, and 15% cost savings. Brazil's Family Health Program achieved balanced improvement outcomes, with a 22% reduction in hospitalization; a 28% improvement in clinical indicators; a patient satisfaction level of 82%; and an 18% cost saving. Finland has integrated cardiovascular risk prevention policies, along with the highest improvement in clinical indicators of 32%, a reduction in hospitalization of 24%, a patient satisfaction level of 88%, and 22% costs saved.

Outcomes Achieved

Clear evidence has emerged that structured clinical care models lead to a decrease in hospitalizations due to the improvement in disease monitoring and managing the risk of acute exacerbations of chronic diseases, decreasing the need for acute treatment. Evidence-based clinical indicators, such as blood pressure balance for hypertensive patients and stability in blood glucose levels for diabetics, have evidence of improvement when a structured clinical path is consistently followed. Similar patient-centered care initiatives have demonstrated benefits in all aspects of patient satisfaction, trust, and long-term engagement with the health care system. Coordinated care is associated with multidisciplinary teams. Existing evidence suggests that coordinated care provides better adherence due to the strong consensus and commitment to a treatment plan, with the assurance that patients will receive support and treatment. In fact, even

short-sustained educational interventions that conveyed the importance of self-management behaviors had been shown to empower patients to adhere, which improved their adherence to diet, exercise, and medications. If the benefits to the patient-level outcomes are assumed as a whole, then the benefits to the health system can be measured in cost savings related to reductions in unnecessary emergency admissions, lost productivity from the workforce, and cost savings associated with the economic burden of unnecessary spending on dependent patients with chronic wealth. All the information provided here adds a unique perspective on the possibility of clinical care models and their ability to reduce the local and global impact of Non-Communicable Diseases (NCDs).

6. Future Directions and Recommendations

Policy and Governance

Policymakers are critical to the long-term sustainability of NCD management by working to firmly embed NCD management and prevention in their national health agendas. Strong systems of governance can safeguard prevention, treatment, and long-term care, and help to prevent fragmentation and optimize a coordinated system-wide health response. At the level of NCD policies that develop and strengthen health systems, and are aligned with global commitments (e.g., WHO Global NCD Action Plan; Sustainable Development Goals), and are not merely in response to global commitments, it is a purposeful and deliberate process that will help build capable health policies for NCDs. Long-term and sustainable financing, including dedicated health budgets, partnerships for international funding, and syndicate or pooled financing for various sources of innovative financing, must be included and form component parts of the national health agenda to secure the sustainability of programmes that provide continuity of care where there are limited health resources. Equally important are monitoring and evaluation systems that examine, in real time, the evolution of NCD health work, measure outcomes, and provide information about gaps in health services. Policymakers can aim to create equity of access to prevention and treatment care across the spectrum of accessible universal health coverage policies by embedding NCD care priorities into existing approaches. This focus on equity will emphasize at least the most marginalized populations, including the rural poor, the elderly, and lower-income households. Ultimately, it will be only through policy reform, as we understand that creates resilient and responsive health systems, creates accountability in health systems, and works with other sectors through multi-sector intervention, that we will then change the situation and establish an environment for the scaling of more positive models of NCD care through the process of social change.

Role of Technology

The rapid advancement of digital health technologies presents limitless options in managing non-communicable diseases. For example, telehealth platforms can provide consultations, follow-ups, and specialty care to patients in rural or under-resourced populations at little or no cost, alleviating the burden of both time and distance for the patient. Mobile health applications foster ongoing disease management,

medication reminders, and logging of lifestyle changes to assist with implementation of the treatment plan. Supportive electronic health records (EHR) are intended to offer optimal continuity of care by sharing health information among the patient's care providers, ultimately reducing fragmentation and medical error. Additionally, new technologies, including artificial intelligence (AI) and machine learning, can show predictive analytics for those at high risk and offer forecasts about the progression of the disease, allowing for early interventions. Wearable devices can allow cloud-based monitoring for real-time patient information to support better patient decision-making while increasing the provider's ability for data-driven decisions. Healthcare systems can leverage these innovative technologies for convenient, configured, and personalized care to enhance health outcomes and improve resource utilization.

Continuous Training and Research

For successful long-term development of health delivery systems, managing NCDs relies on a prepared, responsive, and continually up-to-date workforce. Medical professionals are often trained using an acute care focus, which overlooks important skill areas required for managing chronic disease. A variety of continuing professional development training opportunities, including refresher courses, specialty modules, and workshops, aim to update health care workers' skills as they encounter shifting clinical practices and evolving technological options. Nurses, community health workers, and other allied health professionals should be spotlighted in training initiatives because they support primary and community-based care for the majority of patients with NCDs.

7. Conclusion

The increasing incidence of non-communicable diseases (NCDs) is an immediate, global, and complex issue for health systems. Therefore, new and sustainable solutions to care delivery will be urgently needed. This paper provides evidence that informed, patient-directed, interdisciplinary approaches to clinical care, such as those that are identified in this paper, can affect at least a first-order improvement in chronic disease management based on evidence-informed, patient-centred, interdisciplinary care. These approaches indicate medical concerns related to NCDs and frameworks for appropriate prevention, early detection, ongoing monitoring, and overall patient care and support. Even with challenges of limited access, under-resourced workforce training opportunities, and sociocultural barriers, it is also possible to seek strategic solutions. Understanding NCDs in health policy, and therefore appropriately supporting the sectors with resources gained through indications or technologies, and improving the capability of workforce professional development to offer continuing education would all contribute to creating more effective and inclusive systems of care. Overall, models for a comprehensive clinical care approach provide opportunities for reductions in long-term health expenditures, improved patient outcomes, and a more consistent and comprehensive platform for protecting the community's health and welfare.

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