The Dutch COVID-19 approach: Regional differences in a small country

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ABSTRACT

Objectives: This paper describes the first months of the COVID-19 pandemic in the Netherlands, including policies to reduce the health-related and economic consequences. The Netherlands started with containment and shifted to mitigation within three weeks when implementing a 'mild' lockdown. The initial focus was to obtain herd immunity while preventing Intensive Care Units from getting overwhelmed.

Methods: An in-depth analysis of available national and international COVID-19 data sources was conducted. Due to regional variation in COVID-19 hospitalization rates, this paper focuses on three distinct regions; the initial epicenter; the most northern provinces which – contrary to national policy – decided not to switch to mitigation; and the Bible Belt, as congregations of religious groups were initially excluded from the ban on group formation.

Results: On August 11th, 6,159 COVID-19 deaths were reported with at the peak an excess mortality Z-score of 21.7. As a result of the pandemic, the economy took a severe hit and is predicted to shrink 6.5% compared to projection. The hospitalization rates in the northern regions were over 70% lower compared to the rest of the country (18 versus 66 per 100,000 inhabitants). Differences between the Bible Belt and the rest of the country were hardly detectable.

Conclusion: The Dutch have shown a way to effectively slow down transmission while allowing more personal and economic freedom than most other countries. Furthermore, the regional differences suggest that containment prevented a surge of infections in the northern provinces. The results should be interpreted with caution, due to the descriptive nature of this study.

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1. Introduction

The COVID-19 pandemic reached the Netherlands on February 27th, 2020, when the first patient tested positive for the virus. The country has taken a liberal policy course, with an early shift from containment to mitigation on March 16th. A comparatively mild lockdown was implemented with much individual freedom and responsibility, in contrast with other neighbouring countries where complete restriction on movement was quickly implemented by the government [1,2]. Irrespective of the mild measures, the economy took a severe hit. The government therefore quickly adopted several economic measures.

Regional variation was initially due to the first cases popping up in the south of the country and community transmission was quickly observed in the two most southern provinces [3]. Soon, more cases started to arise throughout the rest of the country. To prevent further spread of the virus, initial containment policies were strengthened by lockdown measures. As the capacity for testing and tracing was quickly pressured in the southern provinces, the policy switched from containment to mitigation aiming to prevent overwhelming Intensive Care Units (ICUs). The mitigation policy was motivated by the aim to achieve herd immunity in the population [4]. However, due to the organisation of the health system, many decision-making powers are decentralised which led to regional policy differences. This allowed tree provinces to object to this change in strategy and continued with their containment policy of testing and tracing, in effect following the World Health Organization's guidance [5].

Even within the small and interconnected country, the number of infected people - indicated by hospitalization rates – continued to vary markedly between regions [6]. The initial high infection rate in the two southern provinces is likely related to the

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locally celebrated Carnival in the week before the first confirmed case. Besides, many early detected cases were traced back to epi-centres in other European countries [3]. Due to school holiday regulations, many families in the north enjoyed their spring break a week before those in the south, minimizing exposure to spreading events during their holidays. While these explanations may have contributed to the initial regional variation in cases of the virus, policy differences likely played a role in the subsequent spread throughout the country.

A better understanding of the impact of the country's approach on the spread of the virus requires a nation-wide description of COVID-19 trends, the government's approach of policies regarding citizens' health, the health system, and the economy. Data on COVID-19 patients is collected similarly in the same health system, which offers a unique opportunity to compare variation in COVID-19 health data, keeping many external factors constant. Besides, from an international perspective, the Netherlands is a homoge-nous country in terms of culture, income, and education. However, regional authorities remained a certain degree of decision-making power which led to different regional policies, that opposed national policy. This makes the Netherlands a near-ideal country to study the effects of different COVID-19 approaches.

This paper aims to describe the health and economic impact of the pandemic and the policies introduced to alleviate them during the first half year of the pandemic in the Netherlands. This is done first by providing a short description of the Dutch health system after which the nation-wide COVID-19 data is presented. Second, elaboration on the government's responses and the nation-wide policy roadmap – both on controlling the virus and protecting the economy – is presented. Third, the differences in regional policy implications are clarified followed by the differences in hospitalization rates in these discussed regions. To understand these differences, aggregate data on hospitalization rates for four specific regions is compared. Last, concluding remarks are given on the state of COVID-19 in the Netherlands. Here, policy implications and suggestions for further in-depth research are made.

2. The Dutch health system

The Netherlands is organized in twelve provinces, 25 Municipal Health Service (GGD) regions, and 355 municipalities [7]. With 17.4 million people, it is a small and dense country (511 individuals/km^2) compared to the average of Organisation for Economic Co-operation and Development (OECD) countries (38 individuals/km^2) [8]. Within-country density differences can be observed between the western megalopolis, the Randstad, which has the highest density especially in some major cities, and the rural countryside [7]. Concerning health outcomes, avoidable mortality is lower (153 versus 208 per 100,000 individuals) and life expectancy at birth is a bit higher than the OECD average (81.1 versus 80.7) [8]. The Dutch spend about 9.9% of their Gross Domestic Product (GDP) on healthcare and have 3.6 practising doctors and 10.9 practising nurses per 1,000 individuals (an average of 3.5 and 8.8 for OECD countries, respectively). Compared to international standards, the Dutch have a stringer focus on primary and long-term care, where expenditure on the latter is the highest in the European Union [9]. Even though the Netherlands has – compared to European averages – a low number of acute beds per person (322 versus 356 per 100,000), access to health care seems to be sufficient, since a low number of unmet needs is reported. Moreover, no significant shortages or oversupply of healthcare professionals and infrastructure are indicated [8].

The roots of the Dutch health system lay in the Bismarckian tradition of social health insurance, with both private and public stakeholders. The system is partly characterized by regulated competition in which it is up to citizens, private insurance companies, and private care providers - where the last two can negotiate on the price and volume of the delivered care - to define the health-care market. Although private players play a significant role in the Dutch system, it is ultimately the Dutch government's responsibility - i.e. of the Ministry of Health, Welfare and Sport - to ensure that healthcare is accessible, affordable and of good quality [10]. Besides, other public health services such as prevention, vaccination, and screening are the responsibility of government-owned institutions. A major player in the organisation of public health is the National Institute for Public Health and Environment (RIVM) which has an advising role to the government on environmental issues and policy support in several public health areas. As a part of public health, the institute is also the central referral point when it comes to infectious diseases, which increased the institute's importance during the COVID-19 pandemic. The executive responsibility of public health services is covered by the regional GGDs. As such, the GGDs were responsible for the organization of testing and tracing of possibly infected individuals during the pandemic.

3. COVID-19 data

Epidemiological data is collected by the GGDs, which distribute the regionally gathered information to the RIVM. COVID-19 related data is updated and presented daily by RIVM including retrospective changes when needed e.g. due to delay in reported information. In these official reports, among other things, the number of reported infected, hospitalized, and deceased patients were presented. On August 11th, 2020, the total number of people tested positive for the virus rose to 59,973, leading to 6,159 confirmed COVID-19 deaths [11]. The Netherlands handles a strict definition of COVID-19 reported deaths, as only those who tested positive for the virus were included in the total number of deceased people [6]. Data on COVID-19 reported deaths and hospitalization rates are presented in Fig. 1, showing the peak of the epidemic around April 6th.

To better understand the mechanisms of the virus, data on the proportion of reported COVID-19 deaths among risk groups is an important indicator. When comparing the gender aspect, women made up to 60.8% of the total number of positively tested people, yet surprisingly men made up to 61.2% of those hospitalized and 55.0% of deaths. These numbers suggest men are more severely impacted by the disease once infected, yet epidemiological research is required to confirm this hypothesis. Furthermore, most deceased patients were old, with 78.5% being 70 years or older [11]. Therefore, the Central Bureau of Statistics (CBS) investigated the effect of COVID-19 in long-term care facilities such as nursing homes. They reported 5,200 additional deaths – a 53% increase - in the period between March 9th and May 10th compared to previous weeks, controlled for seasonal trends [12]. For those younger than 70 years old, the two important risk groups are cardiovascular disease and diabetes, with 43.2% and 25.7% of COVID-19 deaths, respectively [11].

Post-mortem COVID-19 tests were not performed, yet general practitioners (GPs) were asked to keep track of suspected virus-related deaths. On April 25th, already 764 possibly related cases were reported [13]. The RIVM and the CBS report this uncertainty in the true number of COVID-19 related deaths by providing information on excess mortality [14]. Excess mortality rates provide information on the 'surplus' of deaths compared to the expected number of deaths based on the same period in the previous years. In case of an epidemic, this number is expected to provide a better overview of the impact of the virus on mortality by also including undiagnosed patients with a high likelihood of infection. The total number of diseased people is combined with the standardized Z-scores on excess mortality as calculated by EUROMOMO [15] and presented in Fig. 2.
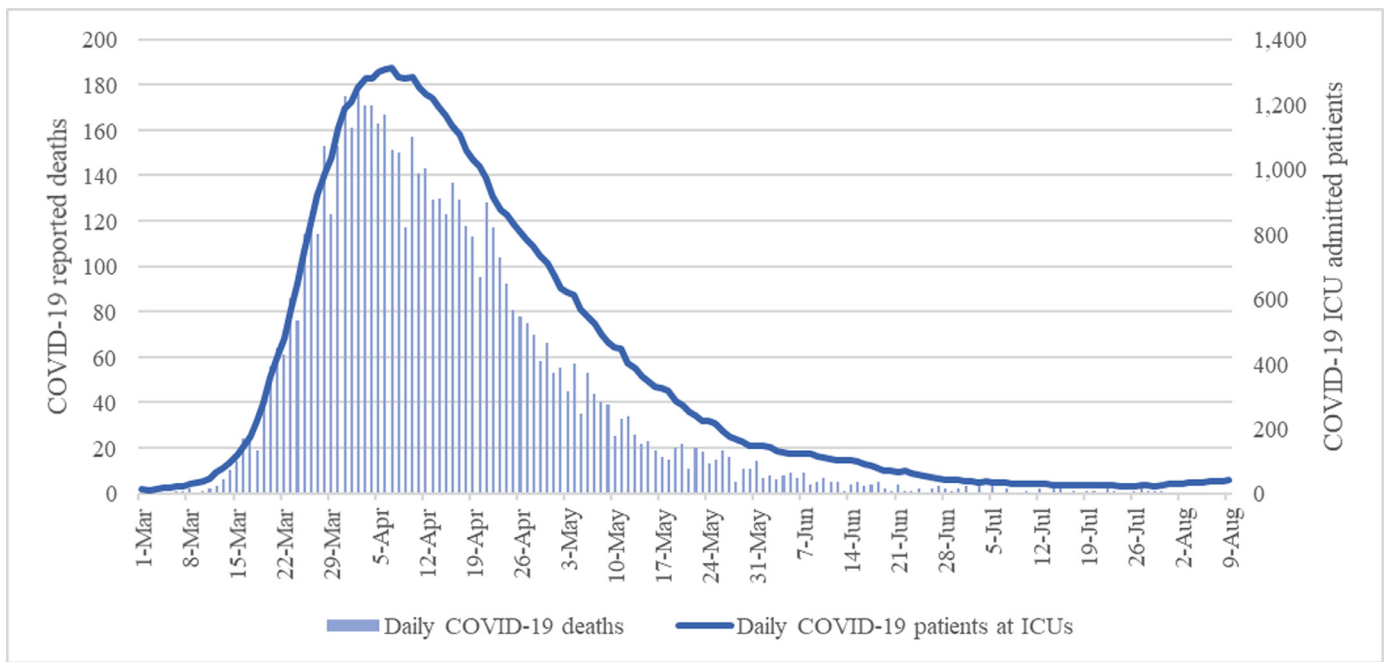
Fig. 1. Daily COVID-19 reported deaths and ICU admitted patients. Note: COVID-19 reported deaths are those who decease and have tested positive for the COVID-19 virus.
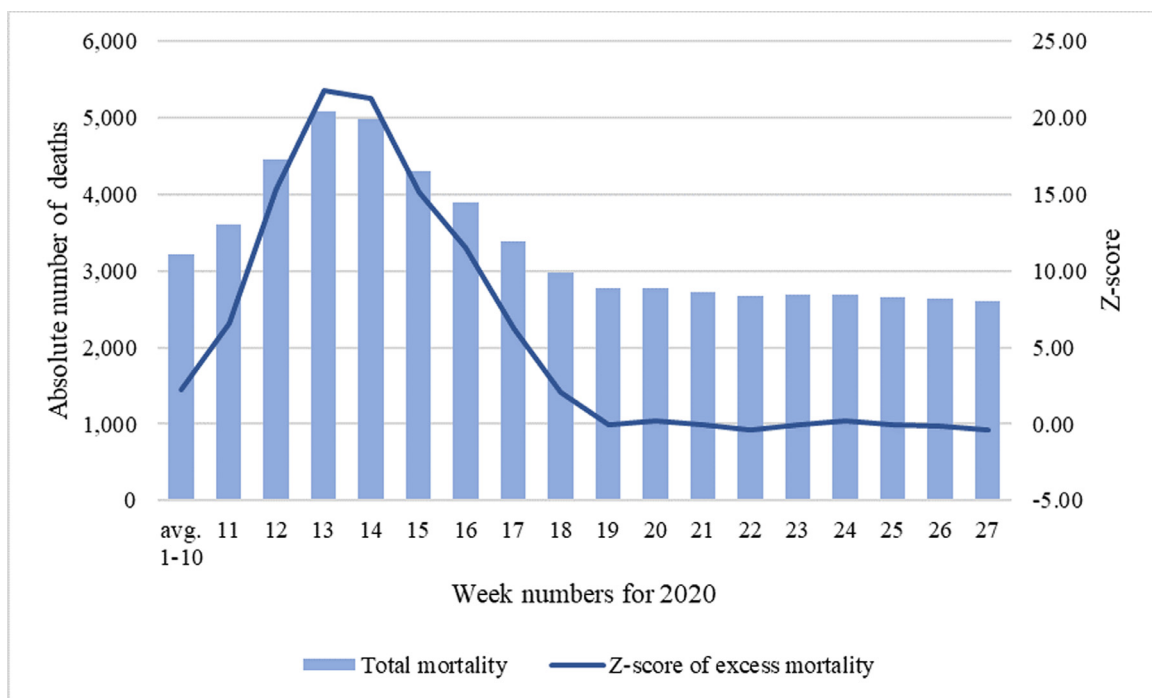

Fig. 2. Weekly total mortality and excess mortality Z-score. Note: first bar presents the average of week 1 to 10.

According to EUROMOMO's classification of Z-scores, any rate lower than 2 does not show any excess, which is observed up to week 10 in the Netherlands. At this point, the Z-score rapidly increases and in week 14 a Z-score of 21.72 can be observed. For five weeks in a row, both very high ($10<z\leq15$) and extremely high (>15) excess scores are found. Even during the flu epidemic of 2018, which had a significant elevation in excess mortality, only one week showed a very high excess mortality with a Z-score of 11 [15]. After the initial peak in excess mortality, the number of diseased people decreased, and no excess mortality is observed since week 20 [15].

4. System and policy response

a. Initial government responses

As of January 27th, COVID-19 was classified as an 'A-disease'. This indicated a major public health threat and gave the government more power to intervene [16]. The government installed an Outbreak Management Team (OMT). The OMT consists of medical experts and officially advises the Minister of Health on the strategy against infectious diseases [17]. However, at the beginning of the outbreak, the Prime Minister announced during a public de-

bate that the government is executing the recommendations given by the OMT, rather than solely consulting them [18].

The first outbreak of the virus occurred in the south of the country which quickly overwhelmed local hospitals and especially their ICUs. To deal with the rapidly expanding need for ICUs, other regional hospitals were asked to accept patients from the epicentre. Due to the structure of the Dutch health system, hospitals and their medical staff retain a large degree of autonomy and were not sure whether they could be hit by such cooperation. Therefore, hesitation and resistance were observed during the initial response. Similarly, health insurance companies faced financial incentives that were not aligned with a national distribution of the ICU-patients. As the stress was building, parties quickly agreed to stop the competition among insurance companies and provided financial guarantees to all hospitals [19]. While this helped during the first weeks of the outbreak, numbers of ICU-admitted patients continued to rise. To coordinate the use of ICUs, the government supported the largest academic hospital to function as a national coordination centre [20]. During the peak, a total of 1,311 COVID-19 patients were treated at the national ICUs which far exceeded the maximum capacity of 1,150 ICUs before the COVID-19 pandemic [21]. This surge capacity of expanding ICU capacity to a total of 2,400 beds within weeks led to high stress-levels and required the nationwide cancellation of virtually all elective care [22].

The Dutch Healthcare Authority reported a reduction in other health services. Between March 12th and April 20th, 360,000 fewer referrals by GPs to hospital care were reported as compared to previous years [23]. Furthermore, referrals to mental healthcare institutes decreased by 49,000 between mid-March and mid-May [24]. As of mid-May, regular care was slowly scaled-up again [23]. Other healthcare providers, such as physiotherapists and home care providers, implemented E-health technologies to ensure continuous care. These innovations were financially supported by the government with a temporary COVID-19 E-health subsidy [25]. Besides, due to the rising number of COVID-19 patients, the demand for personal protective equipment (PPE) rose tremendously. As a consequence of closing borders by PPE producing countries, limited production of PPE within the Netherlands, and lack of emergency storage, PPE quickly became scarce [22].

b. Policy roadmap

According to Daxin Ni, deputy director of the Chinese Center for Disease Control, two strategies in response to the COVID-19 virus exist: a SARS-like strategy and a pandemic flu-like strategy [26]. The SARS-like strategy focusses on complete containment of the spread of the virus and emphasizes early detection and isolation. The pandemic flu-like strategy focusses on controlling the spread, reducing overall harm, and building herd immunity. For a flu-like strategy, the focus is not on early detection and isolation, but on protecting risk groups and the ability to treat severe cases [26]. Following this rationale, the Dutch policy response can be classified as a pandemic flu-like strategy. This classification follows from limited testing, limited travel restrictions, and limited quarantining requirements for people returning from international epicentres.

To control the spread of the virus the Dutch did make an initial - albeit slow and narrowly defined - effort to test, trace and quarantine infected people and their recent contacts. As the virus spread, the main goal became to avoid overwhelming ICUs and to protect risk groups through the flattening of the epidemic curve [27,28]. The government aimed to allow a controlled spread of the virus over several months to establish herd immunity, which was presented to the public by the Prime Minister [4]. This approach received little support from the public. Subsequently, herd immunity was reframed into a consequence rather than the aim of the policy. However, the actual measures remained the same [22]. Afterwards, the government based its approach on indicators such as the basic reproduction number (R0) to remain below the critical value of 1 [29]. The R0 value is a well-known epidemiological measure, which can be interpreted as the expected number of new infections in the population coming from one infected individual.

Different government responses to the pandemic are observed around the world. To compare these measures taken across bor-
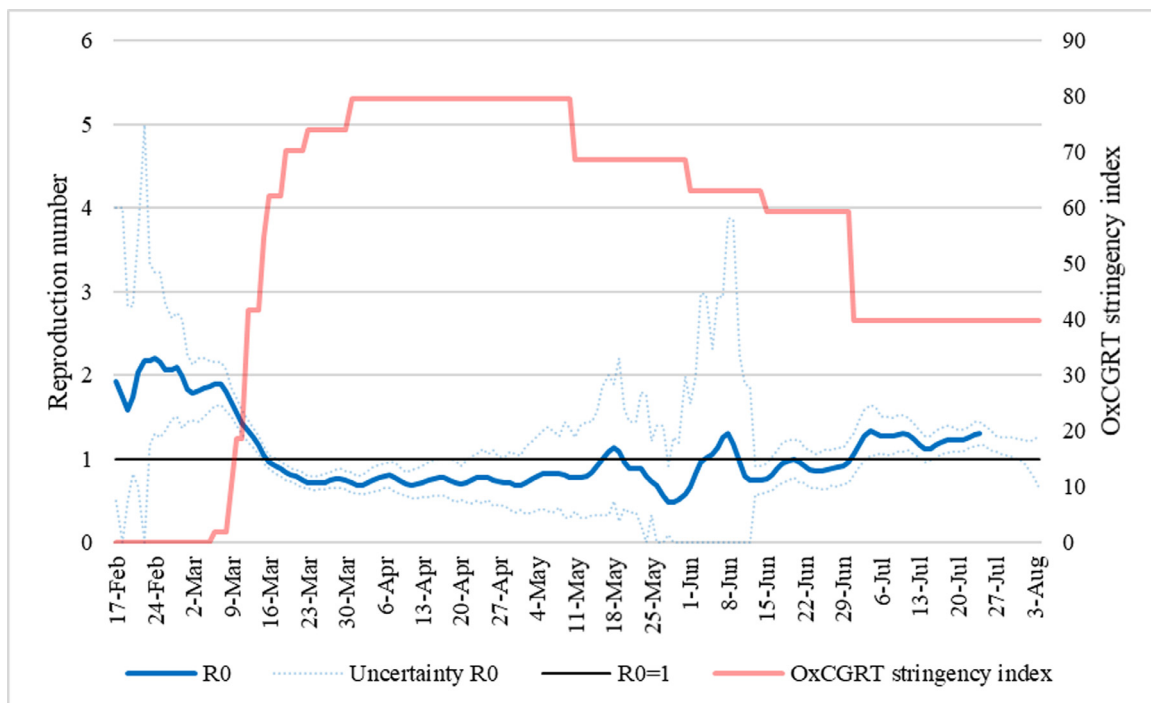

Fig. 3. Reproduction number (R0) and OxCGRT stringency index of the Netherlands over time. R0 values are presented including upper and lower uncertainty boundaries.
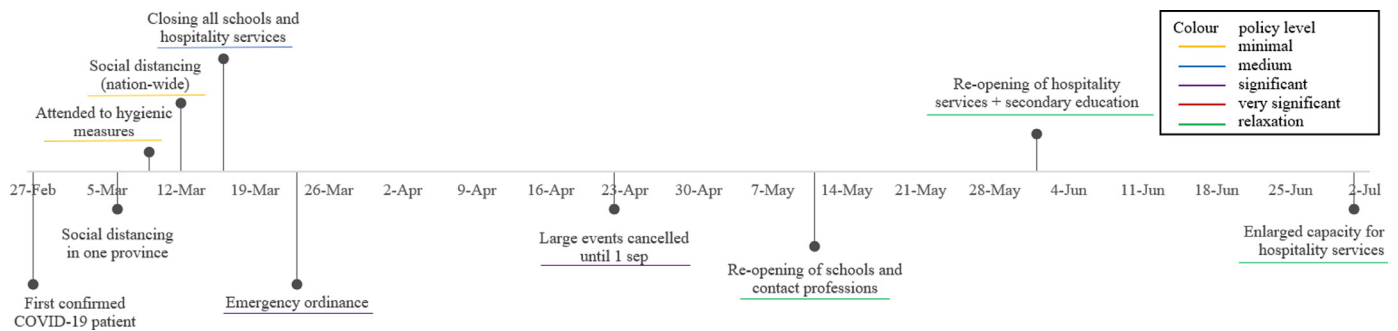
Fig. 4. COVID-19 policy roadmap of the Netherlands.

ders, the Oxford COVID-19 Government Response Tracker (OxCGRT) provides a stringency level scale [2]. Based on the characteristics and intensity of the measures taken by each country, a score from 0 to 100 is attributed. Fig. 3 presents the score of the Netherlands on this scale, which shows that the highest stringency level score reached is 79.63. Additionally, the figure provides information on the R0 level since the government announced to utilize that number as the main value of interest for policymaking [29].

The adopted policies of the Dutch government can be classified in four levels following the scaling method by Moy et al. [30]. These include the minimal (recommended), the medium (mandated), the significant (mandated and enforced), or the very significant (complete restriction on movement) policies. With the relative mild lockdown implemented in the Netherlands, no very significant policy has been implemented. An overview of the most important policies over time is shown in Fig. 4.

The first minimal level policy was introduced on March 6th, where people in the southern province Noord-Brabant were advised to practice social distancing. Three days later, the first nation-wide recommendation involved hygienic measures [3]. As of March 12th, the government moved from containment to mitigation when policies were extended to the nation as a whole and people with non-vital jobs were requested to work from home [27]. Besides, large events were cancelled, and universities closed. On March 16th, additional measures were mandated, including closing all sports facilities and hospitality services. Against the OMT's advice, the government decided to close all schools due to the critique building from teachers and parents on the previous decision to keep schools open [1].

The overall focus was on social distancing where people were to keep a distance of at least 1.5 meters from each other [1]. However, these policies did not bear the desired effects, as public places were often still crowded. Therefore, on March 23rd, new policies were implemented through an emergency ordinance. Municipalities were authorized to fine group formation with more than two people and businesses who did not adhere to the social distancing measures. The implemented measures by the government still allowed people to go for a walk or visit family while adhering to the 1.5 meter distance measure [4]. These measures were extended multiple times [20,31]. The effectiveness of the policy measures can be seen in the movement data provided by Google, where a 12% increase in residential mobility is detected during these months [32].

On May 19th, the COVID-19 approach changed from a mitigation approach back to aiming for containment [25]. To relax previously implemented measures, policies aimed at more stringent testing and tracing were announced. As of May 11th, primary schools re-opened and contact professions could be performed. On June 1st, hospitality services re-opened, although in reduced capacity which number was enlarged one month later. Besides, all secondary education institutes opened [29]. These measures remained in place

until the time of writing this paper. Furthermore, digital initiatives arose in response to the virus. To provide insight into the spread of the virus to the public, the government established an interactive COVID-19 dashboard, which contained data on multiple indicators. These included ICU hospitalization rates, R0-trends, and the number of people tested positive for the virus - both at the national and regional level [33].

c. Economic fluctuations and financial incentives

The implemented containment measures ensured that ICUs were not overwhelmed. However, as a result, the economy was impacted in several ways. Before the arrival of the virus, the Dutch economy – as measured by GDP - was growing over the last 23 quartiles, yet it was estimated that the Dutch' GDP dropped with 1.5% in the first quarter of 2020 compared to the last quarter in 2019 [34]. This is, among other things, due to a decrease in household spending of 6.7% in March 2020 compared to the same period in 2019. The reduction is mainly attributed to less spending on services and durable goods [35]. Comparing the exportation of goods in the same period, a reduction of 4.0% was observed, which was the first reduction in export observed since May 2019. A similar trend can be found for the number of imported goods which decreased by 3.7% [36].

Compared to the first quarter of 2020, the second quarter experienced an even more severe drop of 8.5%. Household spending continued to decrease by 10.4% compared to the first quarter, as well as investments made (-12.4%) and the number of exported goods (-9.8%). The restrictive measures and corresponding limited production in the transportation and hospitality sector further contributed to the drop in the economy [37]. In contrast to previous years where the national debt kept decreasing, the debt increased by € 48 billion to a total of € 385 billion during the first six months of 2020 [38]. Currently, the economic losses are estimated to reach at least € 52.8 billion in 2020, corresponding to a reduction of 6.5% compared to the prognosis [39]. Although severe, the Dutch economy seems less severely impacted by the pandemic as compared to neighbouring countries [37].

The reduction of trust in the economy by entrepreneurs encountered the largest drop ever measured by CBS in the first quarter in 2020. Based on the indicators on which this trust is based, the reduction seems mainly attributable to turnover losses. The arrival of the virus also impacted the labour market. A reduction of 60,000 job vacancies was observed in the first quarter in 2020, a drop of 21% compared to the quarter before. Although this reduction was the largest drop in vacancies ever measured by the CBS, the outlook seemed to be less severe compared to other Western countries [40,41]. The Dutch stock market was also impacted. The Amsterdam Exchange Index experienced a large drop of over 28% between the day of the first positively tested patient (February 27th, 569.97) and its lowest points (March 16th, 409.05). After-

wards, growth was again observed in the stock market (June 10th, 564.60) [42].

To protect the economy and employment, several nation-wide economic emergency policies were adopted. Initial measures were focussed on entrepreneurs and businesses. Some regulations were relaxations of existing ones which made it easier for companies to receive loans and "COVID-19 bridging loans", for which the government acted as the underwriter. Others include emergency regulations that focussed on covering immediate fixed costs and businesses of most severely impacted sectors could receive a one-time emergency allowance up to € 4,000. Moreover, employers who expected a revenue loss of at least 20% due to the COVID-19 measures could apply for the temporary emergency subsidy measure. Depending on the expected revenue losses, businesses could receive a maximum of 90% of their employees' net wage bill. [43]. At the time of writing, no long-term effects of the financial support of the government to business can be analysed. The economy did experience a large drop in both the first and second quarter yet seems less affected as compared to the economy of neighbouring countries. Furthermore, in the first 31 weeks of 2020, no increase – even a small decrease – in the total number of bankruptcies is observed compared to the same period in 2019 [44].

d. Health and economic outlook

To provide an outlook on possible life-years gained and economic losses, this section provides a preliminary estimation of the hypothetical situation in the absence of mitigation measures. Without intervention and applying an R0 of 2.5 [45], it can be expected that 60% of the population would have gotten infected before herd immunity could slow down the transmission. Before the strop of transmission due to immunity, the overshoot would have led to an infection rate of about 85% [46]. If we combine this with an infection fatality rate of 0.5 to 1.0% due to the absence of effective treatment at the start of the pandemic [47], this could have cost the lives of about 70,000 to 140,000 Dutch.

Monetizing health losses enables us to compare health and economic consequences. This involves a computation of Quality Adjusted Life Years (QALYs) lost, based on estimates of life years lost and quality of life during the remaining years. Using the COVID-19 related calculations from Andrew Briggs, the estimated 8 years lost and corresponding 6 QALYs lost per death would provide us with a range of 560,000 to 1,120,000 life years lost and 420,000 to 840,000 QALYs lost [48]. Using an estimate of € 40,000 per QALY lost [49], this would have resulted in an expected health loss between € 16.8 billion and € 33.6 billion. The magnitude of the total economic losses would have been much lower for the hypothetical situation described above as compared to the current situation in which restrictive measures were implemented and an economic loss of € 52.8 billion is found.

5. Testing and tracing

The pandemic flu-like strategy was coherent with the testing and tracing policy. Partly due to the lack of focus on early detection, a limited testing policy - as recommended by the OMT - was applied. This decision was also based on the fear of test materials becoming scarce. However, retrospective research found that most laboratories did not use their full testing capacity. In March, just half of all available tests at laboratories were used and in April this number even dropped to one-third of the total capacity [50].

Due to the limited testing policy, on April 30th the country tested only 11.3 people per 1,000 inhabitants, which is far below the OECD average of 22.9 people per 1,000 residents [51]. From the beginning, testing was only done for hospital employees and patients with severe COVID-19 symptoms who had travelled to areas

with an increased risk of infection and/or had been in contact with contaminated people [27]. Later, testing was slowly extended to extramural health workers and later to educational staff [22,31]. With the primary schools reopening in May, the testing policy started to expand to more professions and as such shifted back to containment strategies. As of June 1st, the GGDs were able to test every willing person with COVID-19 symptoms with a maximum test capacity of 30,000 tests per day [29]. The changes in testing policies are reflected in Fig. 5, where both the weekly number of people being tested and the percentage of those who tested positive is presented.

With the testing policy shifting back to containment where every citizen could be tested, other testing issues occurred. Particularly, the time between making an appointment and receiving the results took on average four days. To effectively implement a containment strategy, the average testing times should decrease [52]. Besides, to support the contact tracing currently done by the GGDs, the government aimed to develop a COVID-19 tracing app. At the time of writing such an app has not yet been implemented, although the testing phase has begun. Due to privacy concerns of the public, the implementation date has been postponed multiple times and further development of the app is required [25].

Apart from COVID-19 testing policies, as of early April, additional serology tests were done by the blood bank which provided insight into the spread of the virus among the population. These tests estimated that mid-April about 3% of the population had antibodies for the virus in their blood and continued to slowly increase to 5.4% [20]. However, the testing results of mid-July showed a decrease when only for 4.1% of the test population antibodies were found [53]. Testing the herd immunity level is in line with the COVID-19 approach of the Netherlands of maximum control of the spread of the virus, rather than complete containment.

Due to the organization of the health system, hospitals and testing centres have the autonomy to deviate from the national policies [8]. The University Medical Centre Groningen (UMCG), the only medical centre in the northern provinces, did not follow the national testing policy. Together with the GGDs in the region, UMCG continued to test both intra- and extramural health personnel with mild symptoms to avoid possible contamination between colleagues and patients and as such adopted a more extended testing policy [5].

6. Regional differences

Regional differences in above-average mortality during the COVID-19 pandemic can be observed per 100,000 inhabitants, as shown in Fig. 6 [54]. Density levels possibly contribute to the spread of the virus, as it is believed that more interaction takes place in more dense areas, which in turn would lead to a faster spread of the virus. However, regional density variation does not overlap with the hospitalization rate per municipality, as some highly dense areas show low hospitalization rates and vice versa. Thus, other factors could be better explanations for the variation. These could include regional variation in policy adherence and is investigated below.

a. Regions of interests

To study these differences, this study identifies three major regions, namely the initial epicentre with high hospitalization rates, the northern regions with low hospitalization rates, and the Bible Belt region with somewhat higher hospitalization rates. The Bible Belt stretches from the south-west to the north-east and has the highest concentration of religious communities, mainly orthodox protestants [55]. The northern regions and Bible Belt are further explored, as these regions deviate from the national policy, namely
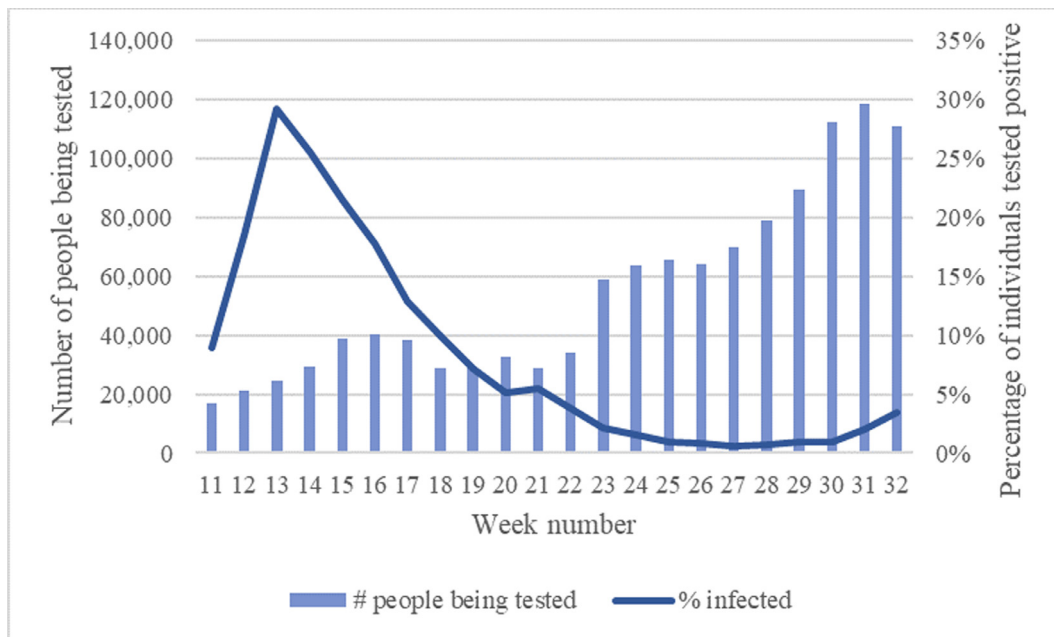
Fig. 5. Number of people being tested for COVID-19 and percentage of those who tested positive for the virus, presented over time.
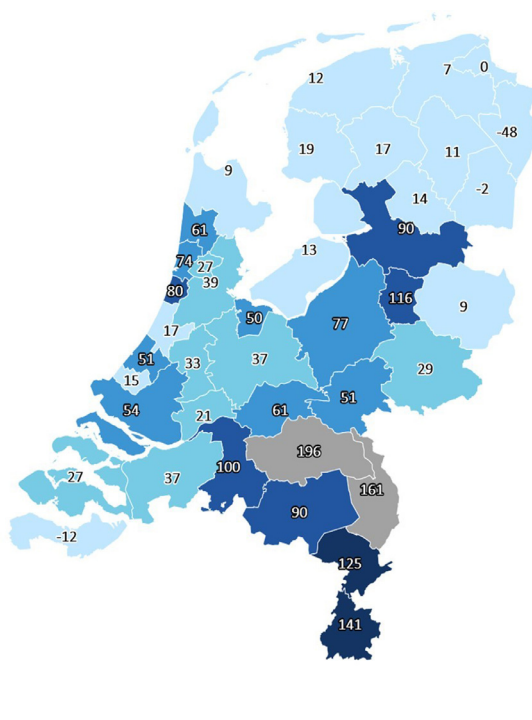

Fig. 6. Regional variation in above-average mortality per 100,000 inhabitants for weeks 11-19, 2020, as compared to weeks 1-10, 2020.

in adherence to the national testing policy and the utilization of legal exceptions on group formation.

Due to the variation in testing and tracing policies between the three northern provinces and the rest of the country, the observed differences can be investigated within the otherwise comparatively homogeneous country of the Netherlands. Another possible explanation for regional variation is the legal exception for religious groups to congregate, while other similar sized groups were barred from gathering. For religious gatherings, groups up to 30 people were allowed, if they adhered to the 1.5 meter policy [4]. While

the Catholic church cancelled its congregations, they continued in the Bible Belt region [56]. Municipalities where the Staatkundig Gereformeerde Partij, the most religious orthodox political party, received at least five percent of the votes during the 2017 election are included as Bible Belt regions [55,57].

b. Hospitalization differences

This analysis uses COVID-19 hospitalization rates to illustrate differences between the regions with more extensive testing and tracing approach and for the legal exception of religious group formation. As hospitalization rates are not influenced by the number of people being tested in the region, this is preferred over the number of COVID-19 related deaths. The results from the first weeks of the pandemic reaching the Netherlands are compared to the initial epicentre and the country averages excluding the three regions of interest. The initial epicentre is investigated separately as higher absolute numbers are observed in this region at all time intervals. The COVID-19 data at the municipality level is combined with the number of inhabitants per municipality taken from the CBS on March 1st, 2020 to calculated regional numbers per 100,000 inhabitants and presented in Fig. 7 [7,58].

The results of the northern regions suggest some underlying factors explaining this deviation from the country averages (18 versus 66 per 100,000 inhabitants, respectively), such as the difference in testing policy between the north and the rest of the country. Another factor that is often suggested for this difference is the average lower density in the north as compared to the rest of the country. However, parts of the epicentre report similar density rates. Also, due to the virus being introduced first in southern regions, the spread to the northern regions started later. This allowed the rest of the country to prepare and adopt containment strategies before their first confirmed case, which in turn could have contributed to controlled dissemination. Further research is needed to investigate this effect.

Furthermore, the aggregated regional data show no substantial difference between Bible Belt municipalities and country averages in terms of hospitalization rates. This could imply that small group formations are not or only to a small extend related to the dissem-
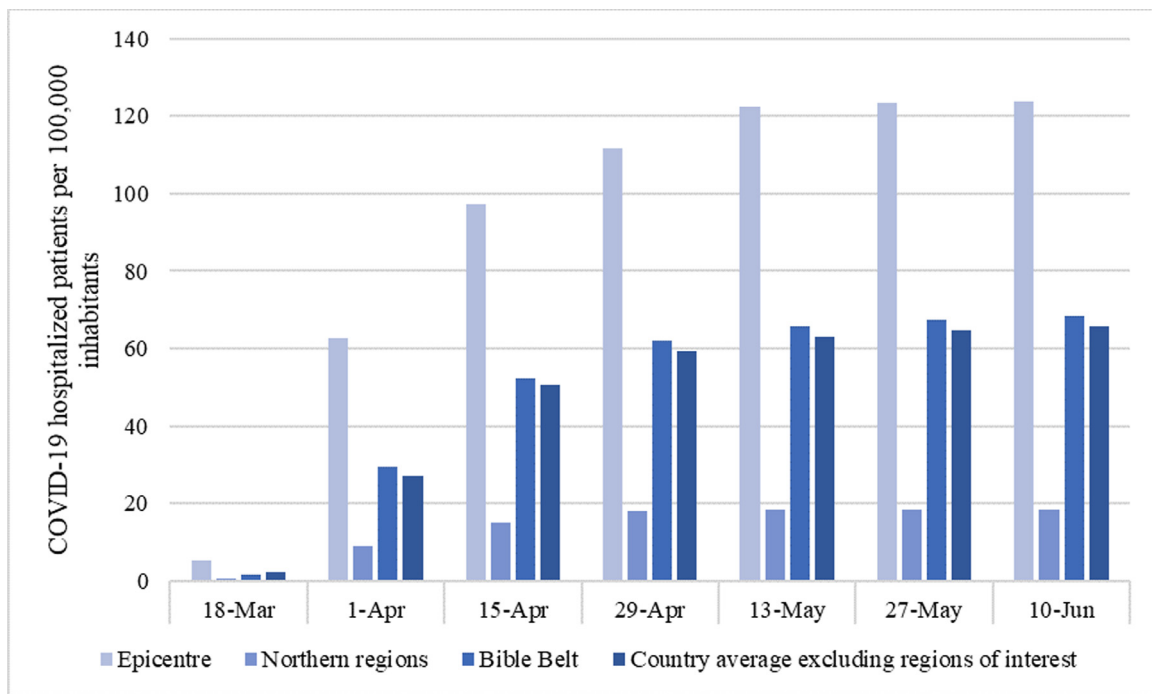
Fig. 7. Absolute number of the COVID-19 hospitalized patients per 100,000 inhabitants at bi-weekly time intervals for each cluster with municipalities belonging to the initial epicentre, the northern regions, the Bible Belt, and the country average excluding the regions of interest, respectively.

ination of the virus. However, additional in-depth analyses of the data are required before this effect can be rejected.

7. Concluding remarks

Compared to other countries the Dutch responded late and with relatively mild measures against the COVID-19 pandemic. This was in line with the initial policy choice to consider COVID-19 to be a severe flu and to strive for herd immunity. The government argued that it relied heavily upon the OMT's scientific medical advice, even though many of the considerations were societal and economical in nature. Therefore, the position and the composition of the OMT was criticized since the involved members were mostly medical while its advice had severe social and economic impact. Ultimately the government opted to shift from containment to a mitigation strategy and focussed on staying within ICU capacity while protecting risk groups and obtaining herd immunity. Although the latter was later referred to as a consequence rather than a goal, the serology tests done by the blood bank show limited immunity among the population. The government's focus on immunity therefore received ample critique. With the limited knowledge of the effects of the COVID-19 virus at the time, aiming for herd immunity was considered a high-risk strategy.

As the virus spread quickly, ICU capacity was ramped up from 1,150 to 2,400 in a matter of weeks and shows the great surge capacity of the Netherlands. To achieve this, the regulated competition health care system was swiftly replaced by a centrally organised one, and virtually all elective hospital care was postponed. This prevented the ICUs from becoming overrun. The relative late lockdown measures, combined with limited testing and tracing, did probably contribute to the high levels of excess mortality - especially in long-term care facilities such as nursing homes.

A variety of initiatives exist that use advanced technological approaches, mainly when it comes to telehealth and care on distance. Many private health institutes adopted at least some digital initiatives to ensure continued care for their patients. The Dutch Government, however, took a lot of time to implement technological

support to improve and protect public health. The track and tracing app is at the time of writing in its testing phase and is expected date to be implanted nation-wide on the 1st of September. The Dutch Government could therefore invest more in disruptive technologies and benefit from cross-border collaboration both in development and implementation of such technologies.

To shield the economy, the government implemented various measures to prevent unemployment rates to rise drastically and to protect the economy. Initially, these policies were to some extent effective. An economic shock did occur, although less severe than the ones in neighbouring countries. Looking at the number of bankruptcies in the first half of 2020, the initial effect of the financial support by the government has protected a large set of businesses. However, these financial measures are not sustainable during the more prolonged and structural duration of the crisis and will therefore have to be replaced.

The decision-making power by regional authorities can be observed in the three most northern provinces, which stuck to containment measures and seem to have escaped high COVID-19 hospitalization rates. These preliminary findings seem to confirm that more extensive testing and tracing policies in regions other than the epicentre could contribute to less dissemination of the virus. The effect of group formation on hospitalization rates may have led to the dissemination of the virus in very religious regions. However, our findings do not, or only to a limited extent, show higher hospitalization rates for the Bible Belt region. Note that all findings should be interpreted with caution, due to the descriptive nature of this evaluation and the early stage of this analysis. However, the initial investigation done to the regional variation in terms of both excess mortality and hospitalization rates indicate the need for regional variations to the national mitigation measures. In line with this finding, the Dutch government gave more decision-making power to the regional authorities during the controlled stages of the virus.

In sum, the Dutch quickly abandoned containment in favour of mitigation with a focus on herd immunity. Contrary to the national policy, the three most northern provinces continued their

containment strategy and were able to prevent local transmission of the virus. The mitigation measures in the rest of the country first resulted in further local transmission, but the mild lockdown eventually slowed transmission down quite effectively, and by the end of May containment became the official strategy again. Taken together, the Dutch have shown a way to effectively slow down transmission while allowing more personal and economic freedom than most other countries, and a way to keep the virus from spreading using containment policy based on tracking, tracing and voluntary isolation and quarantining. This provided the country with a successful medium-term perspective on flattening the epidemiological curve with reasonable levels of personal and economic freedom. However, economic costs remain significant compared to the prevented health losses and long-term equilibria should either greatly reduce the societal cost of containment or involve safe ways to build up herd immunity.

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None.

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