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Abstract

Background: Muslim majority countries have experienced a considerable burden of COVID-19 infection. However, there has been a relative lack of research comparing COVID-19 outbreaks and responses between Muslim-majority countries.

Aims: This study aimed to analyse COVID-19 burden, epidemiology and mitigation strategies in Muslim-majority countries.

Methods: We use a mixed-methods approach to describe the course of the COVID-19 pandemic throughout the Islamic world, highlight the range of non-pharmaceutical interventions used and the speed with which they were implemented, and investigate reasons behind the differing responses between Muslim-majority countries. The number of cases and deaths per million population, and the mean time taken to implement a range of policies, were compared across the Islamic world. Cases per million population and the mean estimated doubling time for cases was compared between Muslim-majority countries on the basis of governance systems, rapidity of institution of mitigation strategies and conflict groups. We also evaluated pushback to implementation of measures within MMCs, especially from religious quarters.

Results: Non-democratic regimes had much shorter doubling time of cases compared to functional democratic Muslim-majority countries (mean 33.9 versus 66.5 days, P = 0.002) and a

significantly greater proportion of countries appeared to have flattened the curve by 1 June 2020 (43.8% versus 12.5%, P

Conclusion: Our analysis indicates wide diversity in the COVID-19 response across Muslim majority countries with clear indication that functional democracies were able to contain the epidemic significantly better than nondemocratic regimes. Future analysis should focus on determination of sub-national differentials and risks as well as targeting of interventions.

Keywords: COVID-19, Muslim-majority countries, mitigation, democracy index

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Introduction

COVID-19, a novel respiratory disease first identified in late December 2019, was declared a global pandemic by the World Health Organization (WHO) on 11 March, 2020. Since first emerging from Wuhan, China, COVID-19 has resulted in almost 30 million recognised infections across 185 countries, and 941 000 deaths at the time of writing (1–3).

Given the absence of a vaccine or viable treatment for COVID-19, non-pharmaceutical interventions (NPIs) have been the main instruments for mitigating risks of infection in tackling this ongoing epidemic (4). These interventions have ranged in complexity and severity from use of face masks, hand hygiene and physical distancing to curfews, international travel restrictions, military-led nationwide lockdowns and border closures. Previous outbreaks, such as that of Ebola in 2014 and H1N1 in 2009, have also shown that the timely use of NPIs and

implementation of such measures can have an impact in reducing the spread of infectious diseases (5,6). However, many of these measures such as social distancing and school closures, as well as closure of places of worship, have only rarely been implemented and require a combination of community buy-in and governmental oversight. Given the reported success of many Asian countries in rapid control of COVID-19, such as in China, Republic of Korea, Viet Nam and Singapore, there is the notion that some government characteristics and socio-political systems may have been more effective in implementing NPIs and controlling the pandemic than others (7).

Muslim majority populations do not represent a homogenous block but do have geographic clustering mainly in the Eastern Mediterranean, North African and Southeast Asian regions. We have previously evaluated the state of reproductive, maternal and child health and implementation within health systems in many Muslim-majority countries or regions and documented the important role of governance as well as societal factors such as female education and empowerment (8,9). The relative role of governments versus religious schools of thought and political parties are also important drivers of population uptake of interventions, such as reproductive health and family planning, and have at times influenced vaccine acceptability, evidenced by the struggle to eradicate polio in some countries. There are also communal religious activities such as mass gatherings on Fridays and during the course of Ramadan and the annual Hajj – all potential barriers in implementation of NPIs in some contexts. Conversely, the Muslim use of facial coverings by females in public could be protective.

Muslim-majority countries have experienced a considerable burden of COVID-19, with the Islamic Republic of Iran and Turkey among the first countries outside of China to see a large-scale outbreak, followed by Pakistan. However, there is relatively little research comparing COVID-19 outbreaks and responses between Muslim-majority countries, especially in the relationship between community engagement, participation in NPIs and the role of governments and governance mechanisms (10). In addition to understanding the progression of COVID-19 outbreaks in these countries, an understanding of how each had tackled their outbreak could offer potentially useful insights for future mitigation strategies, including vaccination programmes.

In this article we describe the course of the COVID-19 pandemic across Muslim-majority countries, highlight the range of NPIs used after the pandemic was called, and the speed with which they were implemented. We also investigate how variations in governance mechanisms and style influenced the response to COVID-19 and potential implications for future strategies.

Methods

Case and mortality data were extracted from the COVID-19 Dashboard created by the Center for Systems Science and Engineering at Johns Hopkins University, United States of America, with maps generated to show the geographical heterogeneity across Muslim-majority countries. Case data per million population were plotted by time since 3 cases per million were reported in each country, to allow for comparisons between Muslim-majority countries, with respect to the speed with which the epidemic unfolded (3).

To assess the progression of NPI implementation between March and May 2020, we created sequential maps utilizing the Coronavirus Government response tracker (OxCGRT) stringency index. This data set, created by a collaborative group of researchers and staff at Oxford University, United Kingdom, provides values to assess the differing stringency of NPIs in countries, specifically the strictness of 'lockdown style' policies that primarily restrict people's behaviour (11). Maps were created to display the stringency index of Muslim-majority countries for the first of each month from March to August 2020.

We also utilized the ACAPS government measures dataset compiled by analysts and volunteers from the University of Copenhagen and the University of Lund, Denmark (12), to assess the early phase of the COVID-19 response, determined a-prior to be the end of Ramadan and Eid festivities (end May 2020). These data were compiled through internet searching of news reports, government sites and other organizations such as the United Nations (UN). Full details on the dataset structure and collection methods can be found through the ACAPS website (13). The full ACAPS data set was downloaded on 3 June 2020. From this, we determined the date of first policy implementation and date of phase out (where applicable) of measure categories in each country. In total, there were 32 different policy measures documented, which fall into five broad categories. These categories range from movement restrictions (such as visa restrictions, domestic travel restrictions and curfew) to public health measures (such as awareness campaigns and mask-wearing policy) to lockdowns (which includes full countrywide lockdown or lockdown of refugee/internally displaced persons camps). To better understand the difference in NPI implementation across Muslim-majority countries, the time between the WHO's announcement of COVID-19 as a global pandemic and the implementation of various NPIs was calculated, with the mean number of days (and 95% confidence interval) plotted for each NPI.

We assessed the nature and effectiveness of governance and civic society engagement in each country on the basis of its rankings on the democracy index, based on the 2019 Democracy Index Report of The Economist Intelligence Unit (14). This report scores countries based on electoral process and pluralism, the functioning of government, political participation, political culture, and civil liberties. We created tertiles of these scores to divide Muslim-majority countries into three democracy groupings: 1 (least democratic), 2 (middle tertile), and 3 (most democratic). These classifications were used to compare the political response to COVID-19 between different democracy and governance categories. Cases per million population (for both

periods) and the mean estimated doubling time for cases was compared between the democracy index tertiles.

Data from the Google Mobility Reports for each Muslim-majority country were assessed to determine whether the month of Ramadan (23 April 2020 – 23 May 2020) or the Eid ul Fitr celebrations that followed, could be identified as having had an impact on the amount of time people in these countries spent at home, in congregational settings such as parks, and retail and workplace environments. Mean mobility scores for this month were compared to those for 11 March 2020 – 22 April 2020, and 24 May 2020 – 3 June 2020. The date of 11 March was chosen as the earliest for mobility scores, since most countries had stabilised around their lowest values by this date (15).

To relate the implementation and uptake of NPI measures, given the known variation in the onset and overall progression of COVID-19 infections, we grouped Muslim-majority countries on the basis of the timing and overall size of COVID-19 outbreak over this period. In total, four outbreak timing/size categories were generated: early start and small outbreak; early start and large outbreak; late start and small outbreak; and late start and large outbreak. An early outbreak was defined as having at least 10 reported cases by the time of the WHO's pandemic announcement of 11 March, while a small outbreak was defined as having fewer than 100 confirmed cases per million as of 1 June. Additional classifications to compare the COVID-19 response between Muslim-majority countries included geography (based on World Bank regions) and population size (based on United Nations Population Division population estimates for 2019) (16,17).

To find reports on the extent of pushback or resistance related to the closure or restriction of religious activities, Google was utilized to find news reports for each country. The search location was set to the country of interest and searches were conducted pairing the country name with the keywords "mosque", "COVID-19", "coronavirus", "prayer", and "imam". The first two pages of search results were screened and relevant articles were opened to look for indication of pushback. Pushback was then categorized as being by religious leaders (e.g. religious leaders or politicians from religious parties speaking out against government policy or encouraging continuation of prayer) or by the general public in response to restrictions on religious gathering (e.g. protests).

Results

As of 1 August 2020, there was a total of 2 435 647 recorded cases of COVID-19 and 60 397 COVID-related deaths across 44 Muslim-majority countries. The greatest relative burden of both cases and deaths have been in Kyrgyzstan (5754 cases and 219 deaths per million population,

respectively) and Islamic Republic of Iran (3747 cases and 210 deaths per million population, respectively) (Figure 1 , Figure 2). It is worth noting, however, that testing rates across Muslim-majority countries are generally low (Appendix 1 online) with the exception of a number of countries in the Gulf Region with relatively small indigenous populations.

We divided our analysis into an assessment of the early stage of the COVID-19 response, arbitrarily defined as the period up to the end of Ramadan and Eid ul Fitr (end May 2020) and the subsequent phase of stabilization leading up to the Hajj (end July 2020). We therefore considered the period up to 1 June to be the first complete phase of response to the pandemic and treated this time as the primary period of interest, given that most stringent measures were seen to relax thereafter. We also compared this primary response period to the period from 2 June to 1 August and to the entire pandemic period included in the John Hopkin's database up to the time of writing (22 January to 1 August 2020) (Figure 3).

There was considerable variation in the commencement and rate of outbreak development. The Islamic Republic of Iran and Turkey experienced outbreaks that started early and escalated rapidly. In contrast, Bangladesh's outbreak began later but case trajectories have since mirrored those in the Islamic Republic of Iran and Turkey. Albania, Tunisia, and Lebanon experienced gradual outbreaks with slow rates of increase when compared to other Muslim-majority countries. Many Muslim-majority countries in Sub-Saharan Africa appeared to be at earlier stages of their COVID-19 outbreaks relative to other Muslim-majority countries. Additionally, there was little evidence of widespread "second waves" of infection among Muslim-majority countries, with the possible exception of Kyrgyzstan and Iraq (Figure 4).

Our analysis showed some differences between governance categories among Muslim-majority countries and COVID-19 burden and trends. As of 1 June 2020, there were notable differences in COVID-19 cases per million population between governance groups, although they were not statistically significant. The most democratic countries had a mean of 199.7 cases per million (95% CI: 137.0, 262.5); the middle tertile countries had a mean of 2534.6 cases per million (95 % CI: 0.0, 5692.6); and the least democratic countries had a mean of 1442.3 cases per million (95% CI: 324.5, 2560.2). There was a significant difference between governance groups with regards to the percentage of countries that had flattened the curve by 1 June. Only 7.1% of the least democratic countries had flattened the curve (95% CI: 0.0, 21.6) whilst 30.8% (95% CI: 3.8, 57.7) and 38.5% (95% CI: 10.1, 66.9) of the middle tertile and most democratic countries had flattened the curve, respectively (Table 1). However, over the entire period for which data were available (22 January to 1 August) there were no statistically significant differences observed between countries for any of the measures calculated (Table 2).

We evaluated if there was a direct link between COVID-19 response and policies and governance in each of the Muslim-majority countries. Policy data were available for 44 Muslim-majority countries in the first response phase of the outbreak.

Among countries with listed start dates for policy measures, the most common control measure was suspension of international flights (90.1%). This was followed by limiting public gatherings (86.4%), domestic travel restrictions (79.5%) and school closures (79.6%). The mean time from the WHO pandemic declaration to the implementation of each policy indicated that a requirement for additional health documents was implemented earliest across countries, while the requirement to wear protective gear was implemented latest across countries (Figure 5). The mean number of days after the WHO's declaration for partial lockdown to be implemented across countries was over two weeks (18 days), while full lockdown occurred almost four weeks (26 days) after the declaration. The range of implementation time varies widely for most policy measures. The reason for this is likely to be a combination of situational differences in case counts by country, countries learning from one another's approach, and public acceptability.

We investigated whether there was an association between the month of Ramadan and increased mobility outside the home. We found less time was spent in places of retail (mean difference, md: -3.18; 95% CI: –5.21, –1.15; P = 0.002), in parks (md: –4.12; 95% CI: –6.03, –2.21; P

To illustrate the range of governmental responses to the COVID-19 pandemic in Muslim-majority countries, we selected Bangladesh, Islamic Republic of Iran, and Turkey for more in-depth analysis (Appendix 3 online). These particular countries were chosen as we considered they represent the early, current, and possible future hotspots of COVID-19 in Muslim-majority countries.

The first reported case of COVID-19 in the Islamic Republic of Iran occurred on 19 February 2020. Early NPIs were limited to policies relating to health screening and preventing travel from China. Following the first detected case, no additional policy action was taken until 27 February 2020, which then included closing all schools and border checks within major cities. Improvements to the public health system were made through donations of test kits and supplies from the Red Cross and Chinese government. Until the country had surpassed 1000 cases on 2 March, no additional actions were taken. At this time, flight suspensions to Europe were implemented along with awareness campaigns and temperature checks; inmates were temporarily released from prisons. This was in the wake of April protests that had called for additional prisoner protections and resulted in deaths of some of those protesting. The implementation of a partial lockdown, in which some parts of the government were closed, did

not occur until 30 March when the country had already recorded over 41 000 cases and nearly 3000 deaths.

At the end of the first phase, Turkey had the greatest number of COVID-19 cases among all Muslim-majority countries, despite the first case not being reported until 11 March 2020. Similar to the Islamic Republic of Iran, early policy measures focused on restrictions of travel from COVID-19 hotspots (primarily Islamic Republic of Iran and China). Within a week of the first reported case, policies were swiftly expanded to include a number of measures to promote social distancing. These included school closures, curfews and the closure of places of social and religious activity including mosques, bars, restaurants, sporting venues, and theatres. Over the following weeks, extensive policy implementation occurred. Along with this swift government action, a number of reports have indicated that government crackdowns had occurred to target claims of misinformation, resulting in the detainment of social media users and journalists (18).

Among all countries for which a phase one response snapshot was created, Bangladesh was one of only three (in addition to Turkmenistan and Uzbekistan) that implemented no social distancing-related policies before 1 June. Early policies instead focused on limiting travel and post-travel quarantine. In the month of April, multiple news agencies reported of thousands gathering at funerals (19,20). Given the current trajectory of cases in Bangladesh along with the considerably higher population density and the possible risk of COVID-19 spreading within Rohingya refugee camps, the situation in Bangladesh has the potential to evolve significantly.

When comparing pushback between countries, it was found that many had closed mosques or restricted communal prayers. There were 16 countries for which we found pushback to distancing was reported by leaders, the public or both (Bangladesh, Djibouti, Egypt, Indonesia, Iraq, Islamic Republic of Iran, Mali, Morocco, Niger, Nigeria, Pakistan, Senegal, Somalia, Syrian Arab Republic, Sudan and Turkmenistan). Of these 16 countries, 11 had outbreaks that were classified as small and 9 had outbreaks classified as starting late. No other trends were seen between categories for this group.

Examination of policy timing across the 16 countries with pushback indicated that half had implemented no COVID-19 related policies at the time of the WHO’s pandemic declaration, while a quarter (Bangladesh, Iraq, Mali, Turkmenistan) had implemented only one. Four countries implemented four or more policies before the WHO pandemic declaration (Indonesia, Islamic Republic of Iran, Pakistan and Sudan).

Where pushback was reported, this consisted of mosques remaining open and communal prayers continuing despite the need for social distancing. In 3 countries (Morocco, Niger and Senegal) this pushback escalated to protests and violence with the public and in some cases religious leaders being arrested (21-23). In Iraq, Nigeria, Senegal and Somalia there has been a mixed response from religious leaders. For example, in Somalia some militant religious leaders have spread misinformation (24). In response, mainstream Muslim clerics have closed madrassas to reduce the spread and are now using teachers from these schools as well as local Imams to spread accurate health information (24).

Discussion

Recognizably, many factors driving the COVID-19 pandemic in countries such as rates of transmission, testing susceptible populations, prevalence of co-morbidities and health system functionality, are important in determining the caseload and mortality. Another important driver of success or otherwise of national responses relates to the decision-making process and population responsiveness to NPIs in countries and the subject of this study. We restricted our analysis to countries facing common challenges related to communal religious practices such as Friday prayers and those in Ramadan and subsequent festivities. Our choice of the three countries for in-depth analysis was also justified by events therein and in neighbouring countries. Although the Islamic Republic of Iran was one of the earliest countries affected by COVID-19 in the Islamic world, the epidemic took longer to gain a foothold in other Muslim-majority countries, and in the case of Turkey it followed the outbreak in Europe. Afghanistan and Pakistan had received some of the earliest travelers from the Islamic Republic of Iran, mostly returning pilgrims, but were able to institute early screening and quarantine measures followed by other measures.

Elsewhere, religious aggregations and returning pilgrims were also blamed for the pandemic spread (25). In several countries, including Pakistan, Bangladesh and Muslim populations in India, there was acrimonious debate around widespread participation in religious activities and communal gatherings (26). However, our analysis of available data on population mobility from Muslim-majority countries and case loads does not suggest any link with mobility during the month of Ramadan or specifically on Fridays, the day for communal afternoon prayers.

There is also a general sense that countries with non-democratic governments have been generally more successful in keeping the COVID-19 outbreak under control (27) compared to participatory democracies. Based on the governance metrics that we used, we found little evidence that strict governance was a major driver of COVID-19 in any of the Muslim-majority countries. In fact, it could be argued that the major outbreaks in Egypt, Islamic Republic of Iran, and Turkey took place despite such lockdown measures being imposed with force and rapidity. Given the need for community engagement and buy-in for many of the measures, such as stoppage of businesses, transportation and services, imposition of rules for physical isolation

and use of masks, it can be argued that Muslim-majority countries with more democratic governments have done better in terms of sustaining a public response with widespread participation. This phenomenon is not just restricted to the Muslim world. No-one has underscored this link with pandemic responsiveness better than Francis Fukuyama who wrote that, “The factors responsible for successful pandemic responses have been state capacity, social trust, and leadership. Countries with all three – a competent state apparatus, a government that citizens trust and listen to, and effective leaders – have performed impressively, limiting the damage they have suffered” (28). Our analysis strongly supports this premise.

Limitations

It is critically important that scientific enquiry and analysis is not hampered by confirmation bias (29). Notwithstanding this limitation, our data do indicate that early imposition of non-pharmacological measures did impact the growth of COVID-19 infections, and epidemic curves have not indicated that strict imposition have led to superior outcomes. We recognize that these are early days and the best data on consequences may only emerge over time, but it is important to test the counterfactual scenarios through these natural experiments against analyses claiming the huge success of large-scale lockdowns and strict measures (27). At the time of writing, a few Muslim-majority countries were still witnessing a secondary rise in cases whereas in others the curve seemed to have flattened – all indicative of a clear lack of association with severe mitigation strategies such as curfews and lockdowns. However, Saudi Arabia was able to institute remarkable control measures and restrictions over the Hajj, with no reported outbreaks.

Several limitations should be recognized in considering these data and countries. As Appendix 1 (online) indicates, testing rates remains low in the vast majority of Muslim-majority countries, with the exception of Qatar and United Arab Emirates. Our analysis is presently limited to burden estimates as reported in the aggregate and further work to evaluate and understand sub-national differentials and inequities is underway. We relied upon the governance assessment indicators provided by the independent analysis of the intelligence unit of The Economist and a widely used Democracy index. These measures could be complemented further by additional information on transparency as well as strengths of the public health systems in each Muslim-majority country (14,30). Our analysis utilizes variables from a variety of different data sources and should therefore be interpreted with caution. While every effort has been made to ensure the credibility of these sources, the high level of complexity within each data source should be considered. We also recognize that while some differences in epidemiological patterns were evident in the early stage of the pandemic, they seem to have disappeared by the end of July. However, the pandemic is far from over and we intend to track progress in these countries in comparison to others prospectively.

We have not presented findings on estimated indirect effects of pandemic and NPIs in these countries. Given the enormous indirect consequences of these public health measures and lockdowns on poverty, rising inequities and interruption of education services (30), further evaluation of the impact of COVID-19 in Muslim-majority countries must include estimation of effects on longer term outcomes (31). These could relate to the consequences of short and medium-term political processes as well as long-term impact on economic and human development.

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Analyse de la charge de morbidité de la COVID-19, épidémiologie et stratégies d'atténuation dans les pays à majorité musulmane

Résumé

Contexte : Les pays à majorité musulmane ont connu une charge considérable d'infection par la COVID-19. On constate cependant un manque relatif de recherches comparant les flambées de COVID-19 et les ripostes entre les pays à majorité musulmane.

Objectifs : La présente étude visait à analyser la charge de morbidité de la COVID-19, l'épidémiologie de cette maladie et les stratégies d'atténuation de sa propagation dans les pays à majorité musulmane.

Méthodes : Nous utilisons une approche fondée sur des méthodes mixtes pour présenter l'évolution de la pandémie de COVID-19 dans le monde islamique, mettre en évidence l'éventail des interventions non pharmaceutiques utilisées et la vitesse à laquelle elles ont été mises en œuvre, et enquêter sur les raisons expliquant les différentes réponses entre les pays à majorité musulmane. Le nombre de cas et de décès par million d'habitants, ainsi que le délai médian nécessaire pour mettre en œuvre un ensemble de politiques, ont été comparés dans l'ensemble du monde islamique. Le nombre de cas par million d'habitants et la durée moyenne estimée du doublement des cas ont été comparés entre les pays à majorité musulmane sur la base des systèmes de gouvernance, de la rapidité de mise en place de stratégies d'atténuation et des groupes en conflit. Nous avons également évalué le refus de la mise en œuvre de mesures dans les pays à majorité musulmane, en particulier dans les milieux religieux.

Résultats : Les régimes non démocratiques avaient une durée de doublement des cas bien plus courte que les pays démocratiques à majorité musulmane fonctionnels (moyenne de 33,9 jours contre 66,5 jours, p = 0,002) et une proportion significativement plus importante de pays semblait avoir connu un aplatissement de la courbe au 1er juin 2020 (43,8 % contre 12,5 %, p

Conclusions : Notre analyse indique une grande diversité de la riposte face à la COVID-19 dans les pays à majorité musulmane, avec une indication claire que les démocraties fonctionnelles ont été capables de contenir l'épidémie de manière significativement meilleure que les régimes non démocratiques. L'analyse future devrait se concentrer sur la détermination des différentiels et des risques infranationaux ainsi que sur le ciblage des interventions.

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