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Surveillance Preparedness for COVID-19 and Other Infectious Diseases in New Zealand: Embracing Digital Health and Telemedicine in Vast and Isolated Territories

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ABSTRACT

The COVID-19 pandemic has underscored the critical importance of robust health crisis preparedness and the integration of digital health technologies. This paper explores the current state and future directions of health crisis preparedness in New Zealand, focusing on surveillance systems for COVID-19 and other infectious diseases. It highlights the role of digital health and telemedicine in managing healthcare delivery in vast and isolated territories. The paper also emphasizes the integration of behavioral economics and behavioral sciences, inspired by the pioneering work of Nobel Prize in Economics Professor Vernon Smith and the legal-economic contributions of Professor Guido Calabresi. It proposes deepening the telemedicine project and ensuring data-driven health decisions using New Zealand's extensive health data sets as crucial steps towards a more resilient and equitable healthcare system.

Keywords: Health Crisis Preparedness; Digital Health; Telemedicine; Behavioral Economics; New Zealand Health Reforms

Introduction

The COVID-19 pandemic has underscored the critical importance of robust health crisis preparedness and the integration of digital health technologies [1]. The unprecedented global health emergency revealed vulnerabilities in health systems worldwide, emphasizing the need for effective surveillance, rapid response mechanisms, efficient communication strategies [2], and equitable healthcare access, especially in geographically challenging regions [3,4]. This article explores the current state and future directions of health crisis preparedness in New Zealand. It delves into the intricacies of surveillance systems for COVID-19 and other infectious diseases, which are essential for early detection, monitoring, and response to health threats [5]. The incorporation of digital health and telemedicine has become increasingly crucial in ensuring healthcare access to remote areas [6]. Telemedicine provides benefits such as improved care access, efficient resource utilization, cost-effectiveness, continuity of care, and equity in healthcare [7]. Behavioral economics and behavioral sciences are pivotal in health crisis preparedness by offering insights into human decision-making under uncertainty [8]. Understanding human behaviour can enhance the design and implementation of health interventions, ensuring better compliance and effectiveness [9,10]. Legal-economic contributions, exemplified by Professor Guido Calabresi, highlight the significance of establishing legal frameworks that support health innovations while upholding equity and justice. New Zealand's Ministry of Health has implemented comprehensive surveillance systems for monitoring COVID-19 and other infectious diseases, incorporating data-driven decision-making, robust testing protocols, and monitoring of emerging variants [11].

The country's ongoing health reforms aim to establish a more resilient and equitable healthcare system, with initiatives like the Digital Health 2020 program focusing on electronic health records, health datasets, preventative health IT capability, digital hospitals, and regional IT foundations. Telemedicine has emerged as a critical tool in providing healthcare access to New Zealand's rural and remote

populations. Successful projects like the Telemedicine Project [12] in the Apulia region of Italy showcase how telemedicine can significantly enhance healthcare delivery in isolated areas. Lessons from such projects can guide New Zealand in enhancing healthcare access and equity, emphasizing the importance of investing in digital infrastructure, developing comprehensive telehealth policies, fostering collaboration, and prioritizing patient-centric care. In conclusion, New Zealand's dedication to enhancing health crisis preparedness through surveillance systems, digital health integration, and telemedicine is commendable [13]. By incorporating insights from behavioural economics and behavioural sciences, inspired by the work of the Nobel Prize of Economics Professor Vernon Smith [14-24] and Professor Guido Calabresi [25-32], New Zealand can ensure equitable access to high-quality healthcare for all residents, irrespective of their location. Future directions include strengthening surveillance systems, expanding digital health initiatives, and promoting collaborative research to enhance health crisis preparedness and digital health strategies.

The Role of Behavioural Economics and Behavioural Sciences

The integration of behavioural economics and behavioral sciences into health crisis preparedness and response strategies is crucial. The pioneering work of Nobel Prize in Economics Professor Vernon Smith has provided significant insights into how individuals make decisions under uncertainty, which is particularly relevant during a health crisis. His research underscores the importance of understanding human behaviour to design effective health interventions and communication strategies. Moreover, the contributions of Professor Guido Calabresi in law and economics have been instrumental in shaping policies that balance public health and economic stability. Calabresi's work emphasizes the need for legal frameworks that support health innovations while ensuring equity and justice. These perspectives are essential in developing comprehensive preparedness plans that are both effective and ethically sound. Furthermore, it is essential to consider socio-economic factors in health crisis preparedness. The study [33] "Income Mobility in New Zealand: A Descriptive Analysis" by Kristie Carter, Penny Mok, and Trinh Le, published in 2014, using data from the Survey of Family, Income and Employment (SoFIE), highlights significant changes in income mobility in New Zealand. The study found substantial short-term and long-term income mobility, with over 60 percent of the population changing income decile groups annually and only 22 percent staying in the same decile group over eight years. This socio-economic mobility impacts public health, as income changes can affect access to healthcare and health outcomes.

Background and Context

New Zealand's geographic isolation and dispersed population present unique challenges in managing infectious diseases. The country has been lauded for its initial response to COVID-19, which included stringent lockdown measures, extensive testing, and effective contact tracing. However, the ongoing pandemic and the emergence of new variants highlight the need for continuous improvement in surveillance systems and healthcare delivery, particularly through digital innovations [34].

Current Surveillance Systems

New Zealand's Ministry of Health has implemented comprehensive surveillance systems to monitor COVID-19 and other infectious diseases. These systems include:

1. Data-Driven Decision Making: Utilizing real-time data analytics to track infection rates, hospitalizations, and vaccination coverage.

2. Robust Testing Protocols: The government has ensured widespread availability of PCR and rapid antigen tests (RATs), with additional purchases of RATs to maintain preparedness.

3. Surveillance of Emerging Variants: Continuous genomic sequencing to identify and monitor new variants of concern, such as the Omicron subvariants JN.1 and its descendants FLiRT and FLip.

In addition to COVID-19, New Zealand's surveillance systems are geared to monitor other infectious diseases such as Vibrio, Avian Influenza (HPAI), and other emerging pathogens. The Ministry of Health employs strong surveillance mechanisms to detect, monitor, and respond to these infectious diseases, ensuring that the healthcare system is prepared for various health crises (Table 1).

Table 1: Proposed Regional Divisions for Health NZ.

Region	Included Areas	Main Cities
Northern Region (North Island)	Northland, Auckland, Waikato, Bay of Plenty	Auckland, Hamilton, Tauranga
Central Region (North Island)	Gisborne, Hawke's Bay, Taranaki, Manawatu-Wanganui, Wellington	Wellington, Palmerston North, Napier
Northern Region (South Island)	Tasman, Nelson, Marlborough, West Coast	Nelson, Blenheim
Southern Region (South Island)	Canterbury, Otago, Southland	Christchurch, Dunedin, Invercargill

Health Reforms and Digital Health Integration

The ongoing health reforms in New Zealand aim to create a more resilient and equitable healthcare system. Key components of these reforms include:

Digital Health 2020 Initiative

The Digital Health 2020 initiative, established by the Ministry of Health, aims to progress the core digital technologies presented in the New Zealand Health Strategy. It guides strategic digital investments across the health and disability sector and aligns sector investment with value delivery. Digital Health 2020 has five core components:

1. Electronic Health Record for New Zealanders: A single longitudinal view of health information accessible to consumers, carers, and decision-makers.

2. Health and Wellness Dataset: Access to health data to support government, health organizations, and individuals in making evidence-based decisions.

3. Preventative Health IT Capability: Information and enabling ICT capability to support and improve the targeting of screening, immunization, and other public health initiatives.

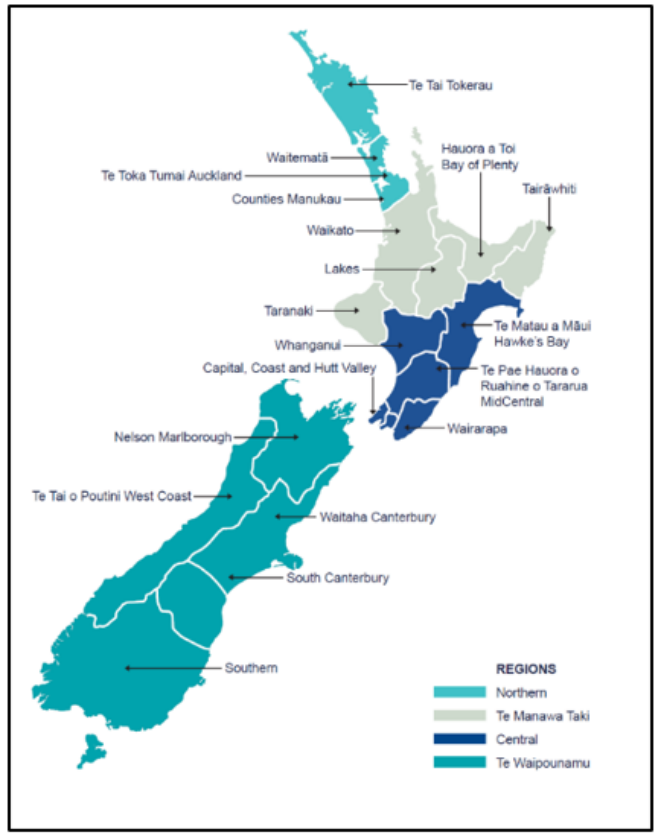
4. Digital Hospitals: Enhancing the digital capability within hospitals and integrating them with the wider sector.

5. Regional IT Foundations: eHealth foundations that support regional access to health information, delivery of the single electronic health record, and lifting digital capability within hospitals.

National Public Health Service and Regional Divisions

The National Public Health Service in New Zealand collaborates with whānau, iwi, and other organizations to foster healthier communities. Utilizing Mātauranga Māori and data-driven approaches, the service delivers health promotion, prevention, and protection efforts at local, regional, and national levels. Key activities include monitoring environmental health, preventing the spread of infectious diseases, promoting healthy eating and physical activity, and supporting early childhood centers and kōhanga reo in creating safe environments and good health practices. Additionally, the service provides health services for children, reviews licenses and public health regulations, and enforces public health plans, strategies, and legislation.

To optimize healthcare delivery and resource management, New Zealand's health system is organized into four regional divisions:



Note: (New Zealand – Te Whatu Ora website. Source: https://www.tewhatuora.govt.nz/corporate-information/our-health-system/health-sector-organisations/public-health-contacts/)

Figure 1: National Public Health Service – Map of the NPHS Health New Regions.

Telemedicine in Vast and Isolated Territories

Telemedicine has emerged as a crucial tool in providing healthcare access to New Zealand's rural and remote populations. Key benefits include:

1. Enhanced Access to Care: Teleconsultations allow patients in isolated areas to receive specialist care without the need for extensive travel.

2. Efficient Resource Utilization: Centralized expertise from urban centers can support rural healthcare providers, ensuring high-quality care is available nationwide.

3. Cost-Effectiveness: Reduces travel costs for patients and healthcare providers, optimizing the use of medical resources.

4. Continuity of Care: Regular virtual follow-ups ensure ongoing management of chronic conditions and timely interventions.

5. Equity in Healthcare: Digital health tools can be tailored to meet the cultural needs of Māori and other communities, promoting health equity (Figure 1).

Case Study: Telemedicine Project in the Apulia Region, Italy [35]

The Telemedicine Project of the Casa Sollievo della Sofferenza Hospital in the Apulia region of Italy serves as an exemplary model of how digital health initiatives can significantly enhance healthcare delivery in isolated territories. This project, spearheaded by the Hospital Casa Sollievo della Sofferenza, was initiated in response to the COVID-19 pandemic and has continued to evolve, demonstrating the effectiveness of telemedicine in providing remote healthcare services.

Overview of the Project

Casa Sollievo della Sofferenza, a private Catholic hospital founded by Father Pio of Pietrelcina, is located in San Giovanni Rotondo, a region with challenging geographic and transportation conditions. Despite these challenges, the hospital has been recognized for its excellence in healthcare delivery, particularly through its innovative use of telemedicine.

Key Components and Achievements

1. Implementation of Televisits: Since July 2022, the hospital has implemented telemedicine services for various specialties, starting with the Gastroenterology Operative Unit focused on inflammatory bowel disease. This initiative has allowed for remote consultations, reducing the need for patients to travel long distances for specialist care.

2. Cost-Reduction: The project has demonstrated significant cost-saving benefits. For patients, it reduces travel expenses and lost workdays. For healthcare providers, it decreases the need for physical space and resources, and alleviates pressure on appointment schedules.

3. Accessibility and Quality of Care: Telemedicine has improved access to healthcare services for the rural population in the southern regions of Italy, which include Apulia, Basilicata, Sicily, Campania, Molise, Abruzzo, and Calabria. This has enhanced the overall quality of care, ensuring that patients receive timely and effective treatment.

4. Adherence to National Guidelines: The project aligns with recent Italian legislation aimed at integrating hospital and territorial care, particularly in light of the challenges posed by the COVID-19 pandemic and the aging population. The hospital's approach reflects the broader goals of the National Recovery and Resilience Plan (PNRR), which focuses on modernizing and digitizing healthcare services across Italy.

5. Future Expansion: The hospital plans to extend telemedicine services to over thirty specialties, further broadening access to high-quality healthcare for remote and underserved populations.

Lessons for New Zealand

The success of the Telemedicine Project in Apulia provides valuable insights for New Zealand as it seeks to enhance healthcare delivery in its vast and isolated territories. Key takeaways include the importance of:

- Investing in Digital Infrastructure: Ensuring robust and widespread digital connectivity to support telemedicine services [36].

- Developing Comprehensive Telehealth Policies: Creating a regulatory framework that supports the integration and expansion of telehealth services [37].

- Fostering Collaboration: Encouraging partnerships between public and private healthcare providers to leverage resources and expertise [38].

- Focusing on Patient-Centric Care: Designing telemedicine initiatives that prioritize the needs and convenience of patients, particularly in rural and remote areas [39-43].

By adopting similar strategies, New Zealand can improve healthcare access and equity, ensuring that all its residents receive the care they need, regardless of their geographic location.

Conclusion

New Zealand's commitment to enhancing health crisis preparedness through robust surveillance systems and the integration of digital health and telemedicine is commendable. Deepening the telemedicine project and ensuring that health decisions are data-driven using New Zealand's extensive health data sets are crucial steps towards a more resilient and equitable healthcare system. By incorporating the insights from behavioral economics and behavioral sciences, inspired by the work of Professor Vernon Smith and Professor Guido

Calabresi, New Zealand can ensure that all its residents have access to high-quality healthcare, regardless of their geographic location.

Future Directions

Further research and investment are needed to:

1. Strengthen Surveillance Systems: Enhance data integration and real-time analytics capabilities to better predict and respond to health crises.

2. Expand Digital Health Initiatives: Continue developing and deploying digital health tools, with a focus on user-friendly interfaces and accessibility for all populations.

3. Foster Collaborative Research: Encourage collaborations between healthcare providers, researchers, and policymakers to continuously improve health crisis preparedness and digital health strategies.

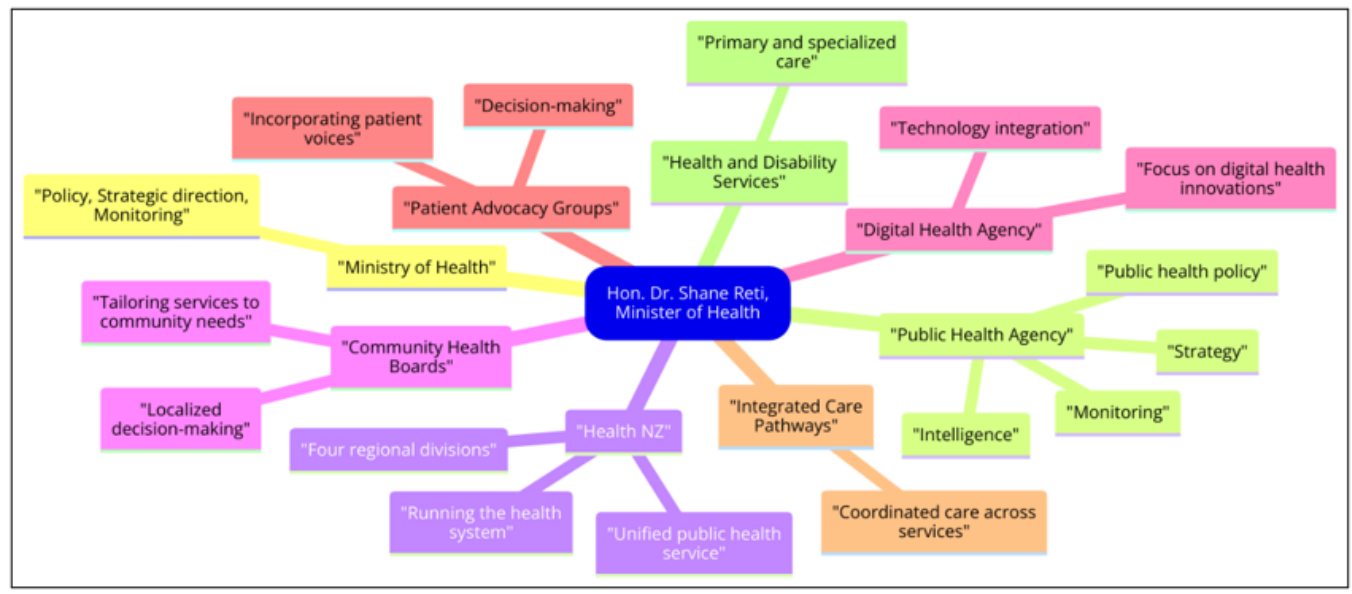


Figure 2.

Mind Map Explanation

The following mind map outlines the proposed health reforms and their key components: (Figure 2)

1. Hon. Dr. Shane Reti, Minister of Health (Blue Box)

o Role: Central policy-making and strategic oversight.

o Difference: Emphasizes a more hands-on approach compared to the current system.

2. Ministry of Health (Yellow Boxes)

o Functions: Policy, strategic direction, monitoring.

o Difference: Suggests a more proactive and central role in strategic direction and monitoring.

3. Public Health Agency (Light Green Boxes)

o Functions: Public health policy, strategy, monitoring, intelligence.

o Difference: A more focused role in public health policy and intelligence.

4. Health NZ (Purple Boxes)

o Functions: Overseeing the unified public health service with four regional divisions.

o Difference: Includes regional divisions for better localized management.

5. Community Health Boards (Pink Boxes)

o Functions: Tailoring services to community needs, localized decision-making.

o Difference: Provides more localized decision-making power.

6. Digital Health Agency (Pink Boxes)

o Functions: Technology integration, focus on digital health innovations.

o Difference: Represents a more focused effort on digital health and telemedicine.

7. Integrated Care Pathways (Orange Boxes)

o Functions: Coordinated care across services.

o Difference: Highlights a focus on integrated care pathways.

8. Patient Advocacy Groups (Red Boxes)

o Functions: Incorporating patient voices into decision-making.

o Difference: Formally integrates patient advocacy into the decision-making process.

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