Impacts of COVID-19 Pandemic on Psychological Well-Being of Older Chronic Kidney Disease Patients

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COVID-19 pandemic has been a major global issue, its eventual influences on the population welfare, global markets, public security, and everyday activities remain uncertain. Indeed, the pandemic has arisen a significant global threat. Its psychological impact is predicted to be severe and enduring, but the absolute magnitude is still largely unclear. Chronic kidney disease (CKD) is a complication markedly contributes to the mortality of COVID-19 cases, meanwhile several studies have demonstrated the high frequency and seriousness of the COVID-19 in CKD patients receiving dialysis. Importantly, the influence of COVID-19 among CKD patients without dialysis is still largely unexplored. Thus, we systemically summarized how mental health affects the spreading of COVID-19 to virtually worldwide, covering perspectives from several countries across a wide range of fields and clinical contexts. This review aims to provide the latest details and reveal potential concerns on the public health including psychological well-being of the older patients with CKD.

Keywords: COVID-19 pandemic, psychological well-being, aging-old age-seniors, immune system, chronic kidney disease

INTRODUCTION

Psychological well-being (PWB) is fundamentally equivalent to other phrases that apply to desirable psychological operations, including pleasure or fulfillment. It is not essential or valuable to consider the fundamental differences between all these phrases (1). Psychological well-being means being on good terms with others and leading a purposeful and meaningful life (2). It was found that people with positive psychological well-being are more carefree and enjoy a more vibrant and comfortable life (3). However, nearly 25% of people with chronic conditions experienced psychological problems related to COVID-19, particularly CKD patients (4, 5). Currently, personalized treatment should be the norm in handling CKD patients (6–10). Because of COVID-19, it seems to be far more critical that this approach be pursued to minimize the possibility of excessive or insufficient treatment and reduce the likelihood of developing a prejudice (11). This applies to COVID-19 as people's psychological well-being experienced the most significant impact during the pandemic. The ones with stable psychological well-being were in a better state than those whose well-being was below par (3). As there have been constant interruptions to everyday life owing to social distancing, which has been imposed to minimize the transmission of COVID-19, precedent hazards to public mental health were observed (12). The
risk of COVID-19 severe complications and poor prognosis is higher for CKD patients, particularly those who undergo chronic dialysis therapy, including higher rates of hospitalization, intensive-care unit admission, mechanical ventilation, and death (13). The well-being of patients has been a significant issue during the pandemic considering the mental effects on even ordinary healthy people were more critical than expected (14). Hence, the impact on the psychological well-being of older CKD patients will be studied.

INTERACTION BETWEEN COVID-19 AND PSYCHOLOGICAL WELL-BEING

The findings of the research conducted by Moreno et al. (15) are diverse (Table 1), possibly due to variations in the methodology adopted, the venues of the analysis, and the fact that the research takes place during the pandemic. Possible consequences of modifications to health resources on accessibility and reliability and performance of psychiatric services throughout the COVID-19 pandemic (16). Phobic anxiety, impulse purchase, and television addiction, all linked to psychological disruptions, insomnia, exhaustion, and consciousness deterioration, have been documented, and digital networking has been linked to heightened anxiety and depression-associated anxiety (17–19).

The illustration (Table 1) shows the possible effects of modifications to health resources on psychiatric services throughout the COVID-19 pandemic. It further describes the reliability and impact of these adjustments in resources amid the COVID-19 pandemic (13). Numerous people worldwide are now feeling stress and paranoia, particularly the elderly or people with existing health issues and even active and energetic youths. The anxiety is about the novel coronavirus, which the technical term is severe acute respiratory syndrome coronavirus (SARS-CoV-2) (20). This hideous virus induces a lethal respiratory condition known COVID-19, which brings fever, severe chest infections, and breathlessness (occasional lack of taste and smell or digestive troubles). COVID-19 is a disease that can escalate quickly; in certain instances, it can be fatal (21). Therefore, the psychological well-being of CKD patients during the period of COVID-19 should be concerned. The current situation is difficult for everyone in public, particularly for the older people who are existing mental health issues; such as anxiety and depression-associated anxiety that are more vulnerable to major medical problems related to coronavirus infection and the emergence of COVID-19 pulmonary disease with possibly catastrophic results (22).

HEALTH EFFECTS OF COVID-19: WORLDWIDE SITUATION

The World Health Organization states that the global transmission of COVID-19 is accelerated bit by bit. As shown by the data updated on 18 February 2020, the total number of confirmed instances had reached over 72,000, with almost 1,900 coming from China (32). The total number of deaths from COVID-19 is estimated to be more significant since the estimates vary from country to country. Although the virus affects everyone, assuming that all factors are identical, evidence has consistently shown that the death rate is higher among older individuals and people with complications (3, 33). The case fatality rate (CFR) of individuals aged 70 was between 0.3 and 3.5%. These figures are lower than the 8% CFR in patients between 70 and 79 and ~15% in patients over 80 in China. As for Italy, empirical studies indicate the average age of patients dying from COVID-19 was 80, with CFR rising above 70 years of age; 12.5% (34–43), 19.7% (44–53), and 22.7% (over 90) (54). A study found that found the subjects to have obtained COVID-19-related information once in a while from the following channels: online (including sites, online news, and internet networks, such as Facebook and Twitter), acquaintances, traditional media (including television, newspapers, and radio), structured activities on COVID-19 (be it online or face-to-face), medical workers in healthcare environments, colleagues, and families. This research concluded that about 80% of the subjects received COVID-19 information online (55).

EFFECTS OF LOCKDOWN ON HUMANS AMID COVID-19

Lockdown may also lead to pressure, resentment, and intensified harmful activities like internet gambling. In earlier outbreaks, the older person affected by lockdown had a higher likelihood of experiencing psychological problems and sorrow (23, 24). It has been observed that the number of elderly resorting to counseling services because of psychological distress has increased (25, 26). Local personal networks and experiences with other inhabitants, relatives, and caregivers due to isolation could also contribute to depression, immobility, and an inactive lifestyle among citizens, adding to their solitude. Solitude as well as social alienation have been associated with worse psychological health (for example, stress, despair, and neurological damage) along with the reduced quality of life (for example, weaker motor control, poorer heart health, sleep disturbance, and loss of strength) and increased death rates. Forced alienation may very well contribute to an inactive lifestyle, yet a person’s lifestyle is crucial to reducing physical, mental, and societal medical issues (27, 28).

Based on current evidence from past disease outbreaks and new data from the recent episode, it is anticipated that mental morbidity will eventually increase. Also, such morbidity may escalate afterward and last longer than the external harmful effects of the outbreak (29). Such a pattern is shown in various aspects throughout this edition, which states that the initial stages of the epidemic did not automatically trigger a rise in psychological well-being sessions. Nevertheless, transition to the current constraints introduced by COVID-19 has added burdens to the field of psychological well-being (30). Moreover, the predicted rise in psychiatric illness, which could lead to more suicidal behavior, is more likely to emerge during and after the outbreak, as the financial crisis, local mental health services, human weaknesses, and the harsh truth of radically transformed habits converge (31).
Controversial expectations, coping with significant shortcomings

ISSUES CAUSED BY COVID-19

ANALYZING THE PSYCHOLOGICAL issues caused by COVID-19

Controversial expectations, coping with significant shortcomings in the resources for screening and therapy and the protection of patients and health care professionals from infection, the pressure of current overall well-being measures that place restrictions on personal autonomy, tremendous and rising financial troubles, and contradictory instructions from professionals are some of the major factors which would inevitably contribute to endless difficulty and heightened threats of Covid-19-related psychological disorder (58, 59). Healthcare practitioners have a major role in resolving these serious consequences as part of the pandemic response (60, 61).

Wide analysis of poor mental health has proven that tremendous problems are widespread in infected communities, an observation that is likely to be replicated in populations affected by the Covid-19 pandemic. Owing to these challenges, numerous people refuse to give in to therapy. Some individuals have developed new attributes. Considering all factors, in “standard” disastrous incidents, technological failures, and deliberate events of massive destruction, a major concern is post-traumatic stress disorder (PTSD) arising from exposure to trauma. Contagious illnesses, such as dangerous virus infection, may not follow existing trauma frameworks required to study PTSD, but other psychological issues such as stress and anxiety can arise (62). Several communities could be more vulnerable than others in coping with the psychosocial effects of disease outbreaks. Particularly, people who suffer from the disease, those at increased risk for infection (including the elderly, people with lower resistance, and those residing in community surroundings), and people with prior medical, emotional, or drug use problems are at heightened risk for antagonistic psychosocial outcomes (63).

OLDER CKD PATIENTS DURING COVID-19 PANDEMIC

The COVID-19 pandemic revealed the notorious vulnerability of the monetary system and the overwhelming ramifications for

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### TABLE 1 | Implications for medical resources changes on availability, efficiency, and output of psychological treatment during the COVID-19 pandemic.

| Possible negative consequences | Possible positive consequences |
|--------------------------------|--------------------------------|
| The healthcare system’s primary emphasis on the detection, reduction, and control of COVID-19. | Knowledge about the psychological implications of COVID-19 has the potential to raise the public’s general psychological health awareness; the chance to highlight the significance of self-care, recovery measures, and household assistance; enhancement of funding for psychological health care from non-profit or private institutions; and multidisciplinary initiatives to activate support groups, using innovations to enable swift, scalable, and effective team interaction and collaboration inside and among teams (for example, psychological well-being, and basic treatment). |
| • Primary educational emphasis on physical wellbeing; emphasis on social distancing rather than bodily distancing while remaining linked. • Redistribution of services to meet physical wellbeing treatment demands; reduced face-to-face interactions among and inside care units; bodily and psychological toll on medical staff; personnel deficiencies in medical services. | • Improve bodily and psychological well-being through behavioral changes, the implementation of low-barrier destigmatized psychosocial assessments, counseling programs, and a student-to-student framework. |
| Controlled admission to other kinds of medical services as a critical component of COVID-19 management | Triage procedures that prioritize acute patients only resulted in a reduction in hospital visits (such as those for administering or distributing of drugs), emergency department visits, inpatient treatment, and pharmaceutical accessibility; community psychoeducation, community cognitive treatment, and mutual help initiatives being eliminated or scaled down; options for cardiometabolic and detrimental impact screening being reduced, overall inpatient spaces being reduced; hospital entry restrictions; reduced hospitalizations; hasty departure to mitigate the possibility of healthcare facility-related infection, particularly for those who have been hospitalized involuntarily. |
| Re-evaluation of the effective provision distribution, data retention regulations, and payment for telehealth and multimedia, virtual medical services, and choices for in-home care; availability strategies (for example, web channels), health policy, privacy rules, flexible drug coverage, including the usage of restricted drugs; creation of digital platforms for community outpatient therapies; controlling techniques that are less resistant to risk; less overcrowding in inpatient wards; re-evaluation of the duration of inpatient stays that are required; reassessment of the demand of forced medical services. |

Source: Moreno et al. (15).
TABLE 2 | Description of studies on older CKD patients negative psychological impact during COVID-19 in the review.

| References          | Country                        | Methods                                                                 | Participants/ Sample | Prevalence                                                                 | Impact on Psychological Well-Being                      |
|---------------------|--------------------------------|-------------------------------------------------------------------------|----------------------|-----------------------------------------------------------------------------|----------------------------------------------------------|
| Lee et al. (52)     | Western Pennsylvania and New Mexico | Phone survey                                                            | N = 49 participants, mean age: 56 years; gender: male 53% | • (1) 27% of the participants had clinical levels of depressive symptoms, but only 12% had anxiety meeting clinical criteria.  
• (2) About 33% of participants reported poor sleep quality over the last month. Perceived stress was high in about 30% of participants, and 85% felt overwhelmed by difficulties with COVID-19, although 41% felt that things were pretty/very often going their way. | • (1) Anxiety;  
• (2) Depressive symptoms. |
| Sousa et al. (91)   | Portugal                       | Mixed method: (1) quantitative method from medical records,               | N = 20, mean age: 66.9 (±11.9); gender: male 55% | • (1) Impact on family relationships (70%); fear of being infected due to high-risk condition (70%); increased emotional distress (55%); fear of getting infected in the dialysis unit (55%); difficulty adjusting to the contingency plan at the dialysis unit (55%); altered self-esteem and autonomy (40%).  
• (2) Impacts on disease and treatment-related health behaviors (25–55%), decreased physical activity (55%); management of dietary recommendations (35%); management of fluid restrictions (25%); need for nephrologist consultation (25%).  
• (3) Positive impacts (40%), personal growth (40%); increased social support (30%).  
• (4) Coping strategies (35-80%).  
• (5) Adherence to the protection measures at home (55%); engage in indoor and outdoor leisure activities (80%); seeking social support for instrumental use (65%); adherence to the protection measures at the dialysis clinic (55%); using social media and/or telephone to communicate (50%); religious coping (45%); seeking social support for emotional use (40%); avoidance (40%). | • (1) Emotional stress include anxiety;  
• Social distrust;  
• (3) Somatization. |
| Yang et al. (93)    | China                          | (1) Survey                                                               | N= 273, mean age: 59.9 (+/- 14.4); gender: male 41.4% | (1) Nonspecific psychiatric morbidity 45.8% by using General Health Questionnaire-28 (GHQ-28)  
(2) Clinical concern (19.4%) by using Impact of Events Scale–Revised (IES-R)  
(3) Kidney Disease Quality of Life (KDOQOL) and KDOQOL-38 Short Form (SF) were significantly improved when compared with the initial study (p = 0.006 and p = 0.031, respectively)  
(4) General Health Questionnaire-28 (GHQ-28) and Impact of Events Scale–Revised (IES-R) did not have significant change, but there were improvement in somatic symptoms (p= 0.006); anxiety and insomnia (p= 0.005); and intrusion (p=0.049) | (1) Somatic symptoms  
(2) Anxiety  
(3) Insomnia  
(4) Duration of hemodialysis may affect mental health, CoL, or health status. |
| Barutcu Atas et al. (49) | Turkey                        | (1) Survey                                                               | N = 106, mean age: 44.2 (+/− 13.3); gender: male 61.3% | • (1) High-perceived stress (49, 46.2%),  
• (2) Poor sleep quality (51, 48.1%)  
• (3) Insomnia (40, 37.7%)  
• (4) Anxiety (25, 23.6%)  
• (5) Depression (47, 44.3%)  
• (6) Regression analyses revealed that high-perceived stress is an independent predictor of anxiety and depression. | • (1) Stress,  
• (2) Sleeping quality,  
• (3) Anxiety,  
• (4) Depression. |
our financial structure should new tactics not be adopted to tailor medical services to specific patient subgroups. The massive group of elderly and feeble people over 65 poses a public health concern. According to the latest data from the Istituto Superiore di Sanità of Italy, COVID-19 tends to be more deadly among elderly patients: 96.4% of deaths were over 60 years of age. People aged 70 or above account for 35.5% of instances as statistics were classified by age level, whereas participants aged over 80 accounts for 52.3%. Patients with renal disease are an elderly group that is especially susceptible to infection and carries a higher risk of death than the average person. The massive group of elderly and feeble people over 65 poses a public health concern. The COVID-19 pandemic revealed the notorious vulnerability of the monetary system and the overwhelming ramifications for our financial structure should new tactics not be adopted to tailor medical services to specific patient subgroups (64).

Given that most patients with CKD are seniors, who experience biological deterioration of renal function and are more vulnerable to renal disease, COVID-19 emerges as a pertinent issue because of the heightened risk of comorbidities and fatality in patients with chronic renal disease (65). Moreover, specific antiviral and immunosuppressive approaches to combat COVID-19 infection have been hampered by severe renal damage. The combination of age and chronic renal disease is most likely a possible cause of COVID-19 in immunosuppressive activity. Immunol senescence is a condition that occurs in older adults and is accompanied by weakened responsive and inherent immune function (66). Numerous changes have occurred, including thymic involution, a reduction in naïve T-cells and progenitor B-cells, and a reduction in the production of MHC class II on macrophages. Among chronic renal disease cases, a significant immunosuppressive condition has been observed as well: (i) diminished granulocyte and monocyte/macrophage phagocytic activity; (ii) reduced antigen-presenting potential of antigen-presenting cells; (iii) loss of antigen-presenting dendritic cells; (iv) weakened B lymphocyte numbers and immune generating ability; (v) reduction in naïve and central memory CD4+ and CD8+ T lymphocytes; (vi) disrupted cell-mediated resistance. Because of such considerations, older CKD patients must fully adhere to the guidelines of the Ministry of Health and Nephrological Scientific Societies for COVID-19 reduction (34–53, 67–92).

**CHALLENGES AND RECOMMENDATIONS CONCERNING THE PSYCHOLOGICAL IMPACT AMONG CKD PATIENTS**

Under the outbreak, further attention to be paid to public health, both physical and psychological, to help communities during this challenging period (71–73). The COVID-19 outbreak has brought many extra challenges to the study, planning, and management of health (4, 74, 75). The problems of COVID-19 mental health and bureaucratic responses to the outbreak are not exactly unprecedented. Past mental health deficiencies could become more deep-rooted and considerably more difficult to tackle (76, 77). Evidence from all over the world of shifts in individuals’ mental health, possibly attributable to the COVID-19 outbreak, has been hindered by the use of residence assessments, distorted or unverifiable mental health metrics, and the lack of other pre-COVID-19 conventional knowledge to measure the transition, be it among individuals or throughout the whole population (78, 79, 93–95).

One study showed elevated rates of mental illness among US adults in 2020 compared with 2018, and the increase was the most significant among young adults aged between 18 and 24 and females (19). Legislators, politicians, and specialized agencies require accurate information on the shifts in mental health associated with the outbreak so that decisions are backed by knowledge on the extent of transitions in individuals’ mental health and vulnerability to psychiatric problems (80). In such a crisis, the ability to track and address psychosocial needs during proper consultation in clinical care is severely constrained by the immense complexity of household regulation. Strategies for telemedicine are given to psychosocial institutions and are increasingly distributed in stimulating environments (81). As far as COVID-19 is concerned, psychosocial evaluation and monitoring may include concerns linked to COVID-19 stress factors (e.g., exposures to infected materials, infected family members, loss of loved ones, and segregation) and further mishaps (e.g., economic hardship) (82, 83).

Psychosocial impacts include depression, stress, psychiatric disturbances, insomnia, heightened drug use and aggressive actions at home, and signs of vulnerability (84) (Table 2), such as previous physical or emotional disorders. Some individuals may need guidance regarding structured psychological health evaluation and treatment. Others benefit from ongoing counseling to enhance health and facilitate adjustment (e.g., psychoeducation or cognitive behavior approaches) (85, 86). Given the increasing financial crisis and the multiple threats of this outbreak, self-destructive thoughts may emerge, which entails a timely meeting with professionals or a recommendation for possible crisis psychiatric hospitalization (87, 88). At the gentler end of the psychosocial spectrum, a large amount of interaction between patients, families, and the wider populace could be better structured by presenting evidence on typical reactions to this form of resistance and by drawing attention to what people can do in the middle of severe circumstances (89, 90).

In a multivariable study, Varshney et al. (48) found that advanced age, prolonged illness, the existence of breathing troubles, and absence of community backup have a significant correlation with unusual mental effects of COVID-19 on individuals with chronic disease. Once they need to go outside for provisions, elderly CKD patients and those living on their own become especially susceptible. Throughout the COVID-19 epidemic, numerous CKD patients in the early to later phases of kidney disease might have testing arrangements postponed. Failure to detect significant development of CKD has profound implications for both the patient and the community (Figure 1) (64, 91).

Healthcare practitioners may provide guidelines for mental stress and adjustment (such as planning exercises and timetabling) (92), connect patients with psychosocial health departments, and encourage patients to pursue adequate mental health assistance as needed (34). Nadler et al. (35) noted that...
because the caregivers typically lessen their children’s discomfort, transparent talks should be encouraged to discuss children’s reactions and issues. As far as health care providers themselves are concerned, the innovative concept of SARS-CoV-2, preliminary screening, minimal treatment options, insufficient PPE and other medical resources, prolonged unresolved pressures, and other related risks are sources of stress and could potentially overwhelm systems (36, 37). SARS-CoV-2 is spread from humans to humans through direct contact with an infected person via nasal spills or touching contaminated substances. Maturity and chronic illness have been identified as possible causes of severe disease and death (38). Ghinai et al. (39) confirmed that SARS-CoV-2, which resulted in the condition currently known as COVID-19, had been disseminated across China and 26 more countries as of 18 February 2020. Advanced age, being female, extended illness, breathing symptoms, and lack of social support were essentially related to the peculiar mental impact of COVID-19 on patients with renal impairment. Patients aged 34 or older were more likely to suffer from psychiatric disorders due to the recent outbreak (40, 41). This result invalidates an Indian study where young adults encountered more significant psychological problems due to COVID-19. This discrepancy may be attributed to the incorrect assumption that COVID-19 is not as accurate in younger individuals (42, 43).

Self-care offered by providers, like mental healthcare providers, requires training on disease and risks (44), tracking someone’s pressure reaction, as well as seeking adequate assistance with personal and occupational responsibilities and issues, such as professional mental health (22, 45, 46). Healthcare systems must handle the burden of subcontractors and comprehensive operations by evaluating reactions and implementation, modifying projects and plans, adjusting expectations, and designing tools to deliver psychosocial assistance based on the circumstances (47).

DISCUSSION

The health care system must offer coaching and instruction on psychosocial problems to healthcare service administrators, emergency personnel, and health care providers. Mental health and emergency response systems must work together to identify, establish and allocate evidence-based resources such as disaster-related mental health, psychological well-being crisis and referral, special patient needs, and alarm and distress treatment. Risk consultation initiatives should resolve the difficulty of emerging problems, such as legislation, vaccination affordability and sufficiency, and the need for evidence-based arrangements related to disease outbreaks, and tackle various psychosocial considerations. Psychological well-being practitioners may strengthen perceptions that can be expressed through supporting the experts. The COVID-19 episode has a devastating impact on personal and collective welfare and care work. Despite health concerns, ultimately, medical treatment practitioners have a significant role in tracking psychosocial needs and delivering psychosocial assistance to their patients, providers of therapeutic services, and social initiatives that should be integrated into overall pandemic healthcare. COVID-19 has contributed to increased recognized risk factors for mental health problems. In addition to weirdness and insecurity, quarantine and physical isolation can lead to significant alienation, lack of income, delays, limited access to core domains, increased exposure to alcohol and internet betting, and decreased family and community assistance, especially in
more vulnerable people (21). The COVID-19 outbreak also provides a significant barrier to involvement in preliminary testing for older adults with tumors who are currently under-served in oncology and other clinical tests. Testing or possible admission to such therapeutic initial testing has been completed or based on several assessment projects worldwide.

CONCLUSION

COVID-19 is an evolving and rapidly growing disease that warrants personalized attention and assessment depending on the incidence of the infection. When humanity is dealing with the outbreak and working to find ways to effectively distribute cancer treatment to more mature patients, it is necessary to intervene to protect the vulnerable and counter the prolonged detrimental consequences in this age group. Since this is unlikely the last outbreak in human history, it is crucial to embrace this opportunity to discover facts and formulate strategies for any possible scenarios. It should also be understood that previous studies could contribute to a range of uses depending on the stage of the outbreak. Overall, it is especially critical that older individuals practice social distancing. Nevertheless, the scientific evidence of the experiences of older adults has been minimal so far. To understand the impact of the outbreak on more mature people and to develop viable arrangements, it is vital to examine how older individuals respond to quarantine measures and identify the difficulties and frustrations faced by older people and patients with CKD.

AUTHOR CONTRIBUTIONS

AC and PT carried out the outline of this manuscript. AC wrote the manuscript with support from JH and JL. JH and JL gave valuable comments and suggestion. PT helped to supervise the whole manuscript with his professional advances in Chronic Kidney Disease. AC and PT linked up the situation of nowadays older CKD patients during COVID-19 and their risk factors of psychological well-being. All authors contributed to the article and approved the submitted version.

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REFERENCES

1. Shanthanna H, Bhatia A, Radhakrishna M, Kelley-Cote E, Vanniyasingam T, Thabane L, et al. Intervenional pain management for chronic pain: a survey of physicians in Canada. *Canad J Anesthesia* (2020) 67:343–52. doi: 10.1007/s12158-019-01547-w
2. Salehinejad MA, Majdinezhad M, Ghanavati E, Kouestanian S, Vicario CM, Nitsche MA, et al. Negative impact of COVID-19 pandemic on sleep quantitative parameters, quality, and circadian alignment: implications for health and psychological well-being. *EXCLI J* (2020) 19:1297. doi: 10.1100/EXCLI.2020.07.09.20149138
3. Torales J, O’Higgins M, Castaldelli-Maia JM, Vetrigni A. The outbreak of COVID-19 coronavirus and its impact on global mental health. *Int J Soc Psychiatry* (2020) 66:317–20. doi: 10.1177/0020764020915212
4. Heid AR, Cartwright F, Wilson-Genderson M, Pruchno R. Challenges experienced by older people during the initial months of the COVID-19 pandemic. *COVID-19 Res*. (2021) 61:48–58. doi: 10.1093/genort/gnaa138
5. Singhai K, Swami MK, Nehhini N, Rastogi A, Jude E. Psychological adaptive difficulties and their management during COVID-19 pandemic in people with diabetes mellitus. *Diabetes Metabolic Syndrome Clin Res Rev*. (2020) 14:1603–5. doi: 10.1016/j.dsx.2020.08.025
6. Tang PMK, Nikolic-Paterson DJ, Lan HY. Macrophages: versatile players in renal inflammation and fibrosis. *Nat Rev Nephrol*. (2019) 15:144–58. doi: 10.1038/s41581-019-0110-2
7. Tang PMK, Zhang YY, Hung JSC, Chung JYF, Huang XR, To KF, et al. DPP4/CD32b/NF-kB circuit: a novel druggable target for inhibiting CRP-driven diabetic nephropathy. *Mol Ther*. (2021) 29:365–75. doi: 10.1016/j.ymthe.2020.08.017
8. Tang PCT, Chan ASW, Zhang CB, Córdoba CAG, Zhang YY, To KF, et al. TGF-β1 signaling: immune dynamics of chronic kidney diseases. *Front Med*. (2021) 8:628519. doi: 10.3389/fmed.2021.628519
9. Tang PMK, Zhang YY, Xiao J, Tang PCT, Chung JYF, Li J, et al. Neural transcription factor Pou4f1 promotes renal fibrosis via macrophage–myofibroblast transition. *Proc Natl Acad Sci USA*. (2020) 117:20741–52. doi: 10.1073/pnas.1917633117
10. Tang PCT, Zhang YY, Chan MKK, Lam WWY, Chung JYF, Kang W, et al. The role of older individuals and COVID-19 on sleep and psychological well-being. *EXCLI J* (2020) 19:1297. doi: 10.1100/EXCLI.2020.07.09.20149138
11. Martel AL, Abdolmaesumi P, Stoyanov D, Mateus D, Zuluaga MA, Zhou SK, et al. Medical imaging computing and computer assisted intervention – MICCAI 2020: 23rd International Conference, Lima, Peru, October 4–8, 2020. In: Proceedings, Part IV. Lecture Notes in Computer Science 12264. (2020). doi: 10.1007/978-3-030-59713-9
12. Xiong J, Lipsitz O, Nasri F, Lui LM, Gill H, Phan L, et al. Impact of COVID-19 pandemic on mental health in the general population: a systematic review. *J Affect Disord*. (2020) 277:55–64. doi: 10.1016/j.jad.2020.08.001
13. Yamada T, Kimkani T, Chopra N, Miyashita H, Chernyavsky S, Miyashita S. Patients with chronic kidney disease have a poorer prognosis of coronavirus disease 2019 (COVID-19): an experience in New York City. *Int Urol Nephrol*. (2020) 52:1405–6. doi: 10.1007/s11255-020-02494-y
14. Bostan S, Erdem R, Öztürk YE, Kılıç T, Yilmaz A. The effect of COVID-19 pandemic on the Turkish society. *Electronic J General Med*. (2020) 17:e237. doi: 10.29333/ejgm/7944
15. Moreno C, Wykes T, Galdersi S, Norderoft M, Cressy N, Jones N, et al. How mental health care should change as a consequence of the COVID-19 pandemic. *Lancet Psychiatry*. (2020) 7:813–24. doi: 10.1016/S2215-0366(20)30307-2
16. Strang P, Bergstrom J, Martinsson L, Lundstrom S. Dying from COVID-19: loneliness, end-of-life discussions, and support for patients and their families in nursing homes and hospitals. A national register study. *J Pain Symptom Manage*. (2020) 60:e2–13. doi: 10.1016/j.jpainsymman.2020.07.020
17. Simoes e Silva AC, Miranda AS, Rocha NP, Teixeira AL. Neuropsychiatric disorders in chronic kidney disease. *Front Pharmacol*. (2019) 10:932. doi: 10.3389/fpharm.2019.00932
18. Rigoli F. The link between coronavirus, anxiety, and religious beliefs in the United States and United Kingdom. *PsyArXiv [Preprint]*. (2020). doi: 10.31234/osf.io/owyqek
Recommendations from the International Society of Geriatric Oncology (SIGO) COVID-19 Working Group. *J Geriatric Oncol*. (2020) 11:1190–8. doi: 10.1016/j.jgo.2020.07.008

Sanyalo A, Okorie C, Marinikovic A, Patidar R, Younis K, Desai P, et al. Comorbidit y and its impact on patients with COVID-19. *JN Comprehs Clin Med*. (2020) 2:1069–76. doi: 10.1007/s42399-020-00364-3

Vik-Mo AO, Giil LM, Borda MG, Ballard C, Aarsland D. The individual course of neuropsychiatric symptoms in people with Alzheimer’s and Lewy body dementia: 12-year longitudinal cohort study. *Br J Psychiatry*. (2020) 216:43–8. doi: 10.1192/bjp.2019.195

Selvin E, Juraschek SP. Diabetes epidemiology in the COVID-19 pandemic. *Diabetes Care*. (2020) 43:1690–4. doi: 10.2337/dc20-1295

Tan BY, Chew NW, Lee GK, Jing M, Goh Y, Yeo LL, et al. Psychological impact of the COVID-19 pandemic on health care workers in Singapore. *Ann Intern Med*. (2020) 173:317–20. doi: 10.7326/M20-1083

Caqueo-Urizar A, Urzúa A, Aragón-Caqueo D, Charles CH, El-Khatib Z, Otu A, et al. Mental health and the COVID-19 pandemic in Chile. *Psichol Trauma Theory Res Pract Policy*. (2020) 12:521–3. doi: 10.1037/trat0000753

Alonso-Lana S, Marqué M, Ruiz A, Boada M. Cognitive and Neuropsychiatric Manifestations of COVID-19 and Effects on Elderly Individuals With Dementia. *Front. Aging Neurosci*. (2020) 12:588872. doi: 10.3389/fnagi.2020.588872

Coppolino G, Presta P, Nicotera R, Placida G, Vita C, Carullo N, et al. COVID-19 and renal disease in elderly patients. *Geriatric Care*. (2020) 6. doi: 10.4801/gec.2020.9029

Corej J, Astor BC, Greene T, Eknoyan G, Levey AS. Prevalence of chronic kidney disease and decreased kidney function in the adult US population. Third National Health Nutrition Examination Survey. *Am J Kidney Dis*. (2003) 41:1–2. doi: 10.1053/ajkd.2003.50007

U. S. Renal Data System. Annual Data Report: Atlas of Chronic Kidney Disease and End-Stage Renal Disease in the United States. National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, MD (2013).

Eckardt KU, Berns JS, Rocco MV, Kasiske BL. Definition and classification of CKD: the debate should be about patient prognosis – a position statement from KDOQI and KDIGO. *Am J Kidney Dis*. (2009) 53:915–20. doi: 10.1053/ajkd.2009.04.001

Fehmran-Ekelhorn I, Skephollm L. Renal function in the elderly (>70 years old) measured by means of iohexol clearance, serum creatinine, serum urea and estimated clearance. *Scand J Urol Nephrol*. (2004) 38:73–7. doi: 10.1002/0036559031H015750

Dowling TC, Wang ES, Ferrucci L, Sorkin JD. Glomerular filtration rate equations overestimate creatinine clearance in older adults enrolled in the Baltimore longitudinal study on aging: impact on renal drug dosing. *Pharmacotherapy*. (2013) 33:912–21. doi: 10.1002/phar.1282

Koppe L, Klich A, Dubourg L, Hadj-Aissa A. Performance of the Cockcroft-Gault formula in patients with CKD. *Clin Chem Lab Med*. (2013) 51:102119. doi: 10.1016/j.ajp.2020.102119

Bambra C, Riordan R, Ford J, Matthews F. The COVID-19 pandemic and health inequalities. *J Epidemiol Commun Health*. (2020) 74:964–8. doi: 10.1136/jech-2020-214401

Rapelli G, Lopez G, Donato S, Pagani AF, Parise M, Bertoni A, et al. A postcard from Italy: challenges and psychosocial resources of partners living with and without a chronic disease During COVID-19 epidemic. *Front Psychol*. (2020) 11:3559. doi: 10.3389/fpsyg.2020.567522

Huppert FA. Psychological well-being: evidence regarding its causes and consequences. *Appl Psychol Health Well Being*. (2009) 1:137–64. doi: 10.1111/j.1758-0854.2009.00108.x

Helmich RC, Bloem BR. The impact of the COVID-19 pandemic on Parkinson’s disease: hidden sorrows and emerging opportunities. *J Parkinson's Dis*. (2020) 10:3351. doi: 10.3233/JPD-202038

Goddin D, Obrenovic B, Khudaykulov A. Effects of economic uncertainty on mental health in the COVID-19 pandemic context: social identity disturbance, job uncertainty and psychological well-being model. *Int J Innov Econ Dev*. (2020) 6:61–74. doi: 10.18775/iied.1849-7551-7020.2015.11.0025

Bebbingt PN, McManus S. Revisiting the one in four: the prevalence of psychiatric disorder in the population of England 2000–2014. *Br J Psychiatry*. (2020) 216:55–7. doi: 10.1192/bjp.2020.196

Curigiano G, Cardoso MJ, Poortmans P, Gentilini O, Pravettoni G, Mazocco K, et al. Recommendations for triage, prioritization and treatment of breast cancer patients during the COVID-19 pandemic. *Breast*. (2020) 52:8–16. doi: 10.1016/j.breast.2020.04.006

Philip M, Mahakalka CC, Kap MN, Khirsagar S, Shukla A. Mental and behavioral changes during COVID 19 pandemic and how to deal with it. *J Crit Rev*. (2020) 7:1105–12. doi: 10.3183/jcr.07.1105

Nouri S, Khoong EC, Lyles CR, Karliner L. Addressing equity in telemedicine for chronic disease management during the Covid-19 pandemic. *NEJM Catalyst Innov Care Deliv*. (2020) 1:1–13. doi: 10.1056/CAT.20.0123

Cullen W, Gulati G, Kelly BD. Mental health in the Covid-19 pandemic. *QJM Int Med*. (2020) 113:111–2. doi: 10.1093/qjmed/cha110

Pfefferbaum B, North CS. Mental health and the Covid-19 pandemic. *New Engl J Med*. (2020) 383:510–2. doi: 10.1056/NEJMmp2008017

Sultana A, Sharma R, Bossam MM, Bhattacharya S, Purohit N. Burnout among healthcare providers during COVID-19 pandemic: challenges and evidence-based interventions. *SocArXiv 4hxga*, Center for Open Science (2020). doi: 10.31235/osf.io/hxsga

Beaghehole R, Epping-Jordan J, Patel V, Chopra M, Ebrahim S, Kidd M, et al. Improving the prevention and management of chronic disease in low-income and middle-income countries: a priority for primary health care. *Lancet*. (2008) 372:940–9. doi: 10.1016/S0140-6736(08)61404-X

Maugeri G, Castrogiovanni P, Battaglia G, Pippi R, D’Agata V, Palma A, et al. The impact of physical activity on psychological health during Covid-19 pandemic in Italy. *Helyon*. (2020) 6:e04315. doi: 10.1002/hely.2020.e04315

Mclglnchey E, H itch C, Butter S, McCaughley L, Berry E, Armour C. Understanding the lived experiences of healthcare professionals during the COVID-19 pandemic: an interpretative phenomenological analysis. *PsyArXiv [Preprint]*. (2020). doi: 10.31234/osf.io/7cvaj

Mirsky JB, Horn DM. Chronic disease management in the COVID-19 era. *Am J Manag Care*. (2020) 26:329–30. doi: 10.37765/ajmcc.2020.43838

Sousa H, Ribeiro O, Costa E, Frontini R, Paul C, Amado L, et al. Being on hemodialysis during the COVID-19 outbreak: a mixed-methods study exploring the impacts on dialysis adequacy, analytical data, patients’ experiences. *Semin Dial*. (2021) 34:66–76. doi: 10.1111/sdi.12914

Guo Y, Cheng C, Zeng Y, Li Y, Zhu M, Yang W, et al. Mental health disorders and associated risk factors in quarantined adults during the COVID-19 outbreak in China: cross-sectional study. *J Med Internet Res*. (2021) 22:e20328. doi: 10.2196/20328

Yang ZH, Pan XT, Chen Y, Wang L, Chen QX, Zhu Y, et al. Psychological profiles of Chinese patients with hemodialysis during the panic of coronavirus disease 2019. *Front Psychiatry*. (2021) 12:1257. doi: 10.3389/fpsyt.2021.616016

Spoorhoy MS, Pratapa SK, Mahant S. Mental health problems faced by healthcare workers due to the COVID-19 pandemic—a review. *Asian J Psychiatr*. (2020) 51:102119. doi: 10.1016/j.ajp.2020.102119
95. Sharma H, Verma S. Preservation of physical and mental health amid COVID-19 pandemic: recommendations from the existing evidence of disease outbreaks. *Int J Acad Med.* (2020) 6:76. doi: 10.4103/IJAM.IJAM_47_20

**Conflict of Interest:** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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