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Identifying factors related to school closures due to COVID-19 in the Middle East and North Africa region

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1. Introduction

Coronavirus disease 2019 (COVID-19) has taken a grievous toll on countries around the world, often exacerbating already difficult conditions for the most vulnerable populations. Decision-makers were tasked with developing a response to the quickly spreading novel virus, with little information early on how the virus spread or how to treat it. As infections and deaths began to rise globally, governments reacted with a litany of policy responses and interventions. These responses to slow the spread and subsequent deaths from COVID-19 varied in restrictiveness, from public information campaigns to overnight curfews and week-long stay-at-home-orders. While some government responses have few downsides, others, such as limiting access to public spaces and travel, can have severe socio-economic effects (Nicola et al., 2020). Because the transmission of COVID-19 is amplified in mass gatherings (World Health Organization, 2020), school closures have been a widely used intervention (e.g., Sebhatu et al., 2020) and have affected approximately 1.5 billion students in 172 countries around the world (United Nations Educational, Scientific and Cultural Organisation, 2020). According to the United Nations Educational, Scientific, and Cultural Organization (United Nations Educational, Scientific and Cultural Organisation, 2020a), adverse effects of school closures on children include interrupted learning, gaps in nutrition and childcare, social isolation, a rise in dropout rates, and increased exposure to violence and exploitation. Other socio-economic costs include confusion, stress, and a loss of income for teachers and parents and strain on the healthcare system as healthcare professionals must choose between childcare needs and their jobs.

The Middle East and North Africa (MENA) region has not been spared by the devastation wrought by COVID-19. A July-August 2020 report from the International Organization for Migration (2020) states that approximately 1 million cases and over 17,000 deaths had been confirmed in the region. Beyond the health ramifications, an Organization of Economic Cooperation and Development (OECD) report attributes “massive economic turmoil” in the region to the pandemic (OECD, 2020, p. 6), including a significant fall in oil prices coupled with drops in economic consumption and sluggish trade. Considering the substantial economic and social consequences of stringent policies, governments typically rolled out COVID-19 procedures beginning with less restrictive policies. A comparison of school closure dates and more stringent curfews or lockdowns shows that the former preceded the latter in every MENA state (Cheng et al., 2020). By mid-March, all MENA states had instated system-wide school closures. All but six states later issued statewide lockdowns on all regular activities (Murray and...
The MENA region is also home to a number of civil and international conflicts that have some states, like Libya, Syria, and Yemen, bordering on failed-state status (Messner De Latour et al., 2020). The ongoing sectarian violence in Iraq and tensions between Palestinians and Israelis continue to plague the region as well. During the timeframe of this study, Lebanon was also experiencing a significant period of public protest and unrest against its government’s perceived corruption, irresponsible fiscal policy, and inability to provide basic services (Human Rights Watch, 2020). Healthcare in the region also varies drastically depending on the state. For instance, the WHO’s Universal Health Coverage Service Coverage Index suggests that a bit less than half of citizens in Yemen and Djibouti have access to essential health services, while around 80% have access to these services in Bahrain, Algeria, and Israel (World Health Organization, 2020b).

Despite their heterogeneity, many MENA states have parallel educational histories with a strong Islamic influence, which has resulted in similar modern education systems (El-Kogali and Kraft, 2020). Policymakers in the region have focused the last several decades on increasing spending on education to levels above that of other developing regions, such as East Asia and Latin America (Benard, 2006; World Bank, 2008). This has resulted in significantly improved access to schooling, including near universal primary enrollment and completion and even educational gender parity in most states (El-Kogali and Kraft, 2020; World Bank, 2008).

However, the average quality of education in the MENA region remains low. There is limited systematic evidence on educational quality in the region, but studies that do exist report that seven of the 10 participating MENA states ranked in the bottom half of the 1999, 2003, and 2007 waves of the Trends in International Mathematics and Science Study (TIMSS; Chapman and Miric, 2009; Salehi-Isfahani et al., 2014). El-Kogali and Kraft (2020) estimate that MENA students are an average of three years of learning behind what their grade level would suggest due to the low quality of education. Additionally, the MENA region has some of the largest gaps in the world in performance between students of different personal and community backgrounds (Salehi-Isfahani et al., 2014), between students at the 25th and 75th percentiles of academic performance, and between males and females, with males usually performing worse (Mullis et al., 2020). This low quality and high inequality compared to other parts of the world can be attributed to a variety of causes, including the tension between modernity and moral or religious tradition (El-Kogali and Kraft, 2020), educational infrastructure and services that have been disrupted or destroyed by conflict (World Bank, 2019), and high rates of student absenteeism (Mullis et al., 2020).

2.1. SCHOOL CLOSURES AND INFECTIOUS DISEASES

Alongside these challenges are others that have emerged globally due to COVID-19, notably whether to close schools in an effort to diminish the effects of this novel coronavirus. Research on the academic consequences of missing school shows that student absences are associated with lower test scores in math and reading, largely due to a decrease in hours of instruction (Goodman, 2014; Gottfried, 2014, 2019; Romero and Lee, 2007). However, Goodman (2014) finds that occasional coordinated absences, such as snow days, do not tend to negatively affect student learning, as teachers can compensate for the whole classroom instead of individual students. Long-term school closures can exacerbate existing disparities, as low-income families have less access to the technology that facilitates distance learning (Nicola et al., 2020), and people in Africa and the Arab states have more limited access to a computer or Internet at home than people in most other regions of the world (International Telecommunication Union, 2019).

Non-academically, absences from school can lead to reduced educational engagement, social isolation, depression, increased dropout rates, and an inability for schools to provide services such as free school meals for children coming from low-income families (Bignardi et al., 2020; Gottfried, 2014; Nicola et al., 2020). School closures also add significant strain on parents who depend on schools to care for their children during the day as school closures require them to find alternative childcare (Rashid et al., 2015). This can negatively impact household finances and staff absenteeism, a particular concern during a public health crisis, when health and social work is in high demand (O’Sullivan et al., 2009; Sadique et al., 2008; UNESCO, 2020).

Despite these concerns, school closures are worthwhile if they can meaningfully alleviate public health crises, which happens primarily by decreasing the number of social contacts people make. Most research on the effectiveness of school closures examines the effects on influenza outbreaks. One study found that during the 2015–2016 influenza season, Russian students decreased their contacts by about half when a school-closure policy was put in place, and workers who lived with...
students also had a significant reduction in their number of contacts (Litvinova et al., 2019). A systematic review by Rashid et al. (2015) finds varied results that school closures reduce influenza transmission, though they do find that closures come with high economic and social costs. Simulated models have also estimated reductions and/or delays in the spread of influenza due to school closures, and targeted closures (e.g., a single classroom, grade, or school) seem to be as effective as closures of entire school systems (Earn et al., 2012; Gemmetto et al., 2014; Lee et al., 2010).

Because school closures are thought to reduce in-person contact and facilitate social distancing, and, therefore, hinder the spread of infectious diseases (e.g., World Health Organization, 2020), they have been a widely implemented intervention around the world in response to the COVID-19 pandemic (UNESCO, 2020). There is limited research at this early stage on the effects of school closures on the spread of coronaviruses. One systematic review by Viner et al. (2020) examines school-based measures, including school closures, for both the Severe Acute Respiratory Syndrome (SARS) 2003 and COVID-19 outbreaks. Evidence from SARS 2003 largely concludes that school-based measures, including school closures, were ineffective in controlling transmission of the infection (Viner et al., 2020). Early evidence of responses to COVID-19 suggests that a combination of distancing techniques, including school closures, has been effective but that school closures alone are expected to have a limited effect on the spread of COVID-19 (Viner et al., 2020). An article by Park et al. (2020) uses a large and representative sample of early COVID-19 patients in South Korea to find that children under the age of 10 were much less likely to spread COVID-19 to others than were adults, but that older children and teens spread the virus at similar or higher rates than adults. The researchers caution, however, that these findings may only be valid during times of school closures, as children exhibit different behavioral patterns that affect their likelihood of transmitting COVID-19 depending on whether they are in school. The relationship between school closures and the spread of COVID-19 is even more complex for the MENA region, because many of the states are low- and middle-income countries (LMICs). Large populations of children, poor sanitation, overcrowding, a lack of personal protective equipment, and a limited ability to implement public health policies are challenges that most LMICs face while attempting to limit the spread of COVID-19, particularly in schools, should they remain open (Zar et al., 2020).

3. Theoretical framework

The public health policy making literature (e.g., Spasoff, 1999) suggests that health, social, economic, political, and external factors contribute to public health policy, and as the previous section indicates, MENA states vary significantly in many of these areas. This study evaluates these factors as they relate to the system-wide closure of schools in the MENA region in response to the COVID-19 crisis.

It is reasonable to conclude that health considerations should play a primary role in policy responses to a public health crisis like a pandemic. Health-related factors that are likely important to school system closures include the risk of COVID-19, preparation of the health system for a serious infectious disease, and the culture of healthcare. By some accounts, states that do not protect their citizens from public health crises face a loss of internal and external legitimacy, which can lead to political instability and the possibility of degraded national security (Albert et al., 2021; Price-Smith, 2009). An increasing risk from an infectious disease is likely to motivate government leaders to take steps to minimize the effects of the disease to protect the government’s legitimacy (Price-Smith, 2009). From this follows the expectation that increased COVID-19 risk will increase the probability that a state will close its schools. The quality of healthcare systems can vary dramatically (Barber et al., 2017), in particular regarding preparation for COVID-19 (World Health Organization, 2020c). States with healthcare systems that are not adequately prepared for a serious infectious disease may have to rely more on non-pharmaceutical interventions to protect citizens. This leads to the expectation that less prepared states will be more likely to close their schools in response to the pandemic. In terms of healthcare culture, it is likely that governments feel greater obligation to intervene in crises that fall within domains of greater government responsibility. Macro-institutional arrangements provide some indication of relative government responsibility (Blank et al., 2018), and states with more extensive government institutions devoted to a particular domain, such as public health, should be more likely to intervene in related crises. The expectation is that states that devote more public resources to healthcare will be more likely to close its schools in response to the pandemic.

Another important factor regarding closing schools is education. The education considerations in this study span both social and economic factors. The importance of the formal education system to a society will shape the likelihood that officials close schools. The literacy rate can proxy for the effectiveness of an education system (World Bank, 2020a) and how informed the population is about health (DeWalt et al., 2004), including COVID-19. The expectation is that literacy rate is related to the likelihood of a state closing schools, though the direction is unclear. States with more effective education systems might hesitate to risk learning losses by closing schools, or they might feel that stronger education systems can more easily recover after school closures. The custodial function of schools is also important, as many parents have to find alternative childcare arrangements if their children cannot regularly attend school. Elderly family members, who are at increased risk for COVID-19 infection, and shared care facilities, which increase the likelihood of infection for all involved children and families, may be viewed as unsatisfactory alternatives. Parents, then, often have to provide the alternative care (Rashid et al., 2015), frequently at substantial social and economic cost. The percent of elementary-age children in school when schools are open shows the scope of the problem, as a higher percent indicates that more children will need alternative childcare. The expectation is that a state with a greater proportion of children in school will be less likely to close schools due to the increased costs to caregivers. The broader social context also matters. Certain living arrangements can promote or hinder the spread of infectious diseases. In particular, living and working around large numbers of other people multiply opportunities for transmission and can facilitate the spread of infectious diseases (Kawashima et al., 2016; Price-Smith, 2009). Following this, the expectation is that states with greater population density will be more likely to close schools in response to the pandemic.

Economically, as women take on the majority of unpaid domestic and care work (OECD, 2020a), particularly when unemployed (Malmberg-Heimonen and Julkunen, 2002), larger numbers of employed women mean fewer caregiving resources for children unable to attend school and, again, increased costs for school closures. The expectation is that states with a greater proportion of women in the workforce will be less likely to close schools due to the increased costs of caregiving. Unemployment also captures an economic effect, as economically sound states and individuals have more financial resources to dedicate to healthcare (Blank et al., 2018). As such, the expectation is that states with stronger economies are expected to be less likely to close schools due to their perceived ability to fund patient treatment. Irrespective of policy content, political factors influence policy adoption. Historical legacies, chiefly colonial control of two-thirds of the states in the MENA region, primarily by Britain and France in the 18th and 19th centuries (Wolfe, 2013), can influence both philosophical and cultural expectations about the role of government. Colonialism left in similar governance arrangements among states with shared colonial histories. Research has found that France tended to impose more direct and centralized rule in their colonies than Britain (Müller-Crepon, 2020), which may have influenced states to have greater administrative tendencies to take centralized, statewide policy actions. Following this, the expectation is that former French colonies will be more likely to close schools than former British colonies. Similarly, there is evidence that regime type matters in health policy (Murray and Rutland, 2022). For
instance, Besley and Kudamatsu (2006) report a strong positive relationship between democracy and successful health policy interventions (but see van der Windt and Vandonos, 2017). In one sense, regime type addresses how many people are involved in policy decision making. Autocratic governments concentrate power in a small number of individuals, whereas democratic governments disperse power among a large number of policymakers and even voters, which creates deliberative barriers to making quick and difficult policy decisions (Sebhatu et al., 2020). These political factors also affect the relationship between leaders and citizens in that autocratic governments are freer to impose restrictions on personal freedoms with relative impunity, while democratic governments ideally promote citizen choice (Blank et al., 2018), which is seemingly philosophically opposed to the idea of government-mandated shutdowns. The deliberation and philosophical arguments are compelling and, indeed, early evidence suggests that autocratic and less democratic governments imposed more stringent lockdowns in response to the pandemic (Frey et al., 2020; Sebhatu et al., 2020), so the expectation is that autocratic regimes will be more likely to close schools than democratic regimes. Further, governments are more likely to enact policies when they are able to implement them. Otherwise, they risk losing legitimacy (Woo et al., 2015). Governments may face a number of obstacles to policy implementation including a lack of security, political, economic, and social effectiveness and legitimacy (Marshall and Elzina-Marshall, 2017). Therefore, another political factor is governmental effectiveness, which is the capacity a government has to implement policy. The expectation is that more effective governments will be more likely to close schools due to their perceived credibility in enforcing such a policy. Similarly, a state in the midst of an armed conflict may have to focus resources on the war effort and away from the general provision of goods and services, including education (United Nations Educational, Scientific and Cultural Organisation, 2011). Further, schools are often viewed as symbols of state power and teachers as community leaders, so schools are frequently targeted for attack during armed conflict. As such, there are multiple supply-side reasons for schools to be closed during armed conflict, and evidence suggests that they often are closed (Justin, 2016). Therefore, the expectation is that states at war will be more likely to close schools.

Research also indicates that factors external to a country can affect its policy decisions. Often termed “policy diffusion,” this is considered a process in which policymakers learn from, compete with, emulate, or are coerced to adopt policies that have been adopted by other countries (e.g., Gilardi, 2013). Although policy can diffuse a number of ways (Berry and Berry, 1999; Shipan and Volden, 2012), geography (e.g., Chamberlain and Haider-Markel, 2005) and time (e.g., Mooney and Lee, 1995) are two primary means. Geographic diffusion usually refers to the change in the likelihood of a country adopting a particular policy when countries that share a border have previously adopted the policy. Geographic diffusion might be particularly important when thinking about COVID-19 due to its ability to spread via human mobility (Kraemer et al., 2020; Price-Smith, 2009). The expectation is that school closures will diffuse among geographically proximate states. Temporal diffusion captures the effect of time on policy adoption, perhaps from states having time to learn about the appeal of a given policy and its effects (Mooney and Lee, 1995) or through emulation pressure based on a desire to comply with norms established by other countries (Gilardi, 2013). Longer periods of observation of an adopted policy in other countries should lead to a greater understanding of the consequences of the policy and make it less risky to adopt. The expectation, then, is that states will be more likely to close schools as time passes. When policy norms have been established by other countries, it is reasonable to expect that increasing time increases the pressure on a lagging state also to adopt. In this case, the expectation is that time and geography will interact to accelerate the rate of diffusion of school closures.

4. Methods and data

This study uses event history analysis (EHA), which is often applied in policy adoption studies, to identify factors related to MENA school closings as a response to the COVID-19 pandemic. EHA is based on the analysis of data that capture the timing and sequence of events in a social process to understand the role of time in that process and, more broadly, to detect patterns of and factors contributing to change in that process (e.g., Box-Steppensmeier and Jones, 1997). EHA is useful because it allows researchers to simultaneously analyze internal (health, social, economic, and political) and external determinants of states’ policy adoption. Following EHA methodology, the data in this study are organized at the state-day level, with the 20 included states having one observation per day until the day after each state’s education system was closed. The states include the 19 states in the MENA region identified by the World Bank (2020b) plus Israel, which shares land borders with five other MENA states, making it pertinent in regard to the spread of infectious disease (Price-Smith, 2009) and geographic diffusion of public health policy.

Appendix A provides full details on the variables used in this study. The dependent variable is an indicator variable derived from the Oxford COVID-19 Government Response Tracker dataset (Hale et al., 2021) that indicates the day when each school closure went into effect. It is important in EHA to have theoretically sound reasons for selecting the beginning and ending points of data collection (Box-Steppensmeier and Jones, 1997). In this case, the data span from January 31, 2020, the day following the WHO’s declaration of an international public health emergency related to COVID-19 (World Health Organization, 2020d), to March 19, 2020, the day the last school system closed. All 20 states’ schools were closed by the end of the observation period. As a result of EHA coding, Bahrain, which closed its schools on February 24 and was the first to do so, contributes 25 observations to the dataset, and Djibouti, which closed its schools on March 19 and was the last to do so, contributes 49 observations to the dataset. This coding procedure results in a total of 781 state-day observations.

The independent variables capture health, social, economic, political, and external effects. Health effects are captured by three measures: disease risk, healthcare system preparation, and healthcare culture. Daily cumulative COVID-19 cases per 100,000 people, as derived from data reported daily by the European Centre for Disease Prevention and Control, 2020, reflects the risk of COVID-19 in the population or, more specifically, the point prevalence (Bicker et al., 2006) of COVID-19 cases in a state. This is one of four time-varying measures used in the study. There are between 0 and 3 cases per 100,000 population in the 781 state-day observations. The expectation is that a state will be more likely to close its schools as its daily cumulative cases and, therefore, disease risk increases. The WHO’s COVID-19 Strategic Preparedness and Response Plan (30 April 2020) reported each state’s preparedness for COVID-19 in terms of its health operations readiness capacities and current position on a continuum of response scenarios (World Health Organization, 2020c). In MENA there are two states reaching the highest level of “sustainable” preparedness (Israel and UAE) and six at the next-to-lowest level of “limited” preparedness, which is the lowest level among the MENA states. The remaining states are divided between the “developed” (five states) and “demonstrated” (seven states) levels. The expectation is that better-prepared states will be less likely to close schools in response to the pandemic. States’ healthcare systems reflect their policies about government versus individual responsibility for healthcare (Blank et al., 2018). Government health spending as a percent of total health spending represents healthcare system type such that a greater percent indicates greater governmental responsibility for

1 The 20 states are: Algeria, Bahrain, Djibouti, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Syria, Tunisia, United Arab Emirates, and Yemen.
healthcare. It ranges from 10% (Yemen) to 88% (Oman) (M = 55.49, SD = 18.73) in the 20 states. The expectation is that a state that contributes proportionately more to total healthcare spending will be more likely to close its schools as the government is believed to have greater responsibility for addressing the pandemic.

The social effects are captured by two education-related variables and a measure of living arrangements. The literacy rate, which reflects the existence of an effective education system, ranges from 56% (Morocco) to 96% (Qatar) (M = 83.80, SD = 10.80) in the 20 states. The expectation is that the literacy rate will have a relationship with the likelihood of school closures, but it is unclear whether that relationship will be positive or negative. The primary school enrollment rate ranges from 62% (Djibouti) to 100% (Iran) (M = 90.80, SD = 10.55). Greater enrollment indicates more disruption to caregiver schedules should schools close, so the expectation is that states with greater primary school enrollment will be less likely to close schools. Percent urban population represents living arrangements and, in the context of infectious diseases, population vulnerability to widespread disease. Urban populations in the MENA states range from 37% (Yemen) to 100% (Kuwait) (M = 76.92, SD = 17.08). The expectation is that states with larger urban populations will be more likely to close schools due to greater vulnerability.

The economic category captures a custodial function of education as well as the general health of the state’s economy. The percent of the workforce that is female ranges from 8% (Yemen) to 47% (Israel) (M = 21.88, SD = 9.51). Greater female workforce participation indicates more disruption to caregiver schedules should schools close, because women are more likely to perform custodial functions for children. The expectation is that states with more women in the workforce will be less likely to close schools. The broad economic factor in these models is unemployment. It ranges from almost 0% (Qatar) to 26% (Palestine) (M = 9.05, SD = 6.55). The expectation is that states with lower unemployment will be less likely to close schools as they will be more likely to have the resources to treat the disease.

Political effects are captured by four measures: colonial legacy, regime type, government effectiveness, and presence of war. Colonial legacy is represented by a pair of indicator variables for states formerly colonized by France (six) and for states not colonized by Britain or France (seven). States colonized by Britain (seven) serve as the comparison group. The expectation is that former French colonies, with their histories of greater administrative control, will be more likely to close schools than former British colonies. The Polity measure indicates regime type in terms of governments’ level of autocracy versus democracy with coding ranging from −10 (strong autocracy) to 10 (strong democracy) (Marshall and Gurr, 2020). Polity scores in the 20 MENA states range from −10 (Bahrain, Qatar, and Saudi Arabia) to 7 (Tunisia) (M = −2.86, SD = 6.10). According to a common classification scheme (e.g., Plumper and Neumayer, 2010), of the 20 MENA states, nine are autocracies (scored −6 to −10), seven are anocracies or semi-democracies (scored −5 to 5), and the remaining four are democracies (scored 6–10). The expectation is that more autocratic regimes are more likely to close schools due to fewer constraints on their policy making. The Center for Systemic Peace’s State Fragility Index represents each state’s ability to make and implement public policy as well as to deliver essential services based on its security, political, economic, and social effectiveness and legitimacy (Marshall and Elzinga-Marshal, 2017). The index ranges from 0, which indicates “no fragility,” to 10, which indicates “extreme fragility,” with measures in the MENA states ranging from 3 (Qatar) to 21 (Yemen) (M = 8.82, SD = 4.93). The expectation is that more effective governments are more likely to close schools due to their greater legitimacy. Presence of war is represented by an indicator variable that specifies whether a state is currently at war (six states) or not (14), as identified by the Center for Systemic Peace. The expectation is that warring states will be more likely to close schools than those not at war.

Lastly, the model includes external measures of geographic and temporal diffusion. These two measures and their interaction comprise the remaining three time-varying measures. Geographic diffusion is represented by the percentage of a state’s bordering states that have already closed schools on each state-day. The expectation is that states will be more likely to close schools as more neighboring states have closed their schools. Temporal diffusion is captured linearly in the form of a count of days, starting with 1 on the first state-day and increasing sequentially to 49 on the last state-day. Berry and Berry (1999) find that policy can temporally diffuse following an S-shaped curve in which a few regional leaders initially adopt followed by a rush of several states then a few laggards. Although the life table, Table 1, and statistical tests suggest this pattern is present, the more intuitive and easily explainable linear pattern used here just as effectively captures the temporal diffusion of school closings in MENA. The expectation is that states will be more likely to close schools as time passes. Finally, greater delay in adopting a policy already adopted by neighboring states may lead to greater pressure on laggard states to also adopt the policy. As such, it is reasonable to conclude that time conditions the effect of geographic diffusion, so the models include a multiplicative interaction term of geographic and temporal diffusion. The expectation is that time and geography will interact to accelerate the rate of diffusion of school closures.

5. Results

The dependent variable is dichotomous, schools closed (coded 1) or not (coded 0), so the regression results are based on a probit model, which is detailed in Appendix B. Probit results only offer easily interpretable information on the direction and statistical significance of relationships, so the average marginal effect (AME) of each variable is also reported. Generally speaking, AMEs are the mean marginal effect of each variable for all observations. The AMEs reported here, then, represent the mean change in probability that a school system will be closed on any day of the time period given a 1-unit change in the independent variable and given that the system has not already been closed (Box-Steppensmeier and Jones, 1997). All variables are centered on their means except those with meaningful 0 values; see Appendix A for this information. P-values are based on two-tailed tests. Overall, the model is statistically significant at conventional levels.

Table 1

| Day       | School Closed | Risk Set | Hazard Rate |
|-----------|---------------|----------|-------------|
| 31-Jan    | 0             | 20       | 0.000       |
| 24-Feb    | 1             | 20       | 0.050       |
| 25-Feb    | 1             | 19       | 0.053       |
| 29-Feb    | 1             | 18       | 0.056       |
| 1-Mar     | 2             | 17       | 0.118       |
| 5-Mar     | 1             | 15       | 0.067       |
| 6-Mar     | 1             | 14       | 0.071       |
| 9-Mar     | 2             | 13       | 0.154       |
| 10-Mar    | 1             | 11       | 0.091       |
| 12-Mar    | 1             | 10       | 0.100       |
| 13-Mar    | 1             | 9        | 0.111       |
| 14-Mar    | 1             | 8        | 0.125       |
| 15-Mar    | 5             | 7        | 0.714       |
| 16-Mar    | 1             | 2        | 0.500       |
| 19-Mar    | 1             | 1        | 1.000       |

NOTE: Day indicates day and month schools closed. Schools Closed indicates the number of school closings taking effect that day and month. Risk Set indicates the number of school systems not yet closed. Hazard Rate is the proportion of school systems that closed on a day and month (School Closed) that could have closed on that day and month (Risk Set).
Starting with the health factors, the results suggest that all three measures played substantial roles in decisions to close school systems. The mean marginal effect depicted in Fig. 1 and detailed in Appendix B shows that each additional COVID-19 case per 100,000 population is associated with an increase in the probability of school closings of a statistically significant 9.3 percentage points (95% CI [4.2, 14.5]) on any given day, on average. It also shows that states with “limited” healthcare-system preparedness, the lowest category among the MENA states as well as the comparison group, were 27.6 percentage points (95% CI [−39.9, −15.3]) more likely to close schools than states in the “developed” category. However, the pattern of the more prepared category being less likely to close schools does not hold perfectly across the categories. While states in the “demonstrated” category were more likely to close schools than more prepared states in the “sustainable” category, as expected, the least likely states to close schools were those in the “developed” category, the second lowest category among the MENA states. Put otherwise, the states most likely to close schools were in the “limited” category (28.3% on any given day; 95% CI [16.0, 40.5]), followed by those in the “demonstrated” category (19.4%; 95% CI [14.3, 24.5]), “sustainable” category (9.6%; 95% CI [5.0, 14.2]), then those in the “developed” category were least likely (1.0%; 95% CI [0.3, 1.1]). Finally, the results show that each additional percentage point of government spending on healthcare predicted a lower probability of school closings by a statistically significant 0.6 percentage points (95% CI [−0.8, −0.3]).

Among the social measures, only urbanicity demonstrated a discernible statistical effect. While the probit coefficient only reached marginal significance (p < 0.06), the results suggest that each 1-percentage-point increase in urbanicity increased the probability of school closings by a statistically significant 0.5 percentage points (95% CI [0.1, 1.0]). It is worth noting that primary school enrollment, an education-related measure and one that can be related to custodial issues, had no discernible effect. Percent primary school enrollment and labor force gender composition, which is discussed below, are not meaningfully correlated (r = 0.04, p > 0.10). This suggests that the lack of effect of primary school enrollment is not the result of high collinearity between the two custodial measures.

In terms of economic factors, female workforce participation is meaningfully related to the likelihood of school closure. The results indicate that a 1-percentage-point increase in the percent of women in the workforce is associated with a 2.9-percentage-point decrease in the probability of schools being closed (95% CI [−4.6, −1.3]). On the other hand, the results indicate that the state of the economy, as measured by the unemployment rate, played no discernible role in decisions to close schools.

Further, the results indicate that each of the political considerations were related to the likelihood of states closing schools. The states with French colonial legacies were 8.8 percentage points more likely to close schools than those with British colonial legacies (95% CI [3.8, 13.9]), the comparison group. The states with no British or French colonial legacy were even more likely to close schools than those with British legacies (20.9 percentage points; 95% CI [9.0, 32.8]). A Wald test indicates there is only a marginal statistical difference between the former French colonies and the states that were not former British or French colonies (χ² = 6.88, p = 0.07). Further, the results suggest that each 1-point increase in Polity score, which indicates greater democratic characteristics, is associated with a 1.3-percentage-point increase (95% CI [0.6, 2.0]) in the probability that a state will close its schools. Moreover, the figure suggests that each 1-point increase in the State Fragility Index is associated with a 2.9-percentage-point decrease (95% CI [−4.6, −1.3]) in the probability of schools being closed. The results also show that conflict was meaningfully related to closures. States that were currently at war were 12.1 percentage points more likely to close schools (95% CI [1.9, 22.3]) than those not at war.

Finally, external factors seemed to play a substantial role in the decisions to close schools. As depicted in Fig. 2, the interactive effect of

![Fig. 1. Average Marginal Effects, Main Model, Note: Gray variables with hollow circles p > 0.10.](image-url)
The results indicate that a 1-unit increase in gender parity is associated with a 0.8-percent decrease (95% CI [-0.5, -1.2]) in the probability schools are closed. Further, like unemployment, GDP per capita (A5) also has a statistically significant relationship with closures. The results suggest that a 1-unit increase in GDP per capita is associated with a 3.6-percent decrease (95% CI [-3.9, -3.3]) in the probability schools are closed. 

Regarding the political measures, two measures have meaningful alternatives. The Freedom House measure of democracy (A6) confirms the effect of the Polity measure that more democratic governments are more likely to close schools. According to the results, partly free states were marginally more likely (p < 0.06) to close schools, and free states were 28.7 percentage points more likely (95% CI [10.1, 47.3]) to close schools. On the other hand, unlike the State Fragility Index, the government effectiveness measure (A7) does not generate a statistically discernible effect.

Finally, in terms of external factors, temporal diffusion still has a significant effect when specified as the classic S-shaped curve (A8), as does its interaction term with geographic diffusion.

5.2. Assessing the five broad factors: relative effects

It is also informative to assess the broad factors by assessing the model based on the aggregated measures that compose each factor. The first column of Table 2 indicates the factors and their associated measures. The Bayesian information criterion (BIC) provides a means for ranking a set of models from “best” to “worst” based on model uncertainty (Raftery, 1995). Specifically, the model with the lowest BIC includes the least uncertainty and, therefore, serves as the most preferred model. Raftery (1995) estimates that a difference in BIC between two models of more than 10 points provides “very strong” evidence in support of the model with the lower BIC, while a difference between six and 10 points provides “strong” evidence. Based on these criteria, Table 2
provides “very strong” evidence that a reduced model that excludes the external measures is the least preferred (i.e., the “worst”) model by far. This suggests that external forces were relatively more important in school closures compared to the other forces. The next least preferred model excludes the economic measures, which suggests the economic measures were the next most important factor. Alternatively, the estimates of proportional reduction of error (PRE) and pseudo $R^2$ suggest somewhat different model preference ordering, but PRE and pseudo $R^2$ still suggest the worst model excludes the external factor, and pseudo $R^2$ suggests the best model still excludes the social factor. Finally, the Wald test estimates the joint significance of a set of measures in a model. In the case of the main model, Wald tests indicate that the joint contribution of the three external measures is statistically significant, as are the joint contributions of the sets of economic, health, and political measures. On the other hand, the test indicates that the social measures make only a marginal statistical contribution. These tests again indicate, based on their $\chi^2$ values, that the external factors are the most important and the social factors the least important factor.

6. Discussion and conclusion

The objective of this study is to identify factors related to the decision making processes that led MENA governments to take the dramatic and costly step to close school systems in response to the first wave of the COVID-19 pandemic. Informed by public health policy making factors (Spasoff, 1999), this study assesses the relationships between health, social, economic, political, and external factors and school closure decisions. Appendix B and Table 2 indicate the three health measures individually and jointly played a meaningful role in the main model. Schools were more likely to be closed on any given day as the prevalence and, therefore, risk of COVID-19 cases increased in a state. On the other hand, they were less likely to be closed in states with a stronger state-oriented healthcare culture. This may suggest that these states felt their healthcare systems were more likely to have sufficient resources to withstand the pandemic instead of indicating they were more likely to have a collectivist nature. Moreover, the effect of risk is robust to an alternative specification. On the other hand, the alternative specification of healthcare culture yields the opposite effect of that in the main model, but this is the effect that was originally expected. This suggests any conclusions about healthcare culture should be carefully considered. Further, there was a greater tendency for lesser prepared states to close schools compared to their better-prepared counterparts, which is consistent with their likely greater reliance on non-pharmaceutical interventions due to a lack of access to medical interventions.

On the other hand, with the possible exception of living arrangements, the social measures neither individually nor jointly played a meaningful role. This includes the education-specific measures. The custodial problems created by the crisis seemed to be important and possibly related to economics. While primary school enrollment played no discernible role, the results indicate that the probability of school closures decreased as the percent of the workforce that is female increased. The robustness check using gender parity suggests that societies with a smaller gender gap were also less likely to close schools. With more women comprising the total workforce, there are likely fewer caregivers at home to supervise homebound children whose schools are closed. The robustness of the findings regarding working women and gender parity more broadly point to another possible factor in the decisions to close schools related to the role of women in society in each state. Also, in economic terms, the measure of economic performance, unemployment, did not generate a meaningful effect in the main model. However, its alternative, GDP per capita, indicated that states with better performing economies were more likely to close schools. Further, although unemployment did not reach a conventional level of statistical significance in the main model ($p = 0.11$), it or its alternative, GDP per capita, did have a statistically discernible effect in six of the eight alternative models, which suggests economic strength should not be completely discounted. Theoretically, rather than viewing this as a healthcare funding issue, this may suggest that leaders with strong economies feel their economies are able to weather pandemic-related constraints. Overall, the results indicate that the economic measures jointly played a meaningful role in the main model.

Appendix B and Table 2 indicate that the political measures individually and jointly played a meaningful role in the main model. The results provide robust evidence that democratic regimes were more likely to close schools than autocratic regimes. While limitations on the number of decision makers and greater restrictions on citizen freedoms in autocracies suggest it would be easier and, therefore, more likely that authoritarian governments would close schools, some previous literature does suggest that democratic regimes are more likely to initiate “superior” health policy interventions (Besley and Kudamatsu, 2006). The results here suggest this is certainly an issue open to further investigation. Government effectiveness also played a role in the main model, but the effect was not robust to an alternative specification. Further, the evidence indicates that states with French colonial legacies were more likely to close than those with British legacies, which is consistent with previous research showing that the French took a more centralized administrative approach to their colonies than the British colonies (Müller-Crepon, 2020), and these effects may persist. Moreover, states at war were substantially more likely to close schools, which may reflect their desire to reduce the number of concerns they have to address while fighting both a war and the pandemic.

Finally, the results indicate the three external measures individually and jointly played a meaningful role in the main model. In fact, external factors of temporal and geographic diffusion seem to have played the most significant role of any category of factors, as suggested by the results in Table 2. Fig. 1 visually depicts that time significantly conditioned the effect of bordering states’ decisions to close their schools such that the negative effect of a neighbor closing its schools was positively offset by the effect of time. Because the policy timeline was so short, state leaders would not have had much time to learn from the experiences (e.g., Shihab and Volden, 2012) of states that closed their schools in the earlier days of the pandemic. Instead, it may be that the negative effect of closures in bordering states can be explained by a belief that the containment efforts of nearby states reduced the need in some leaders’ minds to take drastic steps to contain the disease in their own states; see, for instance, the lower probability and flattened slope of the 90% neighbors line in Fig. 1. On the other hand, see the higher overall probability and greater slope of the 10% neighbors line in Fig. 1. This behavior would be consistent with the conclusion that states’ responses to the pandemic are best reflected in the realist perspective on international relations (Bassuuri and Elshein, 2020; Price-Smith, 2009). By this account, states have prioritized national interests over collective action. Leaders are less likely to take significant steps to fight the pandemic, such as closing schools, when other states already have taken steps, but they are more likely to take drastic steps when other states have not.

While the evidence for these relationships is nontrivial, this study suffers several notable limitations. In terms of policy analysis, all the school systems were closed over a 25-day period, which is an extremely short event history. Although unusual, the timeframe does not seem

**Table 2**

| FACTOR EXCLUDED | BIC  | PRE (%) | Pseudo R$^2$ | Wald $\chi^2$ |
|-----------------|------|---------|--------------|---------------|
| External        | 272.2| 0.0     | 0.11         | 25.05***      |
| Economic        | 214.1| 0.0     | 0.46         | 11.74"        |
| Health          | 201.4| 0.0     | 0.42         | 17.45"        |
| Political       | 197.4| 0.0     | 0.44         | 18.35"        |
| Social          | 191.6| 0.0     | 0.54         | 6.40"         |

Note: see Appendix B for variables that compose each factor. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$, **** $p < 0.001$ (two tailed)
reasonably given the widespread uncertainty and fear generated by public health crises in general (Price-Smith, 2009) and the acute concern about COVID-19 specifically as an international public health emergency (World Health Organization, 2020d). Further, this study does not address related policies at subnational levels that may have affected policy decision making at the national level (Quinton, 2017). It does not capture potential effects of media on decision making (e.g., Sato, 2003), as resource constraints prevented the collection of Arabic-language data. In broader scientific terms, the study only addresses the MENA region. While the region is quite heterogeneous, which strengthens the generalizability of the findings, much of the information is collected from authoritarian states, which often carefully manage publicly released information to cast a positive light on the government (Ahram and Goode, 2016; Sen, 2000). Finally, this study is limited to only the initial decisions that governments made to close schools, which occurred very early in the pandemic. It does not capture subsequent and much more complex decisions to reopen schools fully or on limited schedules. Further, the subsequent policy actions are distinct in nature from the initial and dramatic decision to close schools and likely require stand-alone studies to examine fully. But it is valuable to gain an early perspective on policy actions, particularly those involving crises, so that policy makers and others can learn from (Dobbin et al., 2007) and adjust as appropriate when confronted with similar issues in the future, such as follow-on waves of COVID-19 (e.g., Fickling, 2021). These issues and other important decisions such as when and how schools reopened, whether they closed again, and what educational opportunities were available while schools were closed present important opportunities for future research.

In conclusion, this study presents a glimpse at the considerations regarding the role of schools in early efforts to limit the effects of the COVID-19 pandemic in the MENA region. It is worth noting that all school systems in the region closed, and they were closed fairly early and quickly in the first wave of the pandemic. A study of the region by Murray and Jilani-Hyler (2021) shows that this was not true in terms of society-wide lockdowns. Six of the 20 states never locked down, and the first lockdown occurred several weeks after the first school closure. This study shows that direct educational considerations played little to no role in decisions to close schools. The results suggest the decisions were strongly motivated by external issues concerning the passage of time and bordering states’ policies. Health considerations related to risk of the disease played a lesser, but still important, role. Finally, the results show robust effects related to women’s position in society, which may be associated with custodial complications that result from school closings. In all, these results suggest the decisions of MENA governments to close their schools was motivated by a number of factors and likely complex.

CRedit authorship contribution statement

Olivia G. Carr: Formal analysis, Data curation, Writing – original draft, Writing – review & editing, Project administration. Nadia Jilani-Hyler: Writing – original draft, Writing – review & editing. Gregg R. Murray: Conceptualization, Formal analysis, Data curation, Writing – original draft, Writing – review & editing, Visualization.

Declarations of interest

none.

Appendix B. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.ijedudev.2022.102560.

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