

Strengthening Pandemic Preparedness: A Case Study of Frisius Medical Center

Post-COVID-19

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CFBGR03610.2024-2025.1 - Capstone Bachelor Thesis

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June 6, 2025

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Abstract

Covid-19, a deadly pandemic that made the world silent, has still left some ever-lasting impacts on our society. Especially the Dutch's hospitals and intensive care units. With the lack of medical staff, many have said to be burned out or scared for their own health. Many hospitals around the world faced many challenges such as; not having enough beds, or even lack of oxygen machines. Hospitals were not prepared for the intensity that Covid-19 brought. With the change of weather, globalization and being exposed to new specimens, it can all contribute to new emerging airborne diseases. "not if it, but when" – these are powerful words often mentioned by researchers around the world, stressing the importance of the next "attack". To remind us that the next pandemic can hit us anytime, and that we should be prepared for the next one. Maybe Covid-19 was a wake-up call for hospitals, or maybe it's a lesson to learn.

This thesis aims to examine: *To what extent has Frisius Medical Center in Leeuwarden strengthened its preparedness for future airborne pandemics post-Covid-19?* Key findings show: (1) improved ICU capacity and surveillance systems, (2) ongoing challenges in zoonotic monitoring and staff burnout, and (3) vulnerabilities from budget cuts. The research concludes that while improvements were made, structural changes remain essential for true pandemic preparedness. This research will analyze these questions based on the Dutch Healthcare System in Leeuwarden.

Introduction

The Dutch healthcare system is considered robust and among the best in the world, with 10% of the country's GDP invested (81€ billion/year). It is a decentralized but regulated system,

combining public and private partnerships with government oversight (Van Driesten & Wessels, 2021). Based on universal principles; access to care for all, solidarity through medical insurance (which is compulsory for all and available to all) and high-quality healthcare services. Historical trends, developments and social conditions have shaped the Dutch system (Ministerie van Volksgezondheid, Welzijn en Sport, 2024). There are four key acts underpin this system: the Health Insurance Act (hospital care), Long-Term Act (other types of care), Social Support Act (well-being) and the Youth Act (children) (Ministerie van Volksgezondheid, Welzijn en Sport, 2024).

During the COVID-19 pandemic, the response was split between national (RIVM), regional (GGDs), and local (hospitals) actors (Van Driesten & Wessels, 2021). This thesis focuses on the local level, examining Frisius Medical Center (Frisius MC), the largest hospital in Friesland, to assess how lessons from the pandemic have strengthened preparedness for future airborne outbreaks. Pandemic preparedness must also address equity, particularly for vulnerable groups. Leeuwarden, Friesland's capital, includes some of the Netherlands' poorest neighborhoods (Statistics Netherlands, 2007), making Frisius MC, 2025).

The pandemic exposed systemic challenges, such as workforce shortages and fragmented funding priorities (Van Driesten & Wessels, 2021). By analyzing Frisius MC's post-COVID-19 adaptations, this study identifies progress and persistent gaps, offering insights to build a more resilient healthcare system.

Research Importance

Pandemic preparedness is crucial for society in many ways. An article published by Harvard's School of Public Health stated that for a future pandemic the question is "not if, but when", meaning another pandemic will happen, and it is just a matter of time (Feldscher, 2025). As of August 2024, Covid-19 had infected more than 700 million people and caused more than 7 million deaths worldwide (WHO COVID-19 Dashboard, 2025). The combination of big demographic changes, such as climate change, will alter the landscape and bring new challenges, opening opportunities for new pathogens to emerge or re-emerge (Feldscher, 2025).

The right to health is a fundamental human right, the United Nations (UN) states that everyone has the right to have "a standard of living adequate for health and well-being", including medical care (United Nations, 1948, Article 25). The right to health includes four essential elements: availability, accessibility, acceptability and quality (World Health Organization: WHO, 2023). For hospitals like Frisius MC, this means ensuring these elements are upheld during a crisis. For example, maintaining adequate ICU capacity and staff readiness to handle surges in cases.

In the Netherlands, where life expectancy is increasing due to higher quality of life, the aging population is drastically increasing as well. This means that there will be a higher group of old people over young people in the future (Netherlands, 2025). If a pandemic were to hit this demographic, it will be more challenging for hospitals to manage. The impact of the reduction in the healthcare workforce is being compounded by an overall aging population (McNeill, 2022). Furthermore, if hospitals would not be able to adapt to those changes, there will be higher consequences for society.

Pandemic preparedness can help reduce societal and economic impacts of a pandemic. While pandemics may not be entirely avoidable, preparedness measures can help reduce effects, such as preventing widespread lockdowns and minimizing disruptions to mental health, as seen during Covid-19 (Bosmans et al., 2022). For hospitals this translates to having robust systems in place to ensure continuity of care and resource allocation during emergencies.

Research Question

To what extent Frisius Medical Center has strengthened its readiness for future airborne pandemics post-Covid-19 ?

RIVM Frameworks

The National Institute for Public Health and the Environment (RIVM) is the central body responsible for pandemic preparedness in the Netherlands (RIVM, 2023). Their framework is adapted to the Dutch healthcare system but integrates World Health Organisation (WHO)'s global standards, particularly the International Health Regulations (IHR) and the SPRP 2022 M&E Framework. This hybrid approach will aid to address regional coordination and regulate competition between public and private sectors.

This matters for Leeuwarden because Frisius MC uses RIVM's framework to apply WHO's global guidelines (WHO, 2022), such as intensive care unit (ICU) preparedness like expanding beds during surge (Van Driesten & Wessels, 2021), and bilingual alerts because Leeuwarden is both Frisian and Dutch.

The RIVM framework will be applied throughout the structure of the paper, the interview and the results.

Literature Review

RIVM vs. WHO framework

While this section contrasts RIVM and WHO theoretically, we operationalize RIVM's five-pillar framework in our Methodology to assess Frisius MC's preparedness.

WHO created a framework known as the WHO Covid-19 Strategic Preparedness and Response Plan (SPRP) 2022 M&E framework. It is a global tool designed to track progress in pandemic preparedness and response. It aligns with the WHO goal, which is to end the acute phase of Covid-19 while strengthening long-term resilience against future health emergencies (WHO, 2022).

This framework consists of:

- Monitoring country-level indicators
- Tracking WHO's support to member states
- Integrating with existing systems like IHR

Similar to the RIVM framework, the WHO framework also has 5 core pillars:

- 1. Emergency coordination
- 2. Collaborative surveillance
- 3. Clinical care & resilient health systems
- 4. Community protection

5. Access to countermeasures

To add on to that, both WHO and RIVM frameworks focus on multisectoral coordination, emphasizing extending their partners to health authorities (RIVM/GGD in the Netherlands) and other sectors. In addition, the frameworks support surveillance and early detection. WHO's sequencing indicator mirrors RIVM's emphasis on lab capacity and outbreak monitoring. Furthermore, resource allocation as in personal protective equipment (PPE) stockpiling, ICU capacity, and vaccine distribution are tracked by both frameworks (WHO, 2022).

There are some differences between the RIVM and the WHO framework. The WHO framework focuses on a global scope (194 countries) while the RIVM is specifically focused on the Netherlands (WHO, 2022). As WHO is broader, it would also focus on indicators such as global vaccine equity, rather than specific to Dutch systems. WHO is also led by itself and does voluntary reporting, RIVM is legally mandated under Dutch public health laws. When centering on surveillance, WHO integrates with GISRS (global flu network), as RIVM focuses on regional sentinel systems like GGD Fryslan. Lastly, WHO tracks global supply chains, and RIVM prioritizes local stockpiles (Frisius MC hospital reserves) (WHO, 2022).

Pandemic Preparedness

Post-Covid-19, the Dutch Government wanted to reduce the chance of an outbreak. And if one happens, the aim is to be able to contain it. Therefore extra measures needed to be taken. In 2023, the Dutch Public Health budget funding was increased by 300€ million. In order to be prepared for a future pandemic, the government is taking measures to reduce the chance of a pandemic, prevent harm to the population and limit the economic impact of a pandemic.

Furthermore, to specifically fight infectious diseases and strengthen public health organisations, the Dutch Government will invest more than 34€ million in monitoring diseases, open a new crisis organisation, increase knowledge within staff, extra funding to understanding zoonoses, smarter use of IT, nationwide measures, and expand knowledge (Ministerie van Algemene Zaken, 2023).

To monitor diseases, funds for the RIVM have increased to study the causes of virus and bacteria outbreaks, and how to tackle them. Their framework will be applied to understand the pandemic preparedness of hospitals in Leeuwarden (Ministerie van Algemene Zaken, 2023).

Especially with the increase of intensive animal farming, zoonoses, such as Covid-19 (bats to humans), are becoming more relevant in today's society. It is highly recommended to prevent animal diseases from crossing over to humans, extra funding will therefore go to increasing our understanding of zoonoses. As such, everyone must be aware of infectious diseases, not just healthcare workers or people in close contact with animals (Ministerie van Algemene Zaken, 2023).

The impact of an increasing aging population weighs heavily on the healthcare workforce. According to a Chinese study conducted on patients with Covid-19, the elderly (60+) were more likely to have coexisting conditions that influence the outcome of Covid-19 infection (Dai & al., 2020). This study also indicated that the proportion of severe cases was higher in the elderly than in the younger population. Addressing the health needs of the aging population in the States, "*by 2050, adults over the age of 65 will make up 20 percent of the U.S. population*" (Bellon & al., n.d.). With this surplus in retirees, it could be a burden on hospitals that are already experiencing workforce shortages, such as Frisius MC.

The new crisis organisation, part of the RIVM, has been set up by the Dutch government for the preparedness and quick response to a future outbreak. For instance, extra healthcare workers will be at hand when needed for testing, vaccinating or treating people. A recent article published by the EU-funded METEOR Project showed that during the Covid-19 pandemic, medical staff had thoughts about quitting due to multiple reasons. It was revealed that burnout was very common to medical staff, and that "experienced nurses and physicians felt overwhelmed by the pandemic, possibly never having seen a crisis like this before despite years of practice". Furthermore, "many of them were also in fear for their own lives, which could have contributed to them wanting to quit." (De Vries et al., 2024). The paper underscored the urgent need for hospitals to foster a supportive environment that can retain current personnel and attract new talent, enhancing the quality of services and the wellbeing of staff (Vries et al., 2024). These ongoing symptoms may have originally derived from the shortage of medical staff, which increases the stress on current medical workers. From a global aspect, many developing countries lost some of their most valuable health workers to richer countries. According to WHO, 75% of doctors trained in Mozambique now work abroad. Majority of them moved to Portugal, where wages are higher and there is better medical equipment (Health Workforce: The Health Workforce Crisis, 2025). This unequal migration of healthcare workers can cause crucial instability for developing countries who invest in the education of professional healthcare workers, and offer opportunities for wealthier countries. This can also create a barrier for developing countries trying to evolve. According to a study in German hospitals, the most efficient way to face healthcare staff shortages during the first pandemic wave was to reallocate existing staff within the hospitals (Stroth et al., 2024). However, it was still required to have additional measures when critical patients were taken care of.

In addition, increasing knowledge on infectious diseases to healthcare workers helps hospitals to stay more protected and have a stronger 'army' to fight infectious diseases. The Dutch government wants to up-skill and re-skill staff. The GGD will also receive funding for research on fighting infectious diseases more effectively. To add on to that, the government is working with RIVM and GGDs to develop compatible IT systems to control infectious disease. They can be very useful to keep track of how many people are sick or infected to allow for containing the spread. The data is particularly relevant for hospitals and policymakers to make decisions, and to predict what measures will be effective (Ministerie van Algemene Zaken, 2023). Hospitals can make decisions such as training programs for infection control management, real-time data dashboards for resource allocation (e.g. bed capacity), and visitor restrictions and vaccination prioritization (Klingwort et al., 2024). The outcome of these actions enhances outbreak control, prevents healthcare overload, and lowers fatalities.

Having the measures taken on a national level can help citizens in being prepared for social distancing. If people practised it more regularly, it would become a norm and the country would be less affected by infectious disease. This is laid down in the Public Health Act (Ministerie van Algemene Zaken, 2023).

Lastly, the central government is making more money available for research, for example by finding out the effects of ventilation and how viruses spread. RIVM conducted research that showed that ventilation helps to limit aerogenic transmission of the coronavirus (RIVM, 2021). This type of knowledge is crucial for fighting the spread of diseases. If there is a major outbreak of an infectious disease, people need to have immediate access to healthcare. Therefore, healthcare in the Netherlands needs to increase its flexibility. Firstly, healthcare workers should be able to work at other locations than their usual post in order to reallocate capacity when needed (Ministerie van Algemene Zaken, 2023).

Lessons from COVID-19

Covid-19 has presented Dutch healthcare with complex challenges, from policy to the well-being of healthcare staff. While the lessons below address broader systemic issues, they directly impact hospitals, a focus that will be explored in the next section.

The first lesson learnt from Covid-19 is that governments of most countries were over-reliant on crisis-mode expertise. Meaning that they were initially too dependent on (bio)medical experts during the first wave, and not paying much attention to other disciplines such as social sciences and economics. For example, the Dutch government's early reliance on the Outbreak Management Team (OMT) dominated by medical scientists, leading to advice on measures. To avoid this from happening again, future preparedness requires multidisciplinary advisory teams. For example, having a broader research team in health, economy and ethics can help a country to have a broader understanding of pandemics, which can diversify the choice of policies (*Rathenau Instituut*, 2021). When linking back to hospitals, this focus shows how policies often ignore frontline realities, causing staff burnout or isolation-induced distress.

Another major impact that Covid-19 taught the Dutch healthcare system, is the shortage of medical workers. For the first time in history, healthcare jobs proved to be vulnerable to the economy, with a decrease in employment rates (AMA, 2024). A recent study found that 20% of physicians are likely to leave their current practice within 2 years, while one third claimed to reduce their working hours. This is commonly seen amongst nurses avoiding burn-outs (De Vries et al., 2024). This shows a downward trend of healthcare workers, meaning that healthcare staff

shortages are still present now and will also remain. By 2035, it is predicted that the Netherlands will face a deficit of 266'000 care workers (Sanou, 2024). This workforce collapse could cripple future responses. When applying this to hospitals, understaffing worsened patient care delays and staff exhaustion during peaks.

Furthermore, challenges such as; constrained resources, risking your own life, large numbers of critically ill patients, deaths (often accompanied by health care staff for their last moments), limited PPE and therapeutics, low social interactions, and no clear finish line, all contributes to lower mental health in healthcare staff (McNeill, 2022). In hospitals, this manifested as traumatic stress, especially among ICU teams.

Secondly, there was some fragmented scientific advice. Some European Parliamentary Technology Assessment (EPTA) members were excluded from formal advisory systems, leading to uneven policy input. Integrating bodies like the Rathenau Instituut in the Netherlands, can help to institutionalize inclusive, transparent advisory structures (*Rathenau Instituut*, 2021). For hospitals, protocols can be confusing when there is inconsistent guidance (such as shifting PPE rules).

As the spread of Covid-19 was extremely fast, many rapid decisions were often based on incomplete or uncertain science, with unintended consequences. This lesson can be seen when the Dutch Covid-19 app plans required swift parliamentary scrutiny to address privacy concerns. Therefore, it is important to develop flexible formats for rapid but evidence-informed advice. This can be done by short policy briefs, or horizon scanning (*Rathenau Instituut*, 2021). Hospitals also faced disruptive last-minute policy changes, such as ICU capacity rules, testing chaos and lockdown shifts (Wallenburg et al., 2021). The lack of predefined crisis protocols

under the Public Health Act (WPG) forced hospitals to 'improvise'. The market competition between hospitals, as providers feared losing patients/revenue, harmed the coordination crisis response. This deadlock was resolved once the government forced hospitals to collaborate, overriding hospital's individual interests (Wallenburg et al., 2021).

Fourthly, governments struggled by balancing health with societal impacts. Many measures that were set sparked debates over economic, legal, and moral trade-offs. For example, lockdowns immensely impacted individuals' mental health. The risk from that is that politicians often cited science by preference to justify decisions, eroding public trust. Thus, policies must explicitly acknowledge trade-offs and involve public deliberation (*Rathenau Instituut*, 2021). These trade-offs were relevant in hospitals as they halted non-Covid care and addressed ethical triage dilemmas (NL Times, 2020).

Fifth, many governments lacked flexible governance systems before the epidemic, requiring them to rely on impulsive measures (Rathenau Institute, 2021). To combat this, the Netherlands has invested in preventative technologies such as 'crisis radar', a hybrid system that combines the NL Alert public warning system, the National Crisis Centre, and RIVM's disease surveillance frameworks. For health-related risks, the RIVM's infrastructure remains the principal tool for early detection and action, as seen by its real-time monitoring of COVID-19 variations. Despite the region's farm-heavy economy, gaps in cross-sector coordination remain. For example, livestock-driven zoonotic hazards in Friesland are not fully incorporated into the radar (Ministerie van Algemene Zaken, 2023).

Sixthly, public adherence to measures like handwashing and social distancing was uneven. While these practices reduced transmission, their effectiveness was limited by socio-cultural factors (e.g., multi-generational households in Friesland's rural areas) and distrust in authorities (Rathenau Instituut, 2021). Of course, nobody is perfect nor does anyone respect rules all the time. Thus, future strategies must account for these disparities to ensure equitable protection. Hospitals could relate to this matter, as there were struggles with non-compliance (e.g. visitors refusing masks), which is harmful to staff.

Furthermore, Covid-19 caused digitalization and privacy challenges. The pandemic accelerated digital monitoring, e.g. workplace surveillance. To relate back to the Netherlands, Rathenau Instituut highlighted risks of privacy infringement in Covid-19 apps. As a consequence, ethical and legal safeguards should be embedded in digital health tools (*Rathenau Instituut*, 2021). For hospitals, a balance between digital efficiency and patient data protection would be the safest option.

In addition, the pandemic has negatively affected trust and transparency. There was a lack of clarity on science informed decisions, which damaged public trust. This can be from outside factors such as political and social. For example, some politicians sometimes spread fake news for their own benefit. Thus, the Netherlands must ensure transparent communication about evidence and decision-making processes (*Rathenau Instituut*, 2021). Medical personnel were met with public resentment, including charges that they overstated the dangers (Zhang et al., 2023).

Lastly, Covid-19 showed the world how there is a lack of citizen engagement. Perhaps because the Netherlands has an individualistic culture, a culture that emphasizes self-reliance over prioritizing a group's needs (Andriessen et al., 2019). A study showed that during a pandemic, citizens of a country with an individualistic culture are less likely to follow governmental orders (Huang et al., 2022). The crisis highlighted the need for participatory approaches in policy making. This can be seen as involving communities in measure design. By strengthening local engagement mechanisms, if GGD Fryslan collaborates with Leeuwarden residents, a pandemic would be less impactful (Rathenau Instituut, 2021). Therefore, Frisius MC need local partnerships to tailor outreach (e.g. pro-vaccination banners in rural areas).

The next section will examine how these lessons apply specifically to hospital preparedness, will workforce retention to crisis governance.

Key Concepts

A number of important ideas that are essential to evaluate pandemic preparedness in Frisius MC are highlighted in the literature review. Frisius MC's ICU surge capacity during COVID-19 and GGD Fryslân's transition to digital contact tracing (RIVM, 2023) are prime examples of health system resilience, which is the ability to absorb, adapt, and transform during crises (WHO, 2022). There is conflict between hospital-level autonomy (e.g., Frisius MC's local stockpiling) and centralised coordination (e.g., RIVM mandates) in the Dutch model of regulated competition, which is a public-private healthcare system with government control (van Driesten & Wessels, 2021). GGD Fryslân's bilingual (Dutch/Frisian) communication reflects infodemic management, or systematic measures to prevent misinformation (WHO, 2022), although rural involvement techniques are still lacking. Safety Region Fryslân's crisis drills incorporate certain elements of anticipatory governance, which stresses proactive policy-making using foresight tools (Rathenau Instituut, 2021), however hospital protocols are not integrated. Lastly, even though national funding for zoonotics research has increased, RIVM's framework does not adequately address zoonotic readiness, which is essential for Friesland's livestock-intensive economy (Ministerie van Algemene Zaken, 2023). When taken as a whole, these ideas highlight Leeuwarden's post-COVID-19 readiness' advantages and disadvantages, especially with regard to managing disinformation, addressing dangers unique to rural areas such as zoonotic spillover, and striking a balance between local requirements and federal norms.

Synthesis: Frameworks Applied to Leeuwarden

For Leeuwarden's hospitals, the WHO's clinical care pillars (e.g., ICU capacity, infection control) are enhanced by the RIVM framework's regional orientation, especially its emphasis on GGD coordination and local resource allocation. The RIVM model adapts WHO recommendations, which offer a global standard for pandemic response, to Dutch circumstances, including the rural healthcare dynamics of Friesland. Frisius MC's collaboration with Safety Region Fryslân, is a prime example of how decentralised governance operationalizes WHO's emphasis on "resilient health systems." However, there are still gaps in RIVM's monitoring protocols for the integration of zoonotic hazards, which are crucial for the livestock-dense areas of Friesland (Agrofoodcluster, 2023). Through an analysis of these similarities and differences, this thesis assesses how Frisius MC manages both frameworks to improve preparedness.

Methodology

Research Design

Interviews with healthcare professionals at Frisius MC in Leeuwarden were conducted. The interviews were semi-structured and followed a qualitative approach. The semi-structured approach was useful for obtaining a more conversational perspective, which was beneficial for retrieving data that would have not been able to be obtained with a fully structured interview. Due to time constraints and the study's focus on depth over breadth, the sample size was three participants. A small sample size aligns with qualitative research norms for detailed and context rich insights. Furthermore, the interview questions followed the RIVM framework, categorizing the questions into five different sub-topics. The five pillars are; surveillance and early detection, risk communication, resource allocation, coordination and collaboration, and capacity building. Each question had additional sub-questions, in case of confusion or if more depth was required to the data retrieved. The interview will also be analysed according to the RIVM framework.

The qualitative approach aimed to gather subjective insights, opinions, and overall captivation in regards to the pandemic preparedness of Frisius MC. To strengthen the findings, quantitative data such as ICU bed numbers and PPE stock levels from RIVM reports were incorporated to triangulate interview responses. The interviews are recorded, then transcribed and stored on a Y-drive, the subjects had the choice to have the interview in Dutch or English, as well as online or in-person. One interview was in Dutch (online), while the others were in English in person.

All participants were required to provide informed consent before engaging in the interview. The study covered three participants to collect primary data from. Secondary data was retrieved from RIVM reports, governmental websites, GGD Fryslan policies, and MCL documents, as well as reliable sources. The consent form outlined the purpose of the research, participants are informed about the voluntary nature of their participation and their right to withdraw from the study at any time without providing a reason. Additionally, participants were assured that their responses would remain confidential. To ensure anonymity, participants were labeled to a randomized number (1-3), and any personal details mentioned during the interview

are kept confidential. Furthermore, participants are provided with the researcher's contact information if they have any questions or concerns regarding the study.

Analytical Framework

The RIVM framework covers 5 different themes:

- 1. Surveillance and Detection
- 2. Risk communication
- 3. Resource allocation
- 4. Coordination and collaboration
- 5. Capacity building

The RIVM framework can be directly applied to the Dutch context and reflects on national policies that Frisius MC would follow. In addition, it provides a clear structure for analyzing preparedness at the hospital level, while aligning with the role of GGD Fryslân (Public Health Service) and Frisius MC in pandemic response.

Unfortunately, a key weakness remains: the RIVM covers hospital needs well, but it does not fully address threats from livestock. There are still many animal-to-human disease risks, as Friesland has a farm-heavy economy (Ministerie van Algemene Zaken, 2023). This blind spot counters global evidence, as zoonoses account for 75% of emerging diseases (Jones et al., 2008). Yet, RIVM lacks formal protocols for farm-heavy regions like Friesland. WHO's framework explicitly links human and animal health through its 'One Health' pillar (WHO, 2022). This highlights RIVM's rural preparedness gap. In short, RIVM helps Frisius MC handle general pandemics, but not yet zoonotic ones. The interview questions followed the RIVM framework, categorizing the questions into five different sub-topics. The five pillars are; surveillance and early detection, risk communication, resource allocation, coordination and collaboration, and capacity building. Each question had additional sub-questions, in case of confusion or if more depth was required to the data retrieved. The interview will also be analysed according to the RIVM framework.

Appendix Questions

Monitoring and Early Detection

- 1. How did the hospital detect and follow up COVID-19 cases?
- 2. What role did GGD Fryslân play in monitoring and testing?

Follow-up questions (if necessary):

- a. Was there a formal reporting process between the hospital and GGD Fryslân? If so, how did it work?
- b. Which technologies or tools were most effective for tracking cases?

Coordination and Cooperation

3. How did the hospital cooperate with GGD Fryslân, Safety Region Fryslân and local authorities?

4. What role did regional coordination play in the response?

Follow-up questions (if necessary):

c. Which coordination mechanisms (e.g. meetings, shared platforms) worked best?

d. Were there persistent challenges in collaboration?

Risk communication

- 5. How did the hospital communicate with staff, patients and the public during the pandemic?
- 6. What challenges did you face in risk communication?

Follow-up questions (if necessary):

e. How was misinformation (e.g. false claims on treatments) addressed and identified?

Resource Allocation

7. How were important resources such as PPE (personal protective equipment), ICU beds and ventilators managed during shortages?

8. What strategies were used to address staff shortages?

Follow-up questions (if necessary):

f. Were there any specific strategies to redistribute staff or resources during peaks?

Capacity Building

9. What training or preparedness measures were in place before the pandemic?

10. What lessons were learned to improve preparedness in the future?

Follow-up questions (if necessary):

h. How have emergency protocols changed after Covid-19?

i. What lessons were included in staff training?

Research Aim

This study aimed to assess the extent to which the healthcare system in Leeuwarden has strengthened its preparedness for future pandemics following the COVID-19 pandemic. It seeks to identify improvements in policies, healthcare infrastructure, workforce training, and emergency response mechanisms. The insights given by the healthcare professionals will be valuable in understanding the preparedness measures taken post-COVID-19. Potentially beneficial for future pandemics.

Ethical considerations

Due to time constraints, there will only be 3 interviews. This creates a sample size constraint, and affects the liability of the research output. This could mean that the findings may not represent all Dutch regional hospitals. Furthermore, the study is specifically focused on Leeuwarden (Friesland region) for its geographical location. Meaning that urban/rural dynamics may differ from other provinces. Thus, this study will provide case-study insights. Since there will be a small sample size, there will be a temporal bias. As Covid-19 was dominant for nearly 2 years (2020-2022), there are many retrospective accounts of Covid-19 experiences. This could recall inaccuracies about early-pandemic decisions. As a result, even when no active crisis was present, contemporaneous hospital documents (e.g., annual reports) were used to cross-check participant statements.

Furthermore, another limitation could also be positionality factors. I (the researcher) am an outsider perspective without clinic expertise, meaning that there is potential misinterpretation of operational challenges. The RIVM framework can also be a limitation, since it may overlook emergent themes, missing unanticipated preparedness aspects. However, it does follow international standards as it is highly influenced by WHO guidelines and EU regulations, but customized to Dutch standards. Lastly, the only data collection method used is semi-structured interviews. There could be a lack of Quantitative metrics (eg. PPE stock levels). Therefore referencing secondary data from RIVM reports will be complimentary. In general, Covid-19 is not the only excuse to general preparedness, contagious diseases have always been around. Diseases are inevitable as pathogens constantly mutate; while their emergence cannot be prevented, incorporating lessons learned from Covid-19 or other early-pandemic experiences is vital for mitigating the impact of future outbreaks.

Results

Monitoring and Early Detection

In the early days of the Covid-19 crisis, Participant 3, an intensive care specialist, noted that PCR testing was critical for detecting Covid-19 cases but revealed limitations: "Some patients remained positive for weeks, acting as carriers, likely due to immune status. We monitored symptoms like fever, but negative tests were our benchmark for releasing patients." This highlighted gaps in managing prolonged infections.

Participant 2 explained that in the post-Covid period, Frisius MC shifted to outbreak management plans and dashboards for real-time monitoring: "Our ICU dashboard, built in a week during the crisis, now tracks bed capacity and respiratory cases. But testing is now rare unless outbreaks occur." Participant 1, from the pulmonary department, noted the current decline in Covid-19 cases: "We see patients admitted via the emergency department with Covid-19, often alongside comorbidities like COPD, asthma, or heart failure, and post-Covid patients referred to

outpatient clinics for persistent health issues. Follow-ups typically occur six weeks post-discharge."

Regarding early detection, Participant 1 elaborated on the GGD Fryslan's role: "The GGD was crucial for testing and vaccinations. All initial Covid-19 diagnoses were made through their testing infrastructure. Now, their role has diminished as the pandemic transitioned to an endemic phase." Participant 2 added context about initial challenges: "Early on, GGD testing was overwhelmed, so we set up our own hospital test site. Initially, staff were swabbed in parking garages; later, we moved to indoor facilities handling 50+ tests/day. Collaboration with GGD was critical but strained—especially during regional outbreaks."

Participant 1 also noted a shift in testing methodologies: "Early pandemic, nasal swabs were the standard for diagnosis. Now, testing is less frequent, reflecting the reduced burden of severe cases."

These findings demonstrated even though Frisius MC progressed its surveillance systems post-Covid 19, gaps still remain in integrating ad-hoc global alerts into formal protocols. This suggests a modest improvement in early detection abilities. However, because of the hospital's reliance on GGD infrastructure, it revealed lingering vulnerabilities in decentralized systems.

Coordination and Cooperation

Before patient zero in The Netherlands, participants received informal warnings from global colleagues in Italy and Iran before official announcements. Participant 1 recalled: *"They sent videos of patients collapsing from oxygen drops - they knew it would be bad."* However, these ad-hoc (when necessary) alerts lacked integration into national systems.

When asked about coordination, Participant 1 described intense multilevel collaboration: "There were five to six meetings daily with stakeholders at all levels – national, regional, local – and even case-specific discussions with GGD staff. The collaboration was constant, though it has since scaled back dramatically." Participant 2 added: "We coordinated with three northern provinces via the ROAZ network. Tactical meetings were held twice weekly, but early on, digital tools were lacking."

The crisis demanded rapid adaptations. Participant 1 compared the peak period to a "Netflix disaster movie": "One colleague was assigned full-time to meetings instead of clinical work. Challenges arose daily, requiring real-time problem solving with the GGD and across the healthcare chain." Participant 2 noted: "Entire departments were repurposed. We drafted urologists to support ICUs and created a dedicated contact-tracing team because managers couldn't keep up. The ad-hoc nature was exhausting—like crisis management for two straight years." Participant 3 described how non-ICU specialists were rapidly cross-trained for ICU duties, calling it "chaotic but necessary."

Communication tools evolved throughout the pandemic. Participant 1 recalled early inadequacies: "*Teams/Zoom were not standardized. We relied on phone calls or in-person meetings with masks, which delayed coordination. Covid ward staff were even stigmatized – others avoided us because we were 'dangerous'.*"

Frisius MC's strong corporations and coordination shows rapid adaptations (e.g. ROAZ network, cross departmental collaboration). On the other hand, the 'improvised' actions of these efforts, like redistribution of non-ICU staff, indicates that Frisius MC's preparedness still

depends on crisis-mode flexibility over institutionalized systems, linking back to broader Dutch healthcare fragmentation.

Risk Communication

Frisius MC engaged in public communication efforts. Participant 1, involved in the hospital's strategy, said: *"I was frequently on national television. We also used the internet, patient letters, and in-hospital signage."* Participant 3 noted a pulmonologist became a national 'Hero of Care' through daily broadcasts.

However, Participant 3 expressed frustration: "We faced vaccine skeptics in media debates, as if our expertise equaled fake news." Participant 1 echoed this: "After appearances on talk shows, I was sometimes positioned alongside 'fake news' advocates. This undermined evidence-based messaging." Internally, Participant 2 explained: "We used intranet dashboards to share real-time updates with staff", but external communication faced backlash: "Some staff refused vaccines or spread misinformation privately, requiring individual interventions."

Participant 1 also faced personal risks: "*After advocating for vaccines, I received death threats. Police provided security at my home for a week.*"

Despite efforts on public outreach (e.g. media appearances, intranet updates), misinformation and public mistrust still remained as a persistent challenge. This overlooks a critical weakness in the RIVM's "risk communication" pillar, as Frisius MC lacked structured convention to combat infodemics.

Resource Allocation

Frisius MC expanded ICU capacity significantly. Participant 1 explained: "Normally, we have 20 ICU beds. We repurposed equipment from surgical departments to reach over 150 beds at the peak. Entire wards were converted for Covid-19 use, delaying non-urgent surgeries." Participant 2 noted PPE shortages were avoided through regional sharing but stressed that "staffing was the true bottleneck. Nurses from general wards were paired with ICU teams."

Triage protocols were implemented. Participant 1 stated: "The sickest Covid-19 patients received the best treatments. Acute trauma cases were still operated on, but most elective surgeries were postponed." Participant 3 added ethical dimensions: "We excluded 96-year-olds with dementia—treatment would destroy their remaining quality of life."

Staffing adaptations included cross-training. Participant 1 described unconventional models: "We drafted physicians from other specialties to work under supervision. Nurses underwent rapid, minimal training." Participant 2 noted post-pandemic changes: "We've created redeployment plans specifying which staff can shift roles with minimal training. This didn't exist pre-pandemic."

The PPE stockpiling and the ICU surge capacity (150 beds) reflect remarkable advancements in resource allocation. Yet ethical triage dilemmas and staffing burnout reveal unresolved equity issues, suggesting preparedness gains are unevenly shared.

Capacity Building

Participant 1 described early warnings from Italian colleagues about Covid-19's severity but noted underestimation: *"By the time infected skiers brought it to the Netherlands, Friesland* had just days to prepare." The early response was fragmented: "We scrambled to educate staff and collaborate with GGD Fryslan, but systems were not aligned."

Post-pandemic, Participant 1 expressed frustration: "Funding for the GGD Fryslan and prevention has been cut. Promised budgets never reached frontline clinicians." Participant 3 agreed: "Politicians forgot promises. GGD budget cuts repeat pre-Covid mistakes."

Participant 3 also warned about zoonotic risks in Friesland's farm-heavy economy: "Bird flu spreads via cattle transport. Economic priorities override health safeguards."

Lastly, Participant 1 highlighted structural vulnerabilities: "Hospitals prioritize cost efficiency over surge capacity. We need reserved beds for pandemics." Participant 2 added workforce challenges: "Long Covid has left staff permanently unable to work. Many are 'Covid-moe' (exhausted)".

While Frisius MC had staff redeployment plans implemented after the pandemic, 'covid-moe' (burnout) and budget cuts threaten long-term resilience. As systemic underfunding and zoonotic blind spots persist, the hospital's progress in capacity building is thus restricted. This is a key gap for future airborne threats.

Discussion

Linking back to the research question, *To what extent has Frisius Medical Center strengthened its preparedness for future airborne pandemics post-Covid-19?* This discussion will examine weaknesses and improvements through the RIVM framework's pillars: surveillance and detection, risk communication, resource allocation, coordination and collaboration, and capacity

building. As Covid-19 revealed critical gaps, the focus remains on whether lessons learnt have resulted in long-term gains.

Strengthened Preparedness: Progress Post-Covid-19

Progression was shown in surveillance and early detection as Frisisus MC had real-time dashboards and rapid PCR scaling to follow Covid-19 cases, showing improved monitoring. On the other hand, some gaps were revealed as the resilience of GGD testing was initially overwhelmed, which reveals fragility in decentralized systems. This can also be linked to RIVM's 'surveillance' pillar. On a systematic overview, Frisius MC staff received early warnings from international networks that were informal. This highlights that there is a need for formalized global-local data sharing. This can contribute to WHO's collaborative surveillance, as it proposes to use international networks for preparedness.

Furthermore, resource allocation and ICU capacity had also progressed throughout the pandemic. In order for Frisius MC to adapt to the rapid growing impact of the virus, there was an ICU bed expansion – 150 beds – and staff reallocation. While staff reallocation was a necessary crisis solution, some gaps were identified, the triage protocols which would commonly exclude elderly patients, can raise ethical concerns. This links to the importance of the research, as equity is crucial for human rights, systematic resilience, economic and social stability (Adams-Prassl et al., 2020). While difficult choices are unavoidable during a crisis, structured protocols can help mitigate biases. Social cracks are exploited by pandemics, as seen in Friesland's vulnerable neighborhoods (Statistics Netherlands, 2007). In addition, equitable policies such as reserved ICU beds for high-risk groups could reduce these challenges. On a systematic view, there were some short-term fixes when Frisius MC had to face the workforce shortages. In order to do so,

surgeons were repurposed to different departments where more staff was required. This masked the long-term workforce shortages (Van Driesten & Wessels, 2021), a feedback loop that RIVM's framework overlooks, even though such reallocation remains an essential crisis tool.

In summary, Frisius MC's progress in surveillance and ICU capacity shows lessons learned, however, workforce shortages and triage ethics reveal unsolved systematic challenges.

Persistent Vulnerabilities

Some concerns were raised throughout the interview. Firstly, participant 3 warned about Friesland's farm-heavy economy, especially on the dangers of zoonotic diseases. Due to the high transportation of cattle across the country, it is a haven for zoonotic diseases to emerge or to contaminate. This aligns with the RIVM's lack of zoonotic focus, as keeping a blind eye on this subject can be consequential. In contrast, WHO's 'Access to Countermeasures' assumes global vaccine equity, however, still ignores local agricultural ties.

The interviews and recent news reports have highlighted a critical regression in pandemic preparedness due to budgetary cuts. A news report article released by 'Het Parool' showed that despite the lessons learned, the Netherlands has fewer ICU beds now (850 in 2024 from 1 '150 in 2020) than before Covid-19. Major funding has been reduced for the 'pandemic preparedness' program under the current government (Van Kempen & Soetenhorst, 2025). This is because the Dutch government has decided to focus on broader threats like war and terrorism, over healthcare. These cuts disproportionately affect vulnerable groups, such as Friesland's poorest neighborhoods (Statistics Netherlands, 2007) and the elderly, who faced triage exclusions during COVID-19. Health Minister Fleur Agema, who previously pushed for more ICU beds, now

emphasizes 'resilience' as the focus for healthcare crisis readiness. This deprioritization ignores the urgent need for structural improvements identified during the pandemic, such as permanent ICU surge capacity and GGD strengthening (Dutch Safety Board, 2025). These developments pose a risk for repeating the equity gaps observed. Systematic preparedness needs collaborated health policies with agricultural planning, for example, integrating zoonotic monitoring into RIVM's framework. Participant 1's frustration with unmet funding promises links back to these findings, this indicates a systematic failure to institutionalize preparedness. This aligns with RIVM's failure to address zoonotic risks in rural areas and WHO's lack of enforcement mechanisms for local equity (Ministerie van Algemene Zaken, 2023). Without sustained investment in region-specific needs, pandemic preparedness cannot be equitable.

On a systematic perspective, pandemic preparedness cannot be hoarded, health policies must intersect with agricultural/economic planning. Due to limited funding, this problem remains unaddressed, even though it poses significant risks. A possible reason for this could be coordination challenges. As participant 1 stated, multilevel collaboration (ROAZ network) improved but remained reactive. In addition, participant 3's 'chaotic' cross-training underscores RIVM's weak 'capacity building' for staff resilience. While WHO's 'Emergency Coordination' framework expects centralized national systems to direct local responses, Frisius MC's experience shows how frontline solutions (e.g. staff cross-training) were equally vital for adapting to crisis conditions.

With mistrust and misinformation spreading as fast as the virus, participants experienced generous clashes with the media. Participant 1 received many death threats as well from his media appearances. This could show a lack of infodemic strategies in the RIVM's 'Risk

Communication' pillar. WHO's 'Community Protection' is broader but not locally adapted (e.g. Frisian/Dutch bilingual needs). Linking to RIVM's 'Risk Communication' pillar lacks infomedic techniques, and WHO's "Community Protection" does not properly address local needs. Structure misinformation procedures (e.g. intranet dashboards), could bridge this gap.

To elaborate, Covid-19 should not be an excuse to general preparedness, it should be seen as a structural warning. The pandemic exposed how early investments in surveillance and staff resilience could mitigate future crises. Early-pandemic decisions will help to reduce the stress and pressure from emerging diseases. Initially, budgets must be donated to the healthcare departments in order to prepare, so the after-math would be a lot less impactful for the country. Yet, without sustained funding and zoonotic integration, preparedness remains clinical, not systematic.

Restrictions of the RIVM/WHO Frameworks

Even though the RIVM/WHO frameworks highlight lots of important topics, there can be limitations. While the RIVM's framework is strong due to being tailored to Dutch governance, for example with the coordination with GGD Fryslan, it fails to address systemic inequities exposed by budget cuts. Its main weakness is the lack of scope on zoonotics (Friesland's farms). Staff burnout, which is a systematic outcome of the "regulated competition" model (Wallenburg et al., 2021) presents another major deficiency.

Similarly, WHO's voluntary reporting cannot prevent local backsliding, as seen in the Netherlands' ICU reductions (Van Kempen & Soetenhorst, 2025). With the assumption of stable fundings, both frameworks would work. However, participant 1's frustration of unmet funding

promises, reveals this as a critical gap. Preparedness remains theoretical, as there are no mandates for equitable resource allocation (e.g. ICU bed for rural areas).

Furthermore, WHO's global approach does not apply to local contexts. WHO's framework is considerable when emphasising equity, such as vaccine distribution. However, voluntary reporting fails to enforce local action, for example, when Frisius MC had a PPE shortage.

The WHO/RIVM frameworks' limitations; zoonotic blind spots, unenforced equity measures, and unaddressed staff burn out, reveals a stronger need for collaboration between policy design and frontline realities. While the frameworks provide essential structure, their lack of accountability on systemic pressures (funding cuts, workforce shortages) and Friesland's regional needs (farming risks) suggests preparedness stays theoretical without mandated, localized conversion.

Limitations

The study focused on healthcare professionals from a single hospital (Frisius MC) in the north of the Netherlands. This can limit the generalizability of findings to other healthcare systems or other regions. The absence of support workers and administration workers may limit institutional challenges. Thus, showing a limitation on the sample scope of the participants.

As the pandemic happened five years ago, there could have been a recall bias. Participant's reflections on early pandemic experiences (such as coordination efforts) may be affected by memory inaccuracies due to the time elapsed since the events. In addition, there were some temporal constraints. The study captures a snapshot of post-pandemic changes but cannot assess long-term sustainability of implemented measures. For example, ICU dashboards or staff redeployment plans would differ on a long-term basis.

Qualitative data gathering can provide a lot of in depth-information, but it does not provide the frequency of reported issues. Perhaps, not all staff at Frisius MC experienced PPE shortages or staff burnout. Furthermore, some of the claims, such as lack of ICU beds, there is no quantitative data to validate these. This can link to some methodological boundaries.

The paper also highlights contextual accuracy. It mainly focuses on the Dutch healthcare system and regional policies (GGD Fryslan's role), which does not apply to other countries with different public healthcare infrastructure. To add on to that, the research is also focused on a hospital level, meaning that the findings can not be applied to governmental-level policies.

Myself (the researcher) can have research influence on the paper. As a single analyst, interpretive bias in transcribing interviews cannot be fully ruled out, despite efforts to maintain an objective perspective.

Recommendations

For the Hospital: Frisius MC

Frisius MC can very much benefit from this research paper. At first, it is highly recommended for Frisius MC to strengthen their Zoonotic preparedness. Furthermore, it is important to adopt RIVM's surveillance dashboards, while adapting them to regional needs (see Societal Solutions for zoonotic monitoring strategies).

When executing the ICU triage, it is important to avoid excluding vulnerable groups, such as elderly with comorbidities. There needs to be equity-centered triage protocols. Perhaps, training staff on bias mitigation using lessons from Covid-19, can help reduce ethical concerns.

As mentioned previously, burn-outs and 'Covid-moe' were relevant in medical staff. In order to prevent that, staff resilience programs could help support staff's mental health and support flexible redeployment plans.

For Policymakers

In order to have a strong health institute, there needs to be safeguard funding. This requires amendments to the Dutch Public Health Act (WPG) to mandate minimum ICU bed quotas, such as restoring 1 '150 beds, and guarantee pandemic budgets. This will aid hospitals in the Netherlands to have security and have the budget promises delivered.

Furthermore, there needs to be a reform for the RIVM's framework. As it excludes zoonotics, it could cause some regretful consequences. Therefore, reforming RIVM's framework is needed to mandate intersectoral coordination (especially health to agricultural linkages for zoonotic threats, as detailed in societal solutions).

Empowering local actors can be beneficial for policymakers. For example, funding the GGD Fryslan's bilingual (Dutch/Frisian) outreach, it may limit the spread of misinformation. Furthermore, it can also help build a stronger community to combat a dangerous disease.

Societal Solutions

To have the least effect of a pandemic, public health campaigns can aid the public by spreading knowledge and awareness. For the vulnerable groups in Friesland, to understand their needs, implementing co-design will improve trust within the community.

To mitigate misinformation from the public, a replication of the Frisius MC's intranet dashboards for public use will provide safe and well-sourced information. Offering a multilingual option (Frisian alongside Dutch), will prioritize culture inclusiveness and maintain full accessibility for all residents.

Lastly, cross-sector drills can be sympathetic in understanding zoonotic outbreaks. Thus, tests from livestock-to-human outbreak responses with farmers, hospitals, and GGD Fryslan, can give us more knowledge on how to manage, control and possibly find a cure to zoonotics.

Conclusion

To conclude, the Covid-19 pandemic exposed some critical gaps in pandemic preparedness at Frisius MC and the broader Dutch healthcare system. This thesis set out to examine: *to what extent Frisius Medical Center has strengthened its readiness for future airborne pandemics post-Covid-19.* Progress was shown in the ICU capacity surge (150 beds), real-time surveillance dashboards, and staff redeployment plans, demonstrating refined adaptability during a crisis. In spite of that, critical gaps remain, particularly in zoonotic monitoring (Friesland's heavy farming economy), equitable resource allocation (triage protocols for vulnerable populations), and staff burnout from systematic underfunding.

For true resilience, three key reforms are essential. Firstly, legally mandated ICU bed quotas can prevent relapse on capacity gains. Moreover, the integration of zoonotic risks into RIVM's framework for rural regions like friesland, can help build a stronger 'shield' against emerging zoonotic diseases. Ultimately, policies centered on equity can protect vulnerable populations during crises.

While Frisius MC's adaptations show lessons were grasped, structural barriers (budget cuts and fragmented governance) threaten long-term pandemic preparedness. The next pandemic will test whether these lessons have translated into systematic change or remain dependent on crisis-era improvisation.

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