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Burden of COVID-19 infection and lockdown measures on individuals with chronic diseases in Saudi Arabia: A national population-based study

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Abstract

Background: The recent COVID-19 crisis has placed a huge strain on the global health and economy. The toll of the damage on the human society exceeds the morbidity and mortality of the pandemic and the associated burden, considering the multidimensional impact on all aspects of life.

Objectives: The present study assessed the specific impact of COVID-19 on individuals with chronic diseases including the Years Lost for Disability (YLD) burden of COVID-19 infection, and multidimensional impact on the disease management, adaptive lifestyle, and socioeconomic dimensions.

Method: A national, population-based cross-sectional study was conducted among adult Saudi population. An internet-based questionnaire was used to collect sociodemographic characteristics, medical history, impact of COVID-19 lockdown on the management of the chronic disease, adaptive lifestyle, and impact of COVID-19 on family members. Additionally, data regarding eventual COVID-19 infection, severity and management were collected. YLD was estimated and normalized per 100,000 persons.

Result: Having a chronic disease was not associated with a greater risk of COVID-19 (relative risk [RR]=0.83, p = 0.153); however, it was associated with higher risk of declined physical activity (RR=1.30, p < 0.0001), deteriorated eating habit (RR=1.20, p = 0.002), sleep quality (RR=1.25, p < 0.0001), and overall health perception (RR=1.61, p < 0.0001), loss of family members due to COVID-19 (RR=1.96, p = 0.0001), and impacted household income (RR=1.11, p = 0.010). In case of COVID-19 infection, having a chronic disease was associated with increased risk of hospitalization (RR=5.04, p = 0.005) and having a moderate-to-severe form of COVID-19 (RR=6.00, p = 0.013). The overall YLD was estimated to be 17.7 per 100,000 individuals, and there was no significant difference between individuals with chronic diseases and those without.

Conclusion: COVID-19 entailed a substantial burden on the Saudi society in 2020, and individuals with preexisting chronic diseases suffered more important multidimensional impact, which need further research to assess the real impact of the pandemic and draw the pertinent lessons from the experience for future possible epidemics.

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1. Introduction

The recent COVID-19 crisis has placed a huge strain on the global health and economy. The toll of the damage on the human society exceeds the morbidity and mortality of the pandemic and the associated burden, considering the multidimensional impact on all aspects of life. The lockdowns implemented universally have hindered people's mobility and impacted both care seeking and...
Chronic diseases constitute the leading cause of mortality globally. In 2015, non-communicable diseases accounted for approximately 39.8 million all-age deaths globally, representing 71.3% of all-cause mortality [8]. In 2017, non-communicable diseases accounted for 73.4% of all-case deaths; and cardiovascular diseases, cancers, and HIV/AIDS represented the top three causes of death in age category 15–49 years, for a total 3 million deaths worldwide. In older age categories, i.e. 50 years and older, the top three causes of death in 2017 were cardiovascular diseases, cancers and respiratory diseases, for a total 18.5 million deaths globally [9,10]. On the other hand, substantial evidence showed the correlation of comorbid chronic diseases with the severity of COVID-19 and its subsequent debilitating sequelae. Systematic reviews and meta-analyses showed that COVID-19 patients with preexisting comorbidities such as cardiovascular diseases, diabetes, or chronic pulmonary disease were found to have up to 3.5-fold risk of developing a severe COVID-19, 4.4-fold risk of being admitted in intensive care, and 3-fold risk of mortality [11–13]. This is to be added to the overall burden of COVID-19 crisis and its specific burden on individuals with chronic diseases by reference to the general population.

Considering these observations, we hypothesized that an approach based on the assessment of the multidimensional impact of COVID-19 would provide a more comprehensive and accurate view on the burden of COVID-19 on individuals with preexisting chronic diseases, by comparison with comorbidity-free ones. This two-part study was designed to explore the burden of COVID-19 crisis and lockdown on the management of the chronic disease, adaptive lifestyle, socioeconomic dimension, and psychological health of people with chronic diseases, besides the direct burden of the COVID-19 infection and severity. In this first part, we present the results regarding the burden of COVID-19 infection, as estimated in term of Years Lost for Disability (YLD), in addition to the indirect impact on the disease management, adaptive lifestyle and socioeconomic dimensions. The psychological burden with the associated YLD will be presented in a separate report.

2. Methods

2.1. Design and population

A national, population-based cross-sectional analytic study was conducted, involving adult Saudi Arabia inhabitants, who were residing in the country during June and July 2020. The study protocol was reviewed and approved by the institutional review board at king Abdulaziz University (No 202–20).

2.2. Sampling

An internet based sample method was used, started by randomly selected seeds from each of the 13 regions in Saudi Arabia. In each region the data collectors select 10 household randomly, send the link to the adults, and ask them to distribute the link through twitter, facebook,WhatsApp, snapchat, e-mail, and text massage.

All eligible individuals who consented to participate and returned complete participations were included. The sample size was calculated to detect a risk ratio RR= 1.10 for a given adverse outcome among individuals with chronic diseases (exposed group), with 95% confidence interval (95%CI), by reference to an unknown baseline risk (0.50) in individuals with no history of chronic diseases (unexposed group). By assuming the proportion of the exposed group to be 35% (q1 =0.35) of the total sample size, reflecting the percentage of individuals with at least one chronic disease in an unweighted sample of the Saudi population [14], and by setting a two-tailed α = 0.05 and a statistical power β = 0.80, the sample size was calculated using the following formula [15]:

\[ A = Z_α \sqrt{p(1-p)(\frac{1}{q_1} + \frac{1}{q_0})} = 2.0533 \]

\[ B = Z_β \sqrt{p_1(1-p_1)/(1/q_1) + p_0(1-p_0)/(1/q_0)} = 0.8794 \]

\[ C = (p_1-p_0)^2 = 0.0025 \]

**Total sample size = N = (A+B)^2/C = 3440.** including 1204 (35%) in exposed group and 2236 (65%) in unexposed group.

Where, q0: Proportion of unexposed subjects within the total sample size = 0.65.

q1: Proportion of exposed subjects within the total sample size = 0.35, P0: Risk in unexposed subjects = 0.50 (unknown), P1: Risk in exposed subjects = 0.55 (RR=1.10), Zα is the standard normal deviate for α = 1.96, Zβ is the standard normal deviate for β = 0.8416, and P is the pooled proportion = (q1 * P1) + (q0 * P0) = 0.5175.

The target sample size was further increased to 5740, assuming a 60% response rate after exclusion of eventual noneligible and incomplete participations.

2.3. Data collection tools

A structured questionnaire was used which divided into the following six parts: 1) participants’ sociodemographic characteristics including age, gender, province, marital status, family income, and educational level; 2) comorbidities; 3) impact of COVID-19 lockdown on the management of the chronic disease, where applicable, including 5 dimensions (difficulty acquiring the medicine, irregular dispensation of treatment, receipt of specific guidelines during the pandemic, having had symptoms related to the condition that required doctors’ visit, and difficulty attending follow up visits); 4) adaptive lifestyle including the level of impact (worsened, unchanged or improved) of COVID-19 crisis on adherence to healthy food, physical activity, sleep quality, and overall health perception; 5) socioeconomic impact including COVID-19 infection among family members, loss of a family member due to COVID-19, and impact on household income; 6) perceptions about COVID-19 including level of risk perception (scale score from 10% to 100%), concerns about being infected with COVID-19 (Likert-type scale from 1 “not concerned at all” to 5 “extremely concerned”), and confidence in prevention against COVID-19 (Likert-type scale from 1 “not confident at all” to 5 “extremely confident”). In addition, the Depression, Anxiety and Stress Scale 21-item (DASS-21) was used to screen for anxio-depressive disorders; however, only stress scale was used in the present paper to define the post-acute consequences of COVID-19 infection as described below.

The questionnaire underwent face and content validity by multiple rounds of internal revision and rating of the relevance and importance of each item. This was followed by a pilot administration among a group of 20 voluntary participants to assess the clarity of the items.
2.4. Study variables

Since the present study investigated the multidimensional impact of COVID-19 on individuals with chronic diseases, the study variables are divided into the following types:

1) The exposure variable, consisting of the presence or not of chronic diseases and the number of chronic diseases, if any;
2) Outcome variables, consisting of all outcomes believed to result from COVID-19 pandemic and lockdown or subsequent to COVID-19 infection. These include the following: direct COVID-19 impact such as being infected with COVID-19 and severity and management setting; the impact of COVID-19 pandemic on lifestyle (sleep, food, exercise, etc.); impact on family members’ health and resources; and risk perception and level of concern towards and prevention self-efficacy against COVID-19;
3) Years lost for disability (YLD), which is also analyzed as an outcome and was computed as described below.

2.5. Procedure

The questionnaire was edited in an online using survey monkey, an internet based data collection tool, and a question stating the participant’s consent was added in the first section after a small introduction stating the study objectives, importance, and confidentiality terms. The link was distributed using social media including twitter, facebook,WhatsApp, snapchat, e-mail, and text massage.

2.6. Modeling and estimating the years lost for disability (YLD)

The YLD related to COVID-19 infections was calculated using the following formula:

\[ YLD = \sum_{h=1}^{l} Nh \times Dh \times DWh \]

With \( h \) corresponding to the health state, \( Nh \): number of cases with the health state, \( Dh \): mean duration (in years) of the health state \( h \), and \( DWh \): the disability weight of the state.

We followed the method proposed by Wyper et al. \[16\], who used the GBD 2013 estimates for respiratory tract infection to provide estimates of disability weight (DW) for 5 COVID-19 health states including asymptomatic (DW=0), mild/moderate (DW=0.051), severe (DW=0.133), critical (DW=0.655), and post-acute consequences (DW=0.219) \[16–18\]. In the present study, the post-acute syndrome state was defined as any individual who declared having contracted the COVID-19 and has a decline in sleep quality and or overall health perception or has high levels of stress defined as a DASS-21 stress Score ≥26. The durations of the different health states were defined according to whether the participant was hospitalized or not. For participants who were hospitalized for COVID-19, the duration of the health state used the mean hospital stay of 21.44 days, as estimated by Khan et al. \[19\]. For non-hospitalized participants, we used the duration of 7.79 days, as suggested by Wyper et al. \[16\]. The health states and their respective case definitions, disability weights and durations are summarized in Box 1.

For all COVID-19 related health states the disability duration, in years, was calculated by dividing the number of disability days by 365, thus assuming a single episode per concerned participant. The YLD was computed for every participant, and expressed per 100,000 individuals in the total population, as well as in individuals with versus those without chronic diseases.

2.7. Statistical methods

Statistical analysis was performed with the Statistical Package for Social Sciences version 21.0 for Windows (SPSS Inc., Chicago, IL, USA). Descriptive statistics were used to calculate frequencies and percentages within the levels of the different factor and outcome variables. The association of having the exposure factor (chronic diseases) with a given adverse outcome was analyzed using chi square or Fisher’s exact test, as applicable, with calculation of the risk ratio (RR). For score variables including levels of risk perception, concern and prevention confidence regarding COVID-19 infection, the association with exposure was analyzed by comparing the variance of mean scores between exposed and nonexposed groups using independent t-test. A \( p \) value of < 0.05 was considered to reject the null hypothesis.

3. Results

3.1. Participants’ flow

The total number of individuals who were approached to fill the questionnaire was 5983. Of these, 5861 (98.0%) accepted to participate, and the 122 (2%) remaining refused. Of the 5861 who accepted to participate, 854 (14.6%) did not complete the questionnaire. This resulted in 5007 valid participations (response rate=83.7%).

3.2. Demographic characteristics and medical history

Demographic data of the 5007 included participants showed a 1.52 female ratio and a high prevalence of the age categories 20–29 years (34.9%) and 30–39 years (29.3%). The household income showed a bell-shaped distribution with the highest with the median category being 5–10 K, totaling 21.8% of the participants. Educational levels were high, as 86.4% had a diploma of higher degree. Regional distribution was marked by predominant participation from Makkah region (51.0%), followed by Riyadh (13.5%) and Al-Sharqiyah (10.3%). Medical history showed prevalence of hypertension (7.9%), diabetes (7.2%), and thyroid diseases (5.3%), and 25.0% of the participants had at least one chronic disease (Table 1).

3.3. Impact of the lockdown on the chronic disease management among patients with comorbidities

Table 2 shows the levels of impact on various aspects of care for patients with chronic diseases during the pandemic, and by comparison between those who have a single versus those who have multiple conditions. Of the 1253 concerned participants, 46.0% had irregular discontinuation of their treatment during lockdown and 16.7% encountered difficulty getting their medicines. Further, the majority (79.1%) were not able to visit their physician for a follow up visit regarding their chronic disease during the lockdown period. Individuals who had multiple conditions experienced more often medication shortages (21.8% vs 14.9%, \( p = 0.004 \)) and symptoms related to their condition (32.2% vs 25.4%, \( p = 0.017 \)) as compared with those who have a single condition.

3.4. Multidimensional impact of COVID-19 crisis on individuals with chronic diseases

The overall prevalence of self-reported COVID-19 infection was 6.7%, with no significant difference (\( p = 0.0148 \)) among participants with chronic diseases (5.8%) and their counterparts (7.0%). However, having a chronic disease was associated with higher severity of COVID-19 with increased percentage of hospitalizations (9.6% versus 1.9%, \( p = 0.003 \)) and severe forms (4.1% versus 1.2%, \( p = 0.017 \)).
compared with those not having any chronic disease respectively. Regarding adaptive lifestyle during lockdown, participants with chronic diseases had more difficulty adhering to consuming healthy foods (23.9% versus 19.9%, p < 0.001) and physical activity (47.2% versus 36.2%, p < 0.001), and reported more frequent worsening of sleep quality (30.2% versus 24.1%, p < 0.001) and overall health perception (18.3% versus 11.3%, p < 0.001), by comparison to their counterparts respectively. Socially wise, participants with chronic diseases reported twice the rate of COVID-19-related deaths among their family members (4.4% versus 2.2%, p < 0.001) and more frequent impact on household income (39.6% versus 35.6%, p = 0.011) (Table 3).

3.5. Perceptions about COVID-19

Participants with chronic diseases had higher levels of risk perception about COVID-19 infection (mean score=64.86% versus 60.27%, p < 0.001), and displayed higher levels of concern (mean score=4.24 versus 4.09 out of 5, p < 0.001) and lower levels of prevention confidence (mean score=3.13 versus 3.23 out of 5, p = 0.011) (Table 3).

3.6. Relative risk of multidimensional impact of COVID-19 associated with the chronic disease status

The risk ratios related to chronic disease status for having different adverse outcomes are depicted in Table 4 and Fig. 1. Having a chronic disease was associated with higher risk of declined physical activity (risk ration [RR]=1.30, p < 0.0001), deteriorated eating habit (RR=1.20, p = 0.002), sleep quality (RR=1.25, p < 0.0001) and overall health perception (RR=1.61, p < 0.0001), loss of family members due to COVID-19 (RR=1.96, p = 0.0001), and impacted household income (RR=1.11, p = 0.010). In case of COVID-19 infection, having a chronic disease was associated with increased risk of hospitalization (RR=5.04, p = 0.005) and having a moderate-to-severe form of COVID-19 (RR=6.00, p = 0.013).

3.7. Caption

The forest plot depicts the relative risk (RR, 95%CI) for an individual with chronic disease to develop the given outcome during COVID-19 crisis and lockdown, by reference to individuals having no chronic diseases. Outcomes are divided into (a) outcomes in total cohort, and (b) specific outcomes after COVID-19 infection. The number of chronic diseases was significant in term of relative increase of RR for the following dimensions; that is, individuals with two or more chronic diseases had higher RR for deteriorated eating habit (RR=1.23 vs 1.19), declined physical activity (RR=1.46 vs 1.25), deteriorated sleep quality (RR=1.52 vs 1.16) and deteriorated overall health perception (RR=1.57 vs 1.36, p < 0.001).
**Table 2**

Impact of the lockdown on the chronic disease management among patients with comorbidities (N = 1253).

| Impacted dimension | All cases (N = 1253) | One comorbidity (N = 927) | Two or more comorbidities (N = 326) | p-value |
|--------------------|----------------------|--------------------------|------------------------------------|---------|
|                    | N   | %            | N   | %            | N   | %            |         |
| Medication supply (shortage) | 209 | 16.7         | 138 | 14.9         | 71  | 21.8         | .004 *  |
| Regular medication dispensation | 576 | 46.0         | 470 | 50.7         | 106 | 32.5         | <.001 * |
| Specific guidelines during the pandemic | 834 | 66.6         | 638 | 68.8         | 196 | 60.1         | .004 *  |
| Managing symptoms related to the chronic condition that needed a doctor visit | 340 | 27.1         | 235 | 25.4         | 105 | 32.2         | .017 *  |
| Attending doctor’s visits for follow up for the chronic disease | 991 | 79.1         | 754 | 81.3         | 237 | 72.7         | .001 *  |

**Table 3**

Association of multidimensional impact of COVID-19 and related lockdown with the presence of chronic diseases (N = 5007).

| Dimension                        | Level of impact | Presence of chronic diseases (N = 1253, 25.0%) | Absence of chronic disease (N = 3754, 75.0%) | p-value |
|----------------------------------|-----------------|-----------------------------------------------|--------------------------------------------|---------|
|                                  | N   | %            | N   | %            | N   | %            |         |
| **Direct COVID-19 impact**       |     |              |     |              |     |              |         |
| Infection with COVID-19          | No   | 1180         | 94.2| 3491         | 91.0| .148         |         |
|                                  | Yes  | 73           | 5.8 | 263          | 7.0 |             |         |
| Management place in case of COVID-19 infection (N = 336) | Home | 64 | 87.7 | 238 | 90.5 | .003 * |         |
|                                  | Quarantine units | 2 | 2.7 | 20 | 7.6 | <.001 * |         |
|                                  | Hospital§       | 7 | 9.6 | 5 | 1.9 |             |         |
| COVID-19 severity level (N = 336) | Asymptomatic   | 42 | 57.5 | 158 | 60.1 |             |         |
|                                  | Mild            | 26 | 35.6 | 38.8 | 38.8 |             |         |
|                                  | Moderate        | 2 | 2.7 | 0 | 0.0 | <.001 * |         |
|                                  | Severe          | 3 | 4.1 | 2 | 0.8 | <.001 * |         |
|                                  | Critical        | 0 | 0.0 | 1 | 0.4 | <.001 * |         |
| **Adaptive lifestyle**           |                 |                                             |                                             |         |
| Adherence to healthy food        | Worsened        | 300 | 23.9 | 748 | 19.9 |             |         |
|                                  | Unchanged       | 631 | 50.4 | 1672 | 44.5 |             |         |
|                                  | Improved        | 322 | 25.7 | 1334 | 35.5 | <.001 * |         |
| Level of physical activity       | Worsened        | 591 | 47.2 | 1358 | 36.2 |             |         |
|                                  | Unchanged       | 378 | 30.2 | 1280 | 34.1 | <.001 * |         |
|                                  | Improved        | 284 | 22.7 | 1136 | 29.7 |             |         |
| Sleep quality                    | Worsened        | 378 | 30.2 | 904  | 24.1 |             |         |
|                                  | Unchanged       | 580 | 46.3 | 1768 | 47.1 | <.001 * |         |
|                                  | Improved        | 295 | 23.5 | 1082 | 28.8 | <.001 * |         |
| Overall health perception        | Worsened        | 229 | 18.3 | 426  | 11.3 |             |         |
|                                  | Unchanged       | 744 | 59.4 | 2115 | 56.9 |             |         |
|                                  | Improved        | 280 | 22.3 | 1193 | 31.8 | <.001 * |         |
| **Family impact**                |                 |                                             |                                             |         |
| Family members contracted COVID-19 | No   | 1004 | 80.1 | 3062 | 81.6 |             |         |
|                                  | Yes  | 249 | 19.9 | 692  | 18.4 | <.259       |         |
| Lost a family member because of COVID-19 | No   | 1198 | 95.6 | 3670 | 97.8 |             |         |
|                                  | Yes  | 55  | 4.4  | 84   | 2.2  | <.001 *    |         |
| Family income impacted negatively | No   | 757 | 60.4 | 2418 | 64.4 |             |         |
|                                  | Yes  | 496 | 39.6 | 1336 | 35.6 | <.001 *    |         |
| **Perceptions about COVID-19**   | Mean             | SD | Mean | SD | p-value |             |         |
| Level of risk perception         | Score 10–100%   | 64.86%| 24.94% | 60.27%| 24.88% | <.001 *   |         |
| Level of concern                 | Score 1–5       | 4.24 | 0.85 | 4.09 | 0.92 | <.001 *    |         |
| Prevention confidence            | Score 1–5       | 3.13 | 1.20 | 3.23 | 1.81 | <.001 *    |         |

§ In case of COVID-19 infection, a participant having a chronic disease has a higher odd risk of being hospitalized by reference to one who has no chronic disease (OR=5.47, 95%CI=1.68 – 17.79; p = 0.005).

**Table 4**

Relative risk of multidimensional impact of COVID-19 in relation with the chronic disease status.

| Impacted dimension: adverse outcome | Sample size | Risk estimate | RR | 95%CI | p-value |
|------------------------------------|-------------|---------------|----|------|---------|
| COVID-19 infection                 | n1/N1=73/1253 | n2/N2=263/3754 | 0.83 | 0.65 | 1.07 | .153 |
| Hospitalization in case of COVID-19 infection | 7/73 | 5/263 | 5.04 | 1.65 | 15.43 | .005 * |
| Having a moderate-to-severe form   | 5/73 | 3/263 | 6.00 | 1.47 | 24.54 | .013 * |
| Deteriorated eating habit          | 300/1253 | 748/3754 | 1.20 | 1.07 | 1.35 | .002 * |
| Declined physical activity         | 591/1253 | 1358/3754 | 1.30 | 1.21 | 1.40 | <.0001 * |
| Deteriorated sleep quality         | 378/1253 | 904/3754 | 1.25 | 1.13 | 1.39 | <.0001 * |
| Deteriorated overall health perception | 229/1253 | 426/3754 | 1.61 | 1.39 | 1.87 | <.0001 * |
| Loss of a family member due to COVID-19 | 55/1253 | 84/3754 | 1.96 | 1.40 | 2.74 | .0001 * |
| Impacted household income          | 496/1253 | 1336/3754 | 1.11 | 1.03 | 1.21 | .010 * |

n1/N1: Number of participants with the given adverse outcome out of the total concerned participants with chronic diseases
n2/N2: Number of participants with the given adverse outcome out of the total concerned participants without chronic diseases
Relative risk of multidimensional impact of COVID-19 in relation with the number of chronic diseases.

Table 5

| Comparison                                | One (N=927) | p-value | Two or more (N=326) | p-value |
|-------------------------------------------|-------------|---------|----------------------|---------|
| Impacted dimension: adverse outcome       |             |         |                      |         |
| One (N = 927)                             |             |         |                      |         |
| COVID-19 infection                        | 0.89        | 0.68    | 1.18                 | .419    |
| Hospitalization in case of COVID-19 infection | 4.53  | 1.36    | 15.15               | .000 ** |
| Having a moderate-to-severe form          | 7.56        | 1.86    | 30.73               | .006 *  |
| Deteriorated eating habit                 | 1.19        | 1.04    | 1.36                | <.001 * |
| Declined physical activity                | 1.25        | 1.13    | 1.36                | <.001 * |
| Deteriorated sleep quality                | 1.16        | 1.3     | 1.31                | .005 *  |
| Declined overall health perception        | 1.50        | 1.27    | 1.78                | <.001 * |
| Loss of a family member due to COVID-19   | 2.28        | 1.60    | 3.25                | <.001 * |
| Impacted household income                 | 1.15        | 1.05    | 1.25                | .003 *  |
| RR: Risk ratio; reference category: not having chronic diseases
| 95%CI: 95% confidence interval

4.2. Management of chronic diseases during the COVID-19 crisis and lockdown

The advent of the COVID-19 crisis further complexified the management and escalated the burden of chronic diseases. To mitigate the issue, majority of the countries and health care systems have implemented specific measures such as virtual care to maintain the continuity of and improve access to care for patients with health issues other than COVID-19, including those with chronic diseases [20–24]. The reviews on effectiveness and cost-effectiveness of such a measure showed encouraging results, notably in Saudi Arabia, where telemedicine enabled maintaining adequate levels of care in different conditions and with a good patients’ satisfaction [25–27]. The present study failed to explore the use of and/or satisfaction about telehealth among the participants. Nevertheless, the findings revealed that individuals with chronic diseases struggled to maintain an adequate continuity of care during the lockdown periods, and most of them did not receive any guidelines regarding self-management or specific measures. Most importantly, the majority (79%) reported having missed follow up visits for their chronic diseases, while 46% faced difficulty in treatment dispensation and approximately 17% experienced shortage in medication supply. Comparable results were reported in healthcare centers in Jeddah, where a considerable proportions of patients with pre-existing chronic diseases reported difficulty attending their follow up appointments (44%), reaching their doctors (30%) or obtaining their medication...
(17%), which impact their overall health status [28]. In the present study, more than 18% of individuals with chronic diseases reported worsening in their health status during the lockdown, versus 11.3% among their counterparts.

Internationally, a global survey involving healthcare professionals reported that approximately 24% of the participants indicated poor management of patients with chronic diseases care since the COVID-19 outbreak, 66% reported moderate-to-severe impact in health services provided to these patients, and 65% reported medication shortages [30]. In Spain, a study involving 288 primary care centers showed significant impact in quality care indicators related to follow up, treatment and control of chronic diseases. More remarkably, authors observed a massive drop in the control of hypertension in patients with chronic kidney diseases, diabetes mellitus, or ischemic heart diseases, as well as the control of diabetes, hypothyroidism and dyslipidemia parameters [29]. A study from India showed that 30% of patients with chronic diseases experienced shortage of medications during lockdown period [30].

Beside the impacted accessibility to care, a decline in care seeking behavior and medication compliance may be observed among patients during the lockdown period and add to the specific burden of chronic diseases. A local study based in Jeddah showed a significant reduction in the treatment adherence during the lockdown period among type 2 diabetes patients [31]. Another study from New Zealand showed that more than half of adult primary care clients reported delayed care seeking during lockdown [2].

Furthermore, having multiple chronic diseases was associated with a higher frequency of medication shortage and unmanaged symptoms related to the chronic disease(s). Comparably, a community-based study from India showed that patients with multiple chronic diseases were 1.44 times more exposed to challenges in care continuity during the pandemic and had 1.49-fold risk of bad self-rated physical health [32].

Another aspect of the challenges and burden related to the management of chronic diseases during the COVID-19 crisis, and which was beyond the scope of the present study, is the delay in the diagnosis of chronic diseases. For instance, several authors observed significant drops in the number of newly diagnosed cases of cancers during the lockdown period associated with a decline in the screening practice, which may have resulted in a considerable number of preventable deaths [33–36]. A Spanish study showed massive decline in screening activity for chronic diseases during the first months of the pandemic, both in urban and rural areas, by comparison the previous year [29].

4.3. Adaptive lifestyle, socioeconomic impact and chronic diseases during COVID-19 lockdown

The present study showed a worsening in the lifestyle indicators in approximately 25–50% of individuals with chronic diseases, depending on the dimension, versus 20–36% among the other participants. The effect of COVID-19 lockdown on lifestyle has been thoroughly investigated. In Saudi Arabia, several authors observed significant reduction in physical activity and compliance with health diet in different subpopulations, which was associated with significant weight gain, along with deterioration in sleep quality [37–42]. Where such changes may have negative impact on healthy individuals, patients with preexisting comorbidities are exposed to greater health risks and quality of life impairment as a consequence of unhealthy lifestyle, notably with the increased risk of cardiovascular risk factors that inflate the morbidity in this category of patients [30,43–47].

Regarding the socioeconomic impact of COVID-19, we observed that individuals with chronic diseases had twice as much risk of losing a family member due to COVID-19 as their counterparts. This may be related to the relevance of family history in majority chronic diseases [48,49], in combination with the increased risk of COVID-19 mortality [50].

4.4. Years lost for disability (YLD)

Among the dimensions of COVID-19 impact that were explored in the present study is the YLD associated with COVID-19 acute respiratory infection, which was estimated to be 17.7 years per 100,000 individuals, with no significant difference between individuals with chronic diseases and their counterparts. Due to exclusion of mortality cases, the present study data failed to estimate the disability-adjusted life years (DALYs). By calculating the YLD burden in the adult Saudi population in 2020 [51], the absolute YLDs of COVID-19 infection can be estimated as 4681.6 person-years. Although international literature showed disparate estimates of YLDs, the ones reported in the present study are likely to be relatively high, corresponding, for instance, to the highest figures in Europe. In a study that estimated the burden of COVID-19 respiratory acute infection in 16 European countries, the YLDs estimates ranged between 38 in Estonia and 4791 person-years in Italy. Globally, YLDs related to COVID-19 accounted for less than 2–7% of DALYs in the period January-April 2020 while years of life lost represented up to 98%, depending on the region. Subsequently, the proportion of YLDs increased to represent up to 24% of DALYs in Asia, in the second semester of 2020. This represented a global YLDs burden of approximately 234,375 person-years on 31 May 2020, and 2,19 million person-years by the end of 2020 [52]. By normalizing these global YLDs estimates to 100,000 persons, we find that YLDs of 17.7 per 100,000 persons found in the present study is located within the center of the range 3.02 and 28.25 per 100,000 persons corresponding to global YLDs burden in 31 May and 31 December 2020 respectively. This consistency in findings supports the reliability of YLD calculation method used in the present study.

5. Conclusion

COVID-19 infection entailed a substantial burden on the Saudi society in 2020, with a YLD estimate of 4681.6 person-years among the adult population. Although the YLD did not differ by comorbidity status, individuals with preexisting chronic diseases suffered from more important multidimensional impact including disrupted lifestyle and socioeconomic impact, resulting in a higher impact on the overall health status by comparison to the general population. Additionally, several aspects of the chronic disease management were impacted due to lockdown measures, notably medication shortage and inaccessibility to routine follow up visits, which exposes to further health risks. Such multidimensional impact was even greater in case of multiple comorbidities. Notwithstanding the
odd risk of COVID-19 infection that was not observed in the present study, having a chronic disease was associated with an increased risk of severe COVID-19. The assessment of the real impact of the COVID-19 pandemic on individuals with chronic diseases remains a challenging objective, yet vital to analyze the gaps in management and draw the pertinent lessons from the different experiences.

5.1. Limitations

There are three limitations to the present study. The first one is the use of self-assessment regarding health parameters rather than objective tools, which affects the internal validity of the results. However, this risk is possible with any self-administered questionnaire. The second limitation is the internet-based data collection combined with the randomly selected seed method, which comprises a risk of systematic bias consisting of the elective exclusion of internet non-users. The third limitation is related to the unequal distribution of participants across the regions, which may limit the external validity of the findings and their generalizability to the national population. Additionally, the estimation of YLD is limited using assumed values for duration of health states and disability weights. Consequently, this may impact the overall external validity of the findings. On the other hand, the multidimensional assessments of COVID-19 impact combined with the comparative approach (individuals with versus without chronic diseases) would probably reduce the effect of systematic error, resulting in a better external validity.

Funding

This project was funded by the Deanship of Scientific Research (DSR) at King Abdulaziz University, Jeddah, under grant no. GCV19-13-1441. The authors, therefore, acknowledge with thanks DSR for technical and financial support.

Conflict of interest statement

The authors declare no conflict of interest.

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