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Effects of the COVID-19 pandemic on sleep health among Middle Eastern and North African (MENA) populations: a systematic review of the literature

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ABSTRACT

Objectives This study sought to conduct a systematic review of the literature on the impact of the COVID-19 pandemic on sleep health among Middle Eastern and North African (MENA) populations, understudied geographic regions including with regards to sleep health.

Setting A systematic literature search of studies published from inception to 27 March 2022 was conducted on multiple databases using developed keywords.

Participants Studies were included if they (1) investigated one or more aspects/dimensions of sleep health as an outcome (eg, sleep duration, sleep quality, sleep problems); (2) measured the impact of a COVID-19 pandemic-related domain (eg, impact of quarantine, work from home, lifestyle changes); (3) focused on at least one MENA region population; (4) were peer-reviewed; (5) included ≥100 participants; (6) were written in English and (7) had full-text article publicly available.

Primary and secondary outcomes measured Primary outcomes were sleep duration, sleep quality and sleep problems.

Results In line with Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines, 164 studies were included for data extraction. The Newcastle-Ottawa scale for cross-sectional studies was used to assess the quality of the studies. Overall, the COVID-19 pandemic significantly impacted sleep duration, sleep quality and presence and severity of sleep disorders in MENA populations, including adults, children, students, healthcare workers and people with chronic illnesses. The directionality and strength of associations, as well as the determinants of sleep health, varied by subpopulations.

Conclusions Longitudinal studies are needed to understand the longer-term impact of the COVID-19 pandemic on the sleep health of MENA populations. Sleep health interventions and policy measures should be tailored to the need of each subpopulation.

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STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ Study design that enabled the capturing of a wide scope of evidence, including both quantitative and qualitative studies among a severely understudied population.
⇒ Comprehensive literature search of five major electronic databases and reporting as per Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines.
⇒ Studies included in this review used different methods for assessing sleep health, making it challenging to compare results between different studies and populations.
⇒ Most included studies are cross-sectional in design, posing an intrinsic limitation to this review and making it difficult to establish causation.
Inability to measure for national variations in quarantine policies between countries, which could have had varying effects on the health of the population.

INTRODUCTION

The COVID-19 pandemic, which was announced as a Public Health Emergency of International Concern on 30 January 2020, and a pandemic on 11 March 2020, continues to affect people's lives around the globe. Given the nature of transmission of the SARS-CoV-2 virus, in addition to lack of medication or vaccines in the early response to the pandemic, many of the public health interventions to prevent the transmission focused on physical distancing. Such measures included quarantine and lock-down orders. In turn, this affected people's ability to do many social and physical activities, hence significantly impacting people's 24 hours behavioural patterns. Further, pandemic-related stress also contributed to abrupt changes in lifestyle behaviours.[1 2] For instance, Park *et al* reported that COVID-19 has had a negative impact on healthy and active lifestyles, as well as mental health and quality of life, among a sample of adults in South Korea.[3]

Research in the literature is demonstrating that among the many health outcomes and health behaviours that may be affected by the pandemic is sleep health.[4–8] Prior studies among various populations have shown that

the pandemic affected a variety of sleep health domains, including sleep quality (SQ),[9–11] sleep duration[12 13] and sleep disorders.[7 14] For instance, in a longitudinal study in Spain, Martínez-de-Quel Óscar *et al* reported that perceived sleep problems significantly increased following the onset of the pandemic.[15] Similarly, among 400 students and university administration staff workers in Italy, the prevalence of insomnia increased from 24% prior to the pandemic to 40% during the pandemic. Similarly, difficulties in sleep initiation among the same sample increased from 15% to 42% from before to during the pandemic.[16] A systematic review conducted in July 2020 showed that the prevalence of sleep problems during the COVID-19 pandemic is high and affects approximately 40% of people from the general and healthcare populations.[17] In addition to the observed trend in sleep health outcomes, the pandemic may have exacerbated a number of stressors that can directly increase poor sleep health. For instance, research among several global populations has shown an increase in intimate partner violence (IPV) due to lockdown measures, as well as economic and psychological stress brought about by the pandemic.[18–20] In turn, IPV has been linked with poor SQ and sleep disturbances among different populations.[21 22]

Among Middle Eastern and North African (MENA) populations, the burden of non-communicable diseases has drastically increased from 1990 to 2010.[23] The epidemiological profile of Middle Eastern countries closely resembles that of countries in western Europe, the USA and Canada, with health loss from most non-communicable diseases, such as Cardio Vascular Disease (CVD) and cancer, increasing over the past 20 years.[23] However, Middle Eastern populations are faced with multiple challenges when attempting to deal with such an epidemiological profile. Indeed, political turmoil, conflict and corruption within states have led to challenges in implementing policies and laws, as well as adhering to them on a population level.[24] In addition, while Middle Eastern populations are facing an epidemiological challenge similar to that of the developed world, they continue to be understudied in public health research including sleep health research. In part, this is due to Arab countries having weak health information systems,[25 26] which limits data availability and produces major challenges for sound research and evidence-based policy-making.

In addition, MENA countries epidemiological profile is characterised by high burden of psychosocial problems, including depression and anxiety.[23] Non-communicable diseases and psychosocial problems, among other health outcomes, are consistently associated with sleep health.[27–31] Consequently, this exacerbation in poor sleep health that may be brought about by the pandemic can increase the risk of other undesirable health outcomes among populations. This issue is of increased urgency in areas with underdeveloped health research infrastructure where there continues to be lack of full understanding of the health of the population, as is the case in the MENA region.

Given the evident impact the pandemic had on sleep health worldwide, as well as the well-documented association between sleep health and the leading causes of morbidity and mortality, it is important to understand this association among Middle Eastern populations. This systematic review sought to investigate the association between COVID-19-induced national lockdowns and different domains of sleep health among MENA populations. To the best of our knowledge, this is the first systematic review investigating sleep health among Middle Eastern populations in the context of COVID-19. In addition, and while there are several reviews examining sleep health domains in developed countries,[32 33] there continues to be a lack of reviews studying sleep health in MENA countries, which collectively represent ~600 million of the word population. In fact, this systematic review would be the first to summarise the literature on the sleep health of MENA populations, filling an important gap in the literature.

METHODS

A systematic literature search was performed following Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines.[34] On 27 March 2022, we conducted a systematic literature review on five different databases, namely PubMed, MEDLINE, Embase, CINAHL and Web of Science. A set of specific keywords and MeSH terms was developed and is shown in online supplemental table S1. The protocol of this systematic review is registered with PROSPERO (international prospective register of systematic reviews) with the ID CRD42022321128. The protocol for this review can be publicly accessed on PROSPERO webpage.

Search strategy and selection criteria

The authors developed a set of keywords relevant to the research question and the population investigated. Boolean operators were used to ensure full inclusion of words within the keywords used Using Endnote referencing software, retrieved articles were entered and duplicates were identified and removed. Following that, articles were entered into Rayyan, a free web-tool for screening articles for systematic reviews. As shown in figure 1, title and abstract screening were conducted by two investigators (OAT and YAA-A) independently. Next, full-text articles were accessed and screened in more depth. Conflicts were solved by discussion on the conclusion of the screening process. The articles included were deemed eligible against the following criteria: (1) investigated an aspect sleep health as an outcome of interest (eg, sleep duration, quality and presence of a sleep problem or disorder); (2) investigated a domain related to the COVID-19 pandemic induced lifestyle changes (eg, lockdown, online schooling); (3) focused on at least one MENA population (online supplemental table S2)
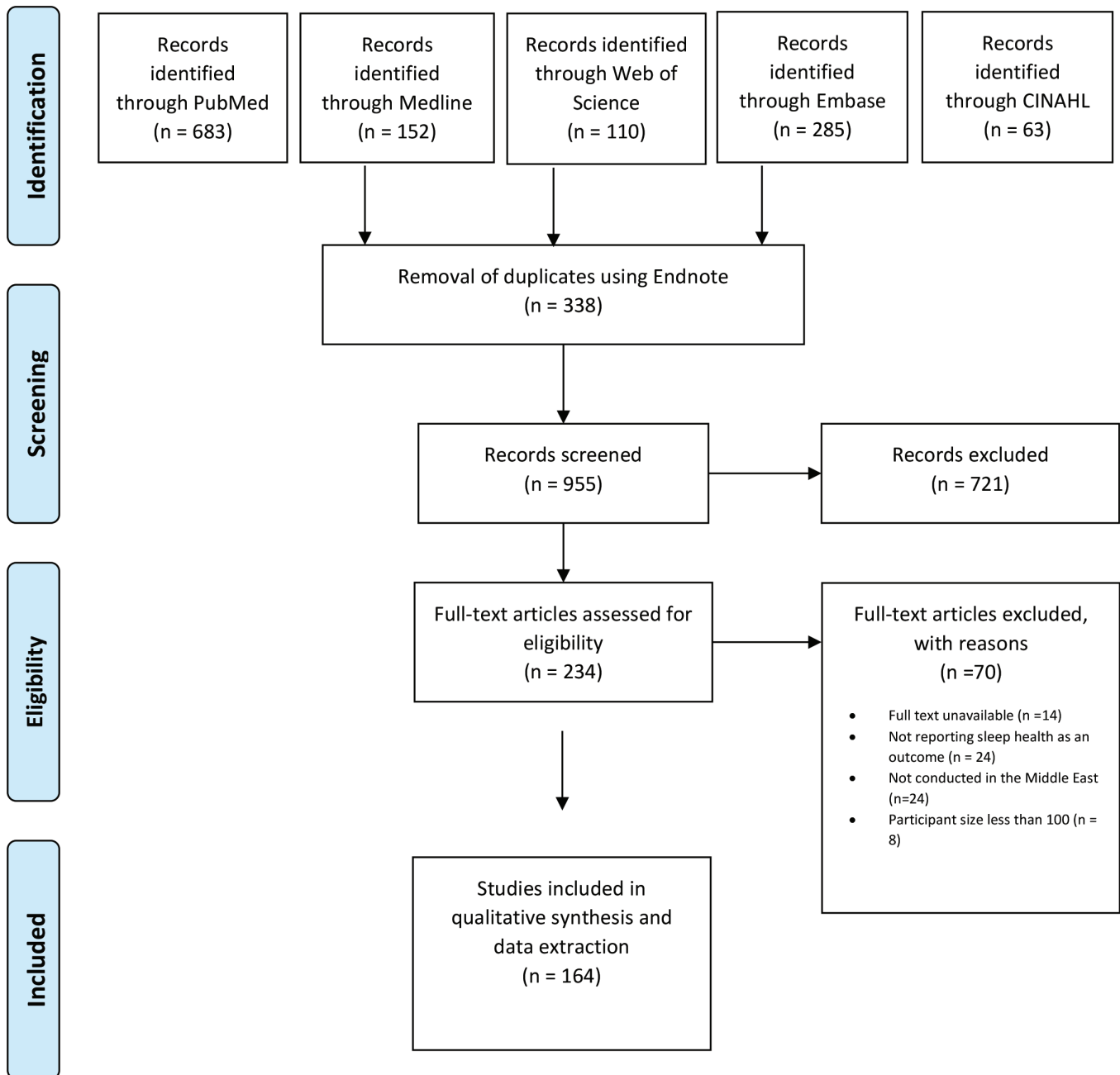
Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses study selection flow diagram outlining the literature review process when searching for articles on PubMed and Web of Science.

includes a list of all MENA countries included); (4) were peer-reviewed; (5) sample size ≥100 participants (6) were written in English; (7) had full-text article publicly available. Similarly, articles were excluded if they met at least one of the following: (1) were not written in English; (2) were not peer-reviewed (3) did not have full-text available; (4) were systematic or narrative review in design. Where multiple articles reported data from the same dataset, we selected the article with the largest numbers of variables included and excluded the other articles as duplicates. Finally, there were no restrictions on the nature of data reported and both qualitative and quantitative studies were included in this review. Of note, prior to conducting our systematic search, an initial literature search was

conducted by the authors to identify systematic reviews of sleep in relation to COVID-19 pandemic.

Data extraction

Data extraction was done following a tabulated form. Two reviewers (OAT and YAA-A) collectively performed the data extraction into a template table. Conflicts were resolved through a discussion and where necessary, a third reviewer. Data were categorised based on subpopulations identified, including adults, children, healthcare workers (HCWs), students and people with chronic illnesses. Other dimensions collected for each study included: (1) the first author and year of publication (eg, reference); (2) location of the study (city and/or country); (3) study

population of interest; (4) study sample size; (5) study design; (6) sleep health measurement tool; (7) sleep health domains and (8) main findings summarised.

Data presentation
All data extracted from identified studies were presented in a tabulated form organised according to the different subpopulations identified among MENA populations. This included: (1) adults; (2) children; (3) HCWs; (4) students and (5) people with chronic illnesses. Main summary findings were presented in the tables, in addition to identifying specific factors that were associated with poor sleep health outcomes.

Quality appraisal
Given that the majority of the studies identified were cross-sectional in design, The Newcastle-Ottawa scale (NOS) was used to assess the quality of the studies. Two reviewers (YAA-A and OAT) independently assessed the risk of bias in all cross-sectional studies. Where necessary, conflicts in scoring were resolved by discussion. Only cross-sectional studies were scored against the NOS, yielding a total of 157 studies for risk assessment. The NOS was developed to assess the quality of non-randomised studies according to different domains of the studies, including the study's design, content and ease of use directed to the task of incorporating the quality assessments in the interpretation of meta-analytic results. Following NOS, the studies were scored against seven different categories, including (1) selection (four subcategories, four stars maximum); (2) comparability (one subcategory; two stars maximum); (3) outcome (two subcategories; three stars maximum). The full list of adapted questions from the NOS is attached as online supplemental file 1. In addition, the results of the NOS assessment for our included cross-sectional studies are shown in online supplemental table S3.

Patient and public involvement
Patients and public were not involved in the design and conduct of this research

RESULTS
Search results
As illustrated in figure 1, the systematic literature search yielded 683 studies from PubMed, 152 studies from MEDLINE, 285 studies from Embase, 63 studies from CINAHL and 110 studies from Web of Science, resulting in a total of 1293 studies. After removing duplicates (n=338), 955 articles were screened independently by two investigators for title and abstract to determine relevance to our research question. This step excluded an additional 721 articles either because they did not investigate sleep health as one of the outcomes (n=535), did not include people from the Middle East, (n=153) or were not peer-reviewed (n=33). After this step, two independent investigators performed full-text screening on 234 potentially relevant articles. A total of 70 studies were excluded at

this stage, mainly due to studies with unavailable full-text article (n=14), studies not reporting sleep health as an outcome (n=24), studies conducted explicitly outside the Middle East (n=24) or had a sample size of less than 100 participants (n=8). As a result, a total of 164 articles were included in this review.

Study characteristics
The sample size of all included studies (n=164) ranged from 103 to 20 697 participants. Online supplemental table S4 presents a full list of all included studies and their extracted data. Furthermore, studies included were conducted across 17 Middle Eastern countries, including Turkey (n=44), Saudi Arabia (n=33), Iran (n=16), Israel (n=12), Jordan (n=12), Egypt (n=10), Oman, (n=6), United Arab Emirates (n=6), Lebanon (n=6), Kuwait (n=4) and Qatar (n=2). Only one study was conducted in each of the following countries: Bahrain, Palestine, Cyprus and Iraq. In addition, 11 studies included samples from multiple countries at once, including Syria, Yemen, Iraq and others.

Quality appraisal
Most studies in this review were cross-sectional in design (n=156). All other study designs were longitudinal (n=8). Online supplemental table S3 presents the full NOS results for all studies assessed for bias, determined using the NOS protocol outlined in the Methods section. Most studies were moderate in quality.

Sleep health outcomes by subpopulation
Data from all eligible studies was organised according to population type, with a total of five subpopulations. These included studies focusing on adults in the general population (n=74), HCWs (n=47), students (n=21), children (n=15) and people with chronic illnesses (n=7). For all populations, qualitative data synthesis was conducted with a focus on three main domains: sleep duration, SQ and sleep disorders.

Adults
Across the studies conducted among adults (n=74), the sample size ranged from 103 to 14 171 participants.

Sleep duration
Studies consistently reported that the pandemic negatively impacted the sleep duration of Middle Eastern adults.[35–43] In a global study including 5896 adults from 11 MENA countries, 49.6% of participants reporting that they were sleeping less than 7 hours and 53.2% reporting 10 or more hours of sleep.[35] In Egypt, 23.1% of adults younger than 30 years old reported inadequate sleeping (< 6 hours/day).[44] In terms of determinants of sleep duration among adults, data from Jordan revealed an increased burden of short sleep duration among males compared with females. Similarly, participants with higher education levels reported decreased daytime sleeping hours.[45] In terms of relationship status, individuals who reported

being single had significantly increased amount of sleep compared with married individuals.[45]

Sleep quality

SQ was altered for both COVID-19 patients and healthy individuals.[46] The Pittsburgh Sleep Quality Index (PSQI) score during lockdown was predominantly influenced by sleep-onset latency, sleep efficiency and total sleep time.[47] Factors associated with reduced SQ included changes in sleeping habits, anxiety, fear driven by COVID-19 news and lack of treatment knowledge, female gender, monthly income, isolation,[48] perceived income, hours spent outdoors, the number of familiar people with COVID-19 and history of depression.[49]

Sleep problems

Most families reported disrupted sleep patterns.[50] When quarantine period started in Saudi Arabia, one-fifth experienced new-onset nightmares, more significant among females.[51] In a global cross-sectional study including a number of Middle Eastern countries, around 33.3% of respondents reported feeling lazy and less energised during the pandemic, as opposed to 4.7% before the pandemic.[52] The prevalence of insomnia, anxiety, depression and obesity increased with increasing phone screen time among university students. Of all countries, Iran reported the highest prevalence of insomnia among adults (55.2%).[46 53] Finally, in a Turkey-based study among pregnant women, mild sleepiness was found in 88.2% of participants (n=356), while severe sleepiness was reported in 11.8% of the same sample.[54]

Children

A total of 15 studies assessed sleep health among children. The sample size of studies ranged from 309 to 20 697 participants.

Sleep duration

Most studies in the literature reported a change in the sleeping duration among children, with varying directions of change (eg, increased or decreased duration). In Saudi Arabia and Jordan, decreased sleep was reported among children's populations.[55 56] Moreover, sleep duration in Israel increased for 13.4% of participants, decreased for 51.1% and remained unchanged for 35.1%. Sleeping less than 7 hours decreased from 41.4% to 5.4%, while sleeping more than 10 hours significantly increased from 4.8% to 49.7%.[57] In Iran 13.4% of children, mostly from urban areas, reported that they had five or fewer hours of sleep.[58]

Sleep quality

In Tukey, 61.5% of children experienced sleeping changes due to the pandemic.[59] Almhizai *et al* demonstrated that older participants woke up more frequently during their sleep compared with children.[60] In Israel, 41.4% of children developed sleeping difficulties.[61] Similarly, in another Israeli study, 60% of mothers reported that their child's sleeping patterns had changed drastically and

reported higher levels of anxiety traits associated with sleep changes.

Sleep problems

Sleep disorders were reported in all studies among children. In Turkey, the prevalence of sleep disturbances among children was 55.5% and significantly associated with 6–8 years of age and poor family relationships. The most common sleep disturbances were bedtime resistance (51.9%) and sleep onset delay (61.4%).[62] Sleep disturbances were more common in children of parents who felt helpless, apprehensive and frightened during the pandemic,[62] and children whose parents were divorced.[60] The direct effect of trauma scores on sleep problems, the direct effect of sleep problems on chronotype scores and on oppositional defiant disorder symptom scores were significant.[63]

Healthcare workers

A total of 47 studies assessed sleep health among HCWs in all Middle Eastern countries listed in the study characteristics, except Palestine, Cyprus and Iraq. The sample size of studies ranged from 105 to 2331 participants.

Sleep duration

Sleep duration significantly decreased for HCWs in most countries, except Israel, where medical residents treating COVID-19 reported longer sleep duration.[64] In Egypt, both physicians on the front line and others were at risk of falling asleep, staying asleep or sleeping excessively.[65] Furthermore, there was a statistically significant decrease in sleeping hours among HCWs with severe and extremely severe depression.[66] Those with higher levels of health anxiety related to COVID-19 were working more days weekly and had lower sleeping hours.[67] Female sex, age ≤30 years, attending emergency and night shifts, watching/reading COVID-19 news ≥2 hours/day, and not getting emotional support from family, society and hospitals were associated with a high likelihood of inadequate sleeping HCW in Egypt.[68]

Sleep quality

Most studies reported poor and reduced SQ, as measured by the PSQI, with poor SQ prevalence ranging from 48.4%[69] to 96.1%.[70] Both, front line HCWs and non-front line HCW reported poor SQ and/or had moderate-severe stress.[71] In Saudi Arabia poor SQ levels were highest among front-line HCWs (emergency departments, intensive care units and wards).[72] The most negatively scored components of SQ included sleep latency, duration and efficacy. Poor SQ was more prevalent among females, nurses, hospital workers, front-line workers, individuals with <5 years of work experience, those with low social support and individuals with increased traumatic stress levels.[73]

Sleep problems

HCWs between 31 and 40 years old treating COVID-19 were at higher risk of severe insomnia, compared with

those above 40 years old.[74] In Turkey, insomnia incidence was 1.5 times higher for HCWs in the front line and significantly higher among those working in the 'area of final diagnosis'.[75] In a tertiary care hospital in Oman, the majority of HCWs (60.2%) aged 34.8±5.7 years and with less working experience (11.9±5.9 years) reported clinical insomnia during the pandemic.[76] Mean Insomnia Severity Index score in Turkey was significantly higher among HCWs working in COVID-19 clinics and intensive care units and among nurses.[73]

Students

A total of 21 studies with sample sizes ranging from 152 to 17 008 participants assessed sleep health among students.

Sleep duration

Among a large cohort of medical and science university students in Jordan, 44.2% of participants (n=1019) reported reduction in their sleeping hours.[77] Another study reported a statistical increase of total sleeping time from 6.6±2.3 hours/day to 8.3±2.7 hours/day.[78] In Israel, a significant reduction in sleep duration from lockdown to postlockdown period for workdays and weekends was reported.[79]

Sleep quality

Furthermore, 85.55% of students reported poor SQ and 67.9% were females. It was found that sleep disturbance and daytime dysfunction were poorer in students with higher body mass index ranges.[80] In Saudi Arabia, 25.9% of a sample of students reported poor SQ, 22.7% felt tired during the day, 9.3% had nightmares and 5.2% had poor dreams.[81] Furthermore, extended quarantine negatively affected SQ of three-quarters of the undergraduate students in Jordan, with poor SQ reported in nearly half of the same sample.[82] In addition, about one-third of the same sample reported sleeping late and waking up more frequently.[82]

Sleep problems

In Saudi Arabia, 22% of students had trouble falling asleep, 17.9% waking up during the night and 8.8% waking up early in the morning.[81] Students reported a statistically high level of insomnia with a high level of depression, anxiety and perceived stress. Undergraduate students reported statistically more insomnia symptoms with a lower level of psychological resilience.[81] Furthermore, lockdown in Turkey led to sleeping later, waking up frequently and failing to fall asleep.[83] In Saudi Arabia, medical students reported Narcolepsy (51.6%), insomnia (31.5%) and circadian rhythm sleep disorder (22.4%) as the most prevalent sleep disorders.[84] Furthermore, a statistically significant increase of night sleep interruptions was reported during COVID-19. In Jordan, students experienced increased insomnia, shallow sleep, nightmares or insufficient sleep, and these disorders were reported in significantly more females than males.[85]

People with chronic illnesses

A total of seven cross-sectional design studies assessed sleep health among the population with special conditions. The sample size of studies ranged from 145 to 2223 participants. Those studies focused on a variety of chronic illnesses, including epilepsy (n=1), neurological conditions (n=1), cancer (n=1), musculoskeletal diseases (n=1), spine illnesses (n=1), rhematic disease (RD) (n=1), and multiple sclerosis (MS) (n=1).

Sleep duration

In Saudi Arabia, 71.2% of patients with epilepsy experienced significant changes in their sleep.[86 87] Almost half of them had been seizure-free in the 3 months prior to the pandemic. Furthermore, 9.6% of patients surveyed reported more sleep than usual, 2.6% reported less sleep and 0.6% reported intermittent sleep.[86 87]

Sleep quality

Quality of sleep among different patient groups, as measured by PSQI, was affected during the pandemic. In Turkey, for patients with musculoskeletal pain, PSQI revealed a weak correlation with pain levels in all body parts.[88] Quality of sleep was found to be bad for 58.7% patients with cancer.[89] Depression, anxiety and defective SQ levels for pregnant women (mean age was 30.17±5.47 years) who were previously in quarantine was significantly higher.[90] SQ among patients with MS was significantly impaired during the pandemic too.[91]

Sleep problems

Although patients reported different experiences, a certain degree of sleep disorders was reported among almost all patients. In Jordan, Athamneh et al reported that 37.5% of patients with chronic headaches reported changes in sleeping patterns during the COVID-19 pandemic.[92] Finally, the frequency of sleep problems in patients with RD was significantly higher than that of non-patients, but significantly lower than that reported in hospital workers.[93]

DISCUSSION

This systematic review of the literature explored the impact of the COVID-19 pandemic on sleep health among populations in the Middle East. To the best of our knowledge, this is the very first systematic review on sleep health among any Middle Eastern population, and one of the first reviews to pool evidence on sleep health during the ongoing COVID-19 pandemic. The findings of our systematic review suggest that across all subpopulations (eg, adults, children, students, HCWs and people with chronic illnesses), the COVID-19 pandemic had a drastic negative Impact on sleep duration, SQ and prevalence of sleep disorders.

Sleep duration was negatively impacted in all populations investigated, whereby the prevalence of short or long sleep seems to have increased. Similarly, SQ in all

populations decreased drastically. Studies reported a consistent association between sociodemographic variables (eg, being single,[40 43 94 95] low education levels,[94–99] unemployment during the pandemic,[100] female gender,[40 48] low social support[73 101] and poorer SQ). Furthermore, with regard to sleep problems, insomnia was the most reported sleeping problem across studies. Higher prevalence of insomnia and other sleep disorders was observed among younger participants, those with a diagnosed mental disorder, unmarried participants and undergraduate students.[102] Such findings suggest that psychological stressors, which may have been exacerbated by the pandemic,[103 104] are associated with sleep problems and contributed to its high prevalence during the pandemic. Moreover, women reported higher rates of insomnia compared with men. Interestingly, there was an observed positive association between lockdown duration and the prevalence of insomnia. Finally, among people with chronic illnesses, reversal of sleeping pattern (eg, initiating sleep after sunrise) was the most frequent change in sleep habits.[86]

When comparing different sub-populations in this study, HCWs' sleep health was the most impaired during the pandemic compared with other subpopulations. While in other populations sleep duration was affected with no specific trend, HCWs demonstrated predominantly decreased sleep duration. Furthermore, in addition to reduced sleep duration, front line HCWs reported the lowest SQ. Among HCWs, being on the front line, being younger and having less experience working were all associated with increased insomnia prevalence. Nurses experienced emotional exhaustion and burn-out levels increased in line with insomnia.[105] Long shifts, busy working conditions and less sleep disturbed their sleeping patterns and made HCWs feel tired.

Our findings are consistent with prior research in other populations.[7 17 106 107] For instance, Jahrami et al reported an increased burden of sleep problem during the COVID-19 pandemic in early 2021, with approximately 40% of the general population reporting sleep problems.[17] Similarly, and consistent with our findings among Middle Eastern front-line workers, a meta-analysis conducted by Salari et al, showed that HCWs are more vulnerable to sleep disturbances during the pandemic.[107] This finding was associated with increased workplace stress and was shown in both nurses and physicians.[107]

The findings of this systematic review are important for public health policy and for directing intervention measures. Given that sleep is a risk factor for the leading causes of death including CVD, hypertension, diabetes, obesity, etc, interventions that promote sleep health are of high public health relevance, particularly in the current pandemic era. Such interventions can include social and administrative support, workplace interventions,[108] providing education that emphasises the importance of sleep behaviour, encouraging promoting behaviours and relaxation strategies. The differences in impact and severity of sleep health problems among

different subpopulations, as identified in this study, suggest that policies and interventions should be tailored to each population. Some authors have already suggested emergency management measures that should be taken to improve the quality of sleep in first line HCWs during a pandemic: strengthen exercise intervention, psychological counselling, drug intervention treatment strategies if necessary and other.[109] Similarly, sleep problems in childhood are linked with impaired motor and cognitive skills, as well as with difficulties in academic activities, emotional regulation, quality of life, growth, body composition and immune function.[110] A daily routine is a fundamental aspect of children's development of healthy behaviours and adequate energy levels. Interventions that focus on health promotion and advocating for healthy sleeping patterns among children, especially as it relates to other health behaviours development, should be implemented.

In addition to intervention efforts to address poor sleep among MENA populations, there is a strong need to understand barriers to adequate sleep among each subpopulation. The current literature provides evidence regarding barriers to adequate sleep focuses primarily on western populations. This includes environmental factors (eg, decreased green space),[111 112] social factors (eg, decreased social cohesion,[113] decreased safety)[114–116] and ambient factors (eg, increased air pollution,[117–121] increased noise).[122] However, there continues to be a lack of data on this topic in the MENA region despite high prevalence of poverty, gender inequality, political turmoil, violence and other factors that are strongly linked with PTSD and other psychological factors, which are known to affect sleep.[123 124] The unique social, structural and environmental context of the MENA region, in addition to the demonstrated exacerbation of poor sleep health by the pandemic, highlights why increased efforts to understand and address sleep health, particularly post-pandemic, is relevant for MENA populations.

Strengths, limitations and future research

This review is the first systematic review of the literature regarding the effects of COVID-19 pandemic on the sleep health of Middle Eastern populations. In addition, this paper provides a robust qualitative synthesis of data to include a wide scope of research on the topic published to date. This review covers a wide range of outcomes (eg, any study that reported a sleep health-related domain), includes only peer-reviewed articles as the source of information of high quality, and incorporates a wider scope of studies and populations. Despite those strengths, this study is not without noteworthy limitations that must be considered when interpreting our results. First, most included studies are cross-sectional in design, which poses an intrinsic limitation given the design. For instance, it is not possible to establish causation with such studies. In addition, most of the studies use self-reported surveys. Given the rapidly evolving situation with the pandemic (eg, lockdown measures, changes in epidemiology of COVID-19), this approach seemed the most suitable to

collect data rapidly. However, this introduces several limitations including self-selection bias, recall bias and social desirability bias.[125–127] Another limitation specific to the design of this review is that it excludes studies conducted in languages other than English. Moreover, quarantine requirements differed across different countries within the MENA region, which could have had varying effects on the health of the population. This variation was challenging to capture and control for within our review and must be a consideration when interpreting our results.

Furthermore, studies included in this review used different methods for assessing sleep health, which varied across populations. Mainly, this included subjective measures, including a variety of tools to measure sleep health (eg, PSQI, Insomnia Severity Index). In turn, this makes it challenging to compare results between different studies and different populations. In addition, it is important to note that no study included in this review used objective tools to measure sleep health (eg, actigraphy), and many studies used tools that do not have demonstrated validity or reliability in the context of sleep health measurement (eg, surveys developed by authors of the study). Consequently, future research should focus on using objective tools to measure sleep health. If not feasible, subjective tools with demonstrated reliability and validity are preferred. Finally, future research should continue to understand the long-term impacts of the abrupt change in lifestyle brought about by the COVID-19 pandemic on Middle Eastern populations.

CONCLUSIONS

This review sought to review and investigate the evidence between COVID-19-induced lockdowns on sleep health among different populations in the MENA region. Given high burden of poor sleep that has been exacerbated by the COVID-19 pandemic, there is a strong need for tailored interventions to improve sleep health. Finally, and considering that Middle Eastern populations continue to be severely understudied in public health, future research should continue to investigate and explore the impact of the COVID-19 pandemic on public health in The Middle East, including longitudinal studies using objective measures to assess the impact of sleep on the health of MENA populations across their lives.

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