

Gender Dynamics and Socio-Cultural Determinants of Middle East Respiratory Syndrome Coronavirus (MERS-CoV) in Saudi Arabia

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Abstract

Middle East Respiratory Syndrome (MERS) is a potentially severe viral respiratory illness that is caused by a new strain from the beta group of coronavirus (CoV). Almost all cases arise from Saudi Arabia, and men are at a greater risk of contracting the virus (68%) in comparison to women. This disparity presents an interesting question: What accounts for these observed sex differences in MERS infection rates? Using an analytic lens that considers the unique dynamics of socially constructed and specific gender roles, this review challenges the common assumption that biological differences in vulnerability (genetic disposition) are the primary drivers for the disparate male infection rates. Specifically, the author uses a gender-based analysis (GBA) to explore gender-based risk factors within Saudi Arabia that may contribute to this disparity. The findings of this review suggest that particular gendered risk factors including religious (Hajj) and cultural practices (shisha smoking) as well as social roles pertaining to livestock management (dromedary camels) may create different exposures to MERS-CoV. Ultimately, this research illustrates a significant gap in the current knowledge and understanding of how gender dynamics affect infectious diseases, especially concerning the issue of containment of and protection from MERS.

Introduction

Middle East Respiratory Syndrome (MERS) is a potentially severe viral respiratory illness that is caused by a new strain from the beta group of coronavirus (CoV).¹ MERS-CoV may cause acute respiratory disease, affecting both the upper and lower respiratory tracts, especially among individuals with underlying health conditions such as diabetes, renal disease, chronic lung disease, and immunodeficiency.^{1,2} Symptoms of MERS include pneumonia, high fever, coughing, and severe shortness of breath.³ Currently, there are no effective anti-viral treatments or preventative interventions, namely vaccines, for patients with MERS.⁴

Since the first confirmed case of MERS in 2012, the World Health Organization (WHO) has reported 1806 laboratory-confirmed cases with 643 deaths globally.⁵ Saudi Arabia demonstrates a similar case-specific mortality rate (1,437 and 615 respectively), making it the country with both the highest incidence and mortality rates across the Arabian Peninsula.^{6,8} Both globally and in Saudi Arabia, men are at a greater risk of contracting the virus (68%) when compared to women.⁹ This disparity presents research and clinical communities with an interesting question: What accounts for the observed sex differences in MERS infection rates?

Using an analytic lens that considers the unique dynamics of socially constructed and specific gender roles, this paper seeks to challenge the assumption that biological differences in vulnerability (genetic disposition) are the primary drivers for the disparate male infection rates. It calls on researchers to use gender-based analysis (GBA) to better account for the impact that culturally specific gender roles play in MERS infection rates. GBA is a particularly powerful analytic tool, because it integrates both the complexity of social location and its influence on infectious diseases. In doing so, it challenges the traditional approaches to infectious disease and offers the promise of new insights into the nature of MERS risk patterns. To demonstrate this analytical framework, this paper begins by considering several gendered risk factors, including gender segregation, gendered religious and cultural practices, and gendered social roles concerning livestock management within Saudi Arabia. This paper considers issues beyond traditional epidemiological approaches by illustrating the link

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between socio-cultural norms and practices and the risk patterns affecting MERS health outcomes. Applying a GBA to existing and future MERS scholarship can yield valuable information that can be used to develop culturally appropriate and thus effective public health programmes to counteract this serious emerging infectious disease.

Gender and (Emerging) Infectious Disease

The WHO defines gender as being “socially constructed roles, behaviours, activities, and attributes that a given society considers appropriate for men and women”.¹⁰ Men and women illustrate diverse characteristics including social and economic behaviour, roles, expectations, and responsibilities. Gender-based health differences emphasize social, political, and economic inequalities and intersect with other important forms of social stratification including class, race, ethnicity, and disability. Importantly, gender differences can be developed, sustained, and reproduced within core institutions and manifest into social relations based on those differences.¹¹ Assessing the parameters of gender roles, which include socio-cultural dynamics as well as male-female differences, is therefore crucial in examining both the patterns of exposure to infectious agents (frequency and intensity) and the treatment of infectious diseases.¹² Historically, and even presently, the relationship between gender and infectious disease has been under-researched, particularly when assessing approaches to disease management and control.

Applying Gender-Based Analysis to the Study of (Emerging) Infectious Diseases

The WHO advocates the use of a gender framework to advance our understanding of communicable diseases among men and women.¹³ Disease experience differs greatly for men and women – a disparity that should be examined in relation to social, cultural, economic, and individual contexts and consequences.¹³ GBAs, like the one advocated by the WHO, are aligned with approaches to infectious diseases that underscore the social determinants of health. Specifically, GBA is a powerful tool for exposing and exploring the relationship between gendered, socio-cultural norms in Saudi Arabia and the emergence of MERS-CoV, including gendered and culturally-specific social roles that affect exposure, available support networks, social stigmas, the use and quality of health services, and decision-making power at the household and community levels.¹³

Gender Dynamics within Saudi Culture

Saudi Arabian culture and the status of Saudi Arabian women within the public domain constitute a complex, culturally-specific social phenomenon. The religion of Islam and the existing ruling-family Sunni Wahhabism have taken precedence in shaping Saudi Arabian culture, from the legal system to the day-to-day living of Saudi Arabian citizens.¹⁴ In-

deed, gender-based segregation is permitted and enforced by the state. Although women are segregated to varying degrees across the Middle East, this segregation is strictly practiced in Saudi Arabia. Deep historical forces, notably religion and cultural customs/norms, have shaped social and governmental sanctions for gender segregation to the extent that the day-to-day life of Saudi Arabian women is largely controlled by defined gender roles within predominantly domestic settings.¹⁴ Women’s roles are largely defined within familial spaces: they tend to stay at home and act as both the reproducers and educators of traditional values for their children.¹⁴

Another key feature of Saudi Arabian culture is the concept of modesty. Modesty is expressed by both genders but more evidently by Muslim women and girls.¹⁵ Traditional clothing for Saudi Arabian women consists mainly of the abayah (black cloak) and tarha (black head scarf). This cultural practice is of potential significance when considering disease risk, because it incorporates the veil.^{15,16}

Focusing exclusively on gendered religious customs is inadequate, because doing so ignores other social, political, and economic factors that intersect and shape cultural and religious practices as well as behaviours that may be associated with disease risk. Moreover, the complexity of Saudi Arabian culture, which includes high cultural homogeneity based on tribal and Islamic affiliation, makes it difficult to distinguish between Islamic principles and cultural traditions/customs of Arabs.¹⁷ It is precisely this unique intersection of religion, culture, and corresponding social positioning of Saudi Arabian women, and gender inequality more broadly, that makes it more difficult for them to navigate through society. Although the Qur’an advocates for the rights of Muslim women, Saudi society is deeply patriarchal; men dominate social institutions and systems, holding legal power and authority across the region.^{17,18} In addition, Saudi Arabian families are generally patrilineal, with the inheritances of property, rights, names, or titles traced to a person’s male kin.^{17,19}

All of these culturally-specific gendered roles and relationships, including deeply-gendered norms that restrict women’s social mobility, influence MERS outbreaks in the region. Applying GBA in infectious disease research allows us to expose these conditions in order to develop a more nuanced understanding of the ways in which the MERS virus manifests itself in this context. Specifically, GBA can expose gendered, socio-cultural practices that may be detrimental or advantageous to the affected community. Moreover, understanding different gendered, socio-cultural norms and practices in Saudi Arabia can help us to identify those gendered practices that contribute to the significant sex differences in MERS-CoV risk between women and men.

MERS - Socio-Cultural Norms within Saudi Arabia

Gender Segregation, Modesty and the Practice of the Veil

Saudi Arabia's laws and moral standards, particularly those surrounding dress, drink, behaviour, and the association of unrelated members of the opposite sex, place the country in a unique position compared to other Muslim countries.¹⁴ The association between socio-cultural practices could have a profound effect, especially in relation to how the MERS virus behaves among these particular practices and norms. For instance, there may be an association between Saudi Arabia's unique cultural customs (e.g. Saudi women wearing both the *purdah* and veil) and reduced risk of air-borne transmission of respiratory-borne diseases like MERS. Specifically, the practice of modesty and other cultural and religious customs such as wearing of the veil/*niqab*, which guards the mouth and nose, may act as a protective mechanism²⁰ that prevents women from coming into contact with contaminated fingers, mucosal membranes, and respiratory droplets. As a result, the use of face cover may unintentionally serve to reduce the risk of women contracting the virus.

The small body of research on these kinds of potentially protective effects is conflicting. Indeed, a recent clinical study did not find a significantly lower incidence of upper respiratory tract illnesses among women wearing a face mask or cover.²⁰ Furthermore, other studies present the veil as an imperfect substitution for the medical face mask, as Muslim women take off their veil within their homes or in the presence of other women, thus "having the same high risk of disease transmission in a closed environment with exposure to droplet infection".²¹ Other potentially relevant distinctions include the absence of a filter and the loose application of the veil to the face in comparison to a face mask, which is elasticized and therefore closely covering the face – a mandatory aspect of clinical practice to prohibit the transmission of viral strains, bacteria, dust, etc.²⁰ Additionally, Ahmad et al. (2001) found that long-term effects of *niqab* use include reduced ventilation function and forced vital capacity.²² This is important, as the combination of airway resistance, increased microclimate temperature, humidity, and skin temperature created inside the *niqab* could produce an ideal environment for organisms to grow and infect the host.²² Other possible reasons why the veil is an imperfect substitute for a clinical face mask is the sharing of veils among family members and the fact that Saudi women do not usually cover their face when alone in their homes, thus resulting in a high risk of contracting infections in closed environments.²²

Gendered Cultural Practices and MERS: Shisha Smoking

Another gendered, cultural practice that may influence the transmission of MERS in Saudi Arabia is shisha smoking.

Sultan Ayoub Meo, a senior physiology professor at King Saud University, recently suggested a shisha-MERS linkage. Specifically, he argued that shisha café culture, which is common in Saudi Arabia and is predominantly practiced by men in public, may further exacerbate the spread of the MERS virus in Saudi Arabia. Other studies suggest shisha smoking, also known as "hookah" smoking, may be a mechanism that increases the risk of MERS virus among family and friends. Notably, shisha uses tobacco that is sweetened with fruit or molasses sugar, which makes the smoke more aromatic than a cigarette.²³ Wood, coal, or even charcoal is used to burn the tobacco in order to create the smoke while the fruit syrup or sugar dampens the tobacco and the water acts as a cooling mechanism to decrease the harshness of the smoke,²³ thus making the shisha smoker inhale more deeply.

A 2012 study conducted by the Centers for Disease Control reported that many shisha smokers believe that smoking shisha carries less of a risk of contracting tobacco-related illnesses than does cigarette smoking. As a result, the act of shisha smoking as a social and entertainment-related activity has increased in recent years, with the majority of shisha-users being male amongst Middle Eastern countries.²⁴ Contrary to public opinion, a study by the WHO concluded that shisha sessions expose individuals to harmful smoke over a long period of time as opposed to cigarettes.²⁵ This is because cigarette smokers typically inhale 0.5 L to 0.6 L of smoke per cigarette, whereas a shisha session can involve the inhalation of anywhere between 7.5 L and 200 L of smoke.^{25,26} Importantly, these findings demonstrate how shisha use creates an ideal environment – the higher amount and duration of shisha smoking, indoor pollutants, and the possibility of exchanging saliva through sharing and second-hand smoke – for shisha smokers (in Saudi Arabia, mainly older males) to be more likely to come in contact with communicable diseases, such as MERS-CoV, when compared to non-shisha smokers.^{24,26,27} More importantly, hookah smoking – especially in regard to sharing of the mouth piece during session and coupled with the use of charcoal and tobacco – was associated with health effects, particularly for infectious diseases like influenza and tuberculosis²⁸ as well as respiratory viruses.²⁹ This gendered, cultural practice may then contribute to the disproportionately high rates of MERS infection in Saudi men compared to Saudi women (the perception that smoking is 'unladylike', which may decrease participation among Muslim women).³⁰

Gendered Dynamics of Religious Practices - Hajj

Hajj (the fifth pillar of Islam) is a religious practice enacted among Muslims, and is one of the most significant manifestations of Islamic faith and unity. Performing the Hajj is a duty that all Muslims (with physical and financial capabilities) must do at least once during their lifetime. Every year, millions of pilgrims across 184 countries arrive at Makkah and Madinah for Hajj.³¹

In recent years, the emergence of MERS has impacted the number of pilgrims participating in the Hajj. For example, in 2013, the number of pilgrims decreased due to the emergence of MERS, during which time the Saudi Arabian Ministry of Health announced that pilgrims were at a high risk of contracting the strain, especially pregnant women, children under the age of 12, the elderly, and those with acute or chronic diseases.³¹ During the event of Hajj, there is an overwhelming attendance of Muslims, with limited geographical space to accommodate everyone. These conditions – crowding, shared accommodations, and exposure to environmental dust and pollutants – collectively create an ideal ecology for transmission of respiratory infections, including MERS.³²

Research exploring communicable and non-communicable diseases during Hajj found that of the pilgrims who were afflicted with common health problems (CPH), the majority (65%) were elderly males.³³ Additionally, current literature examining Hajj have highlighted respiratory diseases (76.2%) as the main health problem facing Hajj pilgrims,³³ with viral respiratory infections such as influenza and rhinovirus being the second leading pattern of CPH facing hajj pilgrims. Specifically, 57% of patients admitted into Saudi hospitals were reported to have respiratory tract infections, making it the leading cause of hospitalization during Hajj.³³ Importantly, elderly hajjis were identified as being a high-risk group during hajj,³³ which is significant, as the majority of cases involving MERS were found to be male, and even higher rates were found amongst elderly males with underlying medical conditions.³⁴

This is particularly interesting since the practice of gender-segregation and wearing of the veil by Muslim women does not occur during the majority of the Hajj event. Notably, while the event is not explicitly separated by gender, the notion of modesty still applies to female pilgrims. Accordingly, it is obligatory for female pilgrims to travel to Hajj with their husband or mahram, a male relative whom they are permanently forbidden to marry because of blood ties. In light of these conditions, further research is needed to determine whether female pilgrims' exposure to and risk of MERS infection increases during the Hajj.

It is equally important to consider the impact of the gendered customary practices during the Hajj on men's exposure and risk of MERS infection. During the Hajj, it is obligatory for all pilgrims to wear ihram. For men, this consists of white garment that covers them from the waist down and includes a white garment over the shoulder. For women, ihram typically consists of a white dress and headscarf or their native dress. Because male pilgrims' customary clothing does not necessarily cover the entire body (exposing their upper body, hands, and legs), their risk of being exposed to the MERS virus presumably increases as they come into direct close contact with contaminated fingers and mucosal membranes of others.

Although there have been no Hajj-related MERS cases reported to date, MERS-CoV remains at the top of the WHO's

list of emerging diseases that have the potential to cause major epidemics.³⁵ Mass gatherings and religious events create an ideal high-risk condition for the rapid spread of infections by attracting large crowds, thus posing a significant public health threat.³⁵ Conversely, a number of unanswered questions still remain, especially in regard to epidemiology, pathogenesis, management, and control.³⁵ As such, continuous monitoring of the virus is crucial for maintaining a safe environment for pilgrims to perform their religious duties, and for preventing it from spreading and becoming pandemic.

Gendered Social Roles and Livestock Management

Epidemiological reports suggest that the MERS virus is zoonotic by nature,³⁶⁻³⁸ with the potential to infect various mammalian cell lines, including primates, pigs, bats, and rabbits.³⁹ Although bats were initially presumed to be the primary host, most patients did not directly contract the virus from bats.³⁸⁻⁴¹ Therefore, a potential trajectory of the MERS virus could be traced as follows: a single variant related beta-coronavirus in bats → intermediate animal → host → human population.⁴² This trajectory appears likely in light of emerging evidence that suggests camels may play intermediate roles, both as disease victims and as reservoirs to exacerbate transmission.⁴³ This, in turn, suggests that the MERS virus travelled from the primary host (bats) to this potential intermediate animal before infecting humans, as both the geographical and cultural context favour this mechanism.

A number of sero-epidemiological studies suggest that dromedary (single-humped) camels residing in regions within the Arabian Peninsula and the Middle East were the only domestic livestock reported to have specific antibodies to the MERS-CoV virus.⁴⁴⁻⁴⁶ Furthermore, there are several studies that highlight the link between MERS-CoV and dromedary camels. For instance, two human cases of MERS-CoV infection diagnosed in 2013 were linked to a camel farm in Qatar.⁴⁷ Moreover, MERS-CoV and dromedary camels were found to have cross infection potential, wherein the virus can be transmitted from camel to human via close contact.⁴⁷ Serum samples obtained from dromedary camels in Saudi Arabia were found to exhibit a high sero-positivity (72%) to the MERS virus.⁴⁷ Specifically, sero-positivity was greatly significant amongst those who were exposed to dromedary camels; indeed, it was found to be 15 and 23 times higher amongst shepherds and slaughterhouse workers, respectively.⁴⁷ Additionally, transmission of MERS virus via droplets was emphasized both in hospital settings and especially in dromedary camels, which were found to have very high concentrations in their nasal secretions, making this transmission avenue a likely route.⁴⁸ Additionally, transmission routes via dust particles should not be excluded, as these particles can be contaminated by camel urine and droppings.⁴⁸

In addition, some studies have revealed that MERS-CoV has been prevalent among dromedary camels for approximately

20 years,³⁵ with some documenting an association as early as 1992 in Saudi Arabia,⁴⁹ suggesting that it is not a newly-emerging zoonotic pathogen from camels.⁴⁴ The Arabian Peninsula is home to only 1.2 of the 30 million camels worldwide, of which 95% are dromedary camels.⁴⁸ Despite this relatively low number, dromedary camels in Saudi Arabia carry the MERS virus at significantly greater rates than those imported across the African region.⁴⁹ The study of dromedary camels not only supports their role in human infection theory but has also found them to be an important source of income and social prestige, as they are “indispensable to the traditional nomadic lifestyle, provide milk, meat, wool, leather, medicinal purposes as well as for transport, trade and racing”.⁴⁴

Camel husbandry is a gendered practice; occupations that incorporate huge commercial farms and those that manage and herd large animals are male-dominated.⁵⁰ A gendered division of labour characterizes pastoralist societies.⁵¹ Specifically, while pastoral societies are male-dominated, women living in these communities are typically responsible for subsistence, which includes the care of animals near the household.⁵¹ Moreover, existing literature has reported a drastic change in dromedary camel farming practices in Saudi Arabia, where the number has changed from 80,000 to as high as approximately 800,000, with 20% of the dromedary camel owners to be retired.⁴⁸ This could explain the responsibility of herding and managing large animals (including dromedary camels) to be male-dominated, as studies have highlighted camel rearing to be both an exclusively male activity and popular among middle-aged and retired men.⁴⁸ Furthermore, these data could potentially underline an important gendered channel of transmission and may also help to explain the high rates of male infection given that these men are in continuous contact with this important intermediary host.⁵² Unfortunately, there is limited research on the care of specific species of farm animals, which makes the empirical investigation of those possible gendered relationships exceedingly difficult. The situation is complicated further, because “[labour] force surveys do not often separately list activity rates by sex for the care of different types of animals”.⁵³

Notably, camel herds normally move across the Arabian Peninsula (by grazing, participating in camel races and camel shows) in Saudi Arabia and many other Gulf countries such as Kuwait, Oman, Qatar and United Arab Emirates (UAE).⁴⁴ These movements are important, because they can explain the link between epidemiology and viral evolution. In addition, by incorporating the concept of gender roles, it is possible that the movement of camels between locations provides an understanding of how the virus may spread and predicts particular gender roles that may be at risk of the MERS infection. For instance, camel shows (also called Mazayin al-Ibl – meaning “best of camels”) are an annual tradition among many Gulf countries, especially in the eastern region of Saudi Arabia where one of the largest camel shows has more than

100 camel herds representing over 160,000 camels from various regions in the Arabian Peninsula and 160,000 people attending every year. Moreover, there are major annual racing competitions held around February called Janadriyah.⁴⁴ Similar festivals are held among other Gulf countries such as the UAE, Oman, Qatar, and Kuwait.³⁹

This important consideration could explain how the continuous movement of camels across borders might influence the amplification and evolution of MERS-CoV.⁴⁴ For example, previous reports have suggested a high degree of similarity amongst MERS-CoV sequences obtained from Al-Ahsa and MERS-CoV from humans in the UAE and Burydah.⁴⁴ The pre-existing social norms that exist in the majority of the Middle East and more specifically in Saudi Arabia – the majority of participants are middle-aged and retired men, and women are generally not involved in sports and other leisure activities – may potentially impart a gender-based discrepancy in the risk of acquiring the virus.⁴⁸ Therefore, the increased occurrence of male-dominated sports, such as camel racing, and higher male participation within these activities could potentially increase the risk of males acquiring the virus.

While researchers have yet to conclusively determine if this animal does, in fact, function as an intermediary linking the virus from an unknown animal reservoir to human beings or even as the reservoir for MERS-CoV,⁴⁴ there is considerable evidence pointing to dromedary camels being the primary host animal for the MERS-CoV virus as well as an important vehicle in transmitting the virus to humans, which by nature of husbandry practices in the region is deeply gendered.

Conclusion

The present review has explored gendered socio-cultural norms and practices that may influence observed sex-differences in MERS infection. Research suggests that, in some contexts, the veil may serve to reduce exposure and risk of infection, while in others, the practice of the veil may actually increase women’s risk of infection. Other kinds of gendered, culturally-specific practices including shisha smoking, participating in the Hajj, and livestock management of dromedary camels may exacerbate transmission of the MERS-CoV virus and, in part, account for the observed sex differences in MERS infection.

To better understand potential models of transmission and infection, it is vital that we develop a more nuanced understanding of religious and cultural practices in Saudi Arabia that takes gender norms into consideration. Indeed, applying a gender-based analysis to the review of emerging infectious disease can help us to understand how behaviour, activities, and differential access to resources and decision-making affect disease transmission and outcomes. This review of the literature demonstrates the utility of this type of analysis in generating areas for future research and public health policy, particularly in regard to the MERS coronavirus.

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