ORIGINAL ARTICLE

Design recommendation of a care center to overcome the psychological and behavioral impact of infectious diseases on humans

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ABSTRACT

The Covid 19 pandemic threatened the life of individuals, and there was a lack of information on treatment, handling of patients and disposal of waste. The psychological and behavioral impact on humans due to outbreak of Covid is studied and based on that, a person-centered care center is suggested. The research methodology used are surveys and interviews among stake holders. Based on the surveys and interviews conducted during the pandemic, it is found that 94% of the respondents prefer to use private vehicles with at least one member to accompany them. People prefer to use 3 ply facemasks, followed by cotton masks and N95 masks. Existing literature discusses the physical effects on individuals. This paper focuses on psychological and behavioral changes. Based on the study, person centered a care center is recommended with facilities to treat patients with different levels of infections and a counselling center for the persons suffering from Covid and other infectious diseases.

Key words:
covid; psychological effect; behavioral; face mask; care center

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INTRODUCTION

The COVID-19 pandemic has threatened the health and lives of millions of people across the globe. On the 30th January 2020, the World Health Organization declared a public health emergency of international concern, and governments were urged to prepare for the global spread of Covid-19 from East Asia .[1] The primary focus has been on preventing transmission of the virus by developing health guidelines through digital apps and platforms, [2,3] finding the right treatment and developing a vaccine. Limited attention was given to the behavior and psychological changes [4-5] due to lock down, lack of social interactions, online work and education,[6] which has prominent effects on humans[7]. The Covid infected respondents and their family members suffered psychologically which included anxiety related to health, life and global uncertainty [8] to the effects of restrictions that have been placed on lives in the form of social distancing [9] , self-isolation and quarantine regimes[10-11]. Key workers, younger adults, those living in over-crowded house- holds, and individuals with health conditions (especially mental health conditions) have reported more daily stress.[12] According to Grover et.al[13] more than two-fifth of the people experienced common mental disorders due to lockdown and the COVID-19 pandemic, and there is a need for psychological health services everyone in the society.[14] It is found that the masks and gloves used by the individuals infected with coronavirus keep piling up. Infectious waste is characterized as any material that is suspected to contain pathogens (bacteria, viruses, parasites or fungi) in sufficient concentration or quantity to cause disease in susceptible hosts. [13,15] This causes environmental and health problems if these items are stored, transported, and handled improperly. [16-17] The quantity of daily face mask usage depends on the number of people residing in a certain country, urban population (per cent), face masks acceptance rate (per cent) and average daily face masks per capita.[18] Hence, there is a need to have a waste collection and safe disposal facility at care centers.

The main objective of this research is to discuss the psychological and behavioral impacts on humans due to outbreak of Covid-19 and other pandemics. Based on this, a person focus care center is outlined with the facilities to enhance the wellbeing of persons infected with infectious diseases like Covid in addition to medical treatment. Existing literature [19 -23] has extensively discussed the physical effects on individuals. However, this paper focusses more on psychological effects on human life during the pandemic and lock down periods. Based on surveys, interviews among stakeholders (people affected with Covid-19, caretakers and family members of the Covid-19 infected patients, doctors and nurses [24] who have treated Covid-19 infected patients), it is recommended to set up a care center in each region with separate facilities to treat patients with different levels of infections and a counselling center to overcome psychological and behavioral changes.

METHODS

The qualitative and quantitative methods are used to achieve the objective of this research. The quantitative data is collected through surveys conducted in Saudi Arabia and India. Qualitative analysis is based on literature reviews, interviews, and case studies. The research is divided into four different parts.

The first part focuses mainly on surveys conducted among adults from 20 - 60 years old. The survey questionnaires were distributed among the audience through electronic media and the data was

accumulated in the period from June 2020 to September 2020. This part of the research is to have a better understanding of the safety preferences and precautions taken by individuals during the Covid-19 period.

The second part of the research includes extensive literature review to discuss the disposal of different infectious waste by the community and the methods of safe disposal of infectious waste. In this paper, the infectious waste refers to used masks and gloves and did not include the other medical wastes.

Third part of the research includes the results of interviews conducted among different stakeholders which included Covid-19 patients, and their family members, medical staffs such as doctors, and nurses who have treated Covid-19 patients to understand the psychological effects and physical damage experienced by these individuals. The respondents of the interviews are residing in Saudi Arabia and India.

The last part of the research is to suggest the Covid care center based on the results of surveys, interviews, case studies and literature. The design of the center focuses on segregation of patients, and reduction of stress in patients, physicians, care takers, and the family members. It also enhances the overall wellbeing of the individuals and the community.

Design of Questionare

Questions were developed based on the information required to achieve the objectives of the research. A set of 15 questionnaires was prepared, which included multiple-choice questions, opinion questions, questions with yes or no options. Based on the choice of the respondents, other questions were linked to yes or no options. Some questions allow the respondents to choose more than one option. The survey was administered using the Google Forms platform from June 2020 to September 2020. The distribution of the questionnaire was conducted through the outreach of social media platforms, e-mail, and standard messaging services.

Statistical Analysis

The surveys were distributed to a population of 500 members with different age groups ranging from less than 20 to higher than 60 years residing in India and Saudi Arabia and received responses from approximately 300 participants. The results of the survey analysis are depicted in the form of percentages and numbers for the questionnaire on preventive measures to overcome the spread of infectious diseases, precautions during travel, habits of disposal of used masks and gloves, and measures taken to enhance the immune system during pandemic.

Ethical Considerations

This research has received ethical approval from the scientific research center of Dar Al-Hekma University. The participation in the surveys and interviews is voluntary and the information is included with the consent of participants. No personal details are enquired in the research study. There is no risk associated with conducted research.

RESULTS

Prevention and Precautionary Measures

The survey was conducted among individuals in the age group between 0 to 60 years of age, in which 43% were male, 57% were female. Most of them were in the age group between 20 to 40 years of age. The preventive measures preferred by the respondents to combat the spread of infectious diseases were to wash hands regularly, maintain social distancing, travel only when essential and preference for online shopping (Figure 1). As per Ong et.al.,[25] and Kampf et.al.,[26] 60 to 71 % ethanol sanitizers were effective to eliminate pathogens of infectious diseases such as MERS, SARS, COV-2.

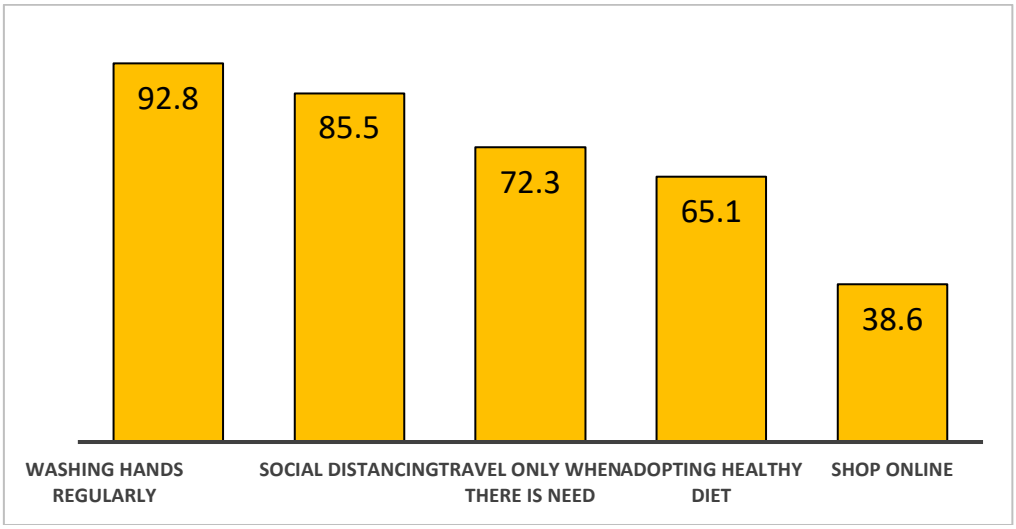
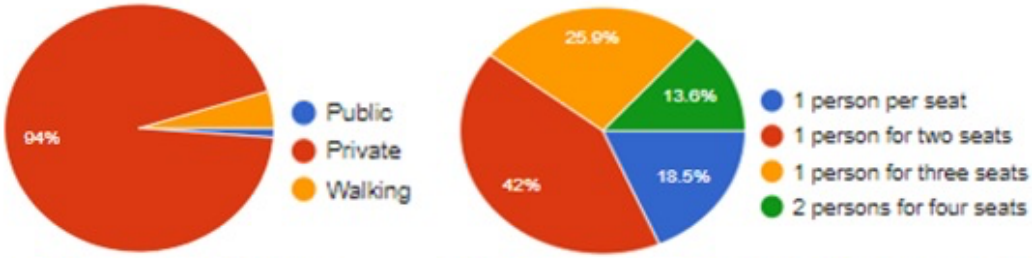


Figure 1. Preventive measures

Mode of Transporation

Survey analysis for mode of transportation revealed that 94% of the respondents preferred to use private vehicles (Figure 2a) and the remaining preferred public transport options such as taxi, bus, train and airplane. In case of air and bus travel, 42%of people preferred seating arrangement of one person for every two seats, 26% preferred one person per three seats, as shown in Figure 2b.



a) Transport preference b) Preferences in public transport (Bus and Airplane)

Figure 2. Mode of transport

Development of Immunity System

From the survey, 92% of the respondents preferred to have a healthy diet, 46% preferred to take supplementary vitamins, 60% opted for regular exercise and yoga and 64% preferred exposure to sunlight.

Infectious Wastes

The study was carried out to find the preference of the respondents, in using different types of personal protective equipment such as face masks and gloves and the awareness of the people about these protective equipment.

From the surveys, it was found that 10-17 % of the respondents were unaware of the type of masks and gloves used by them. From the survey results, 48%

preferred to use 3 ply facemasks, followed by cotton masks and N95 masks as shown in Figure 3a. From Figure 3b, 45 % of respondents preferred to use rubber gloves compared to the vinyl and cotton gloves.

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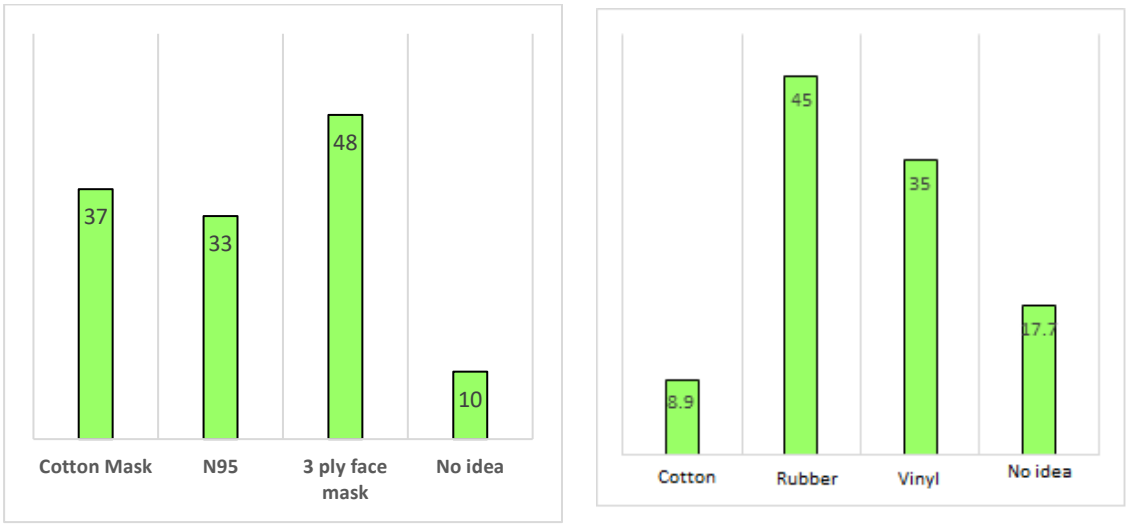
The survey also indicated that 74% of respondents discarded the used gloves and masks either in a closed bin or the one designated for collection

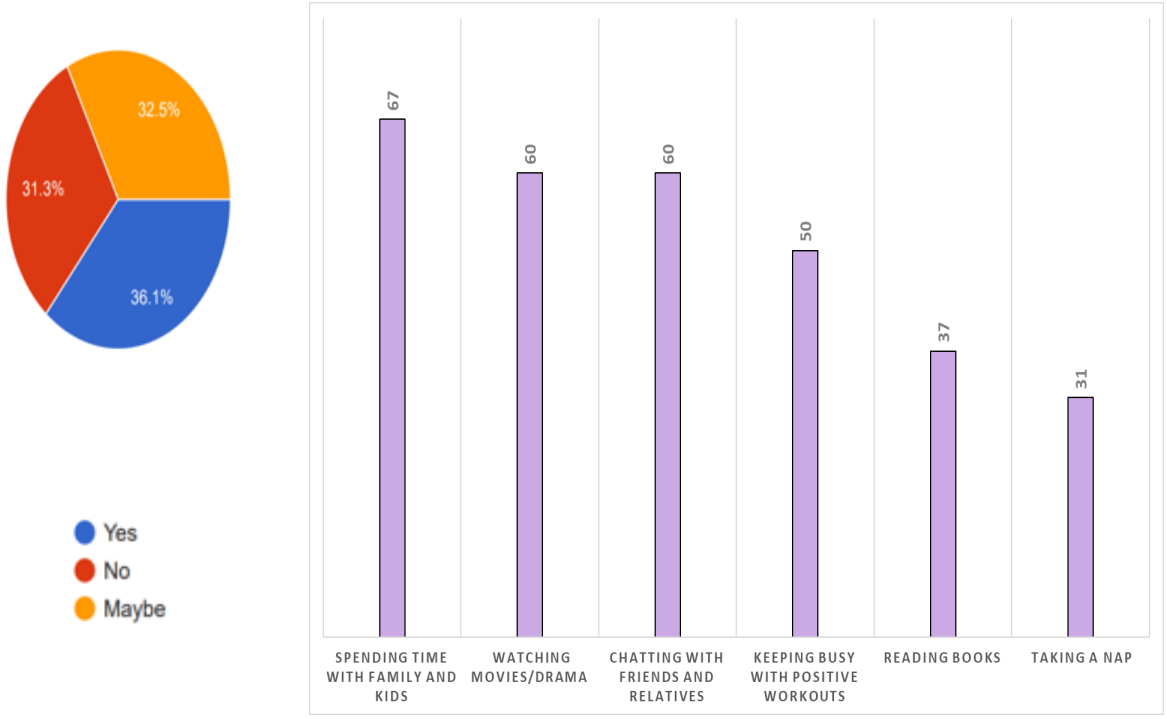


(a) Masks (b) Gloves

Figure 3. Preferences for types of masks and gloves.

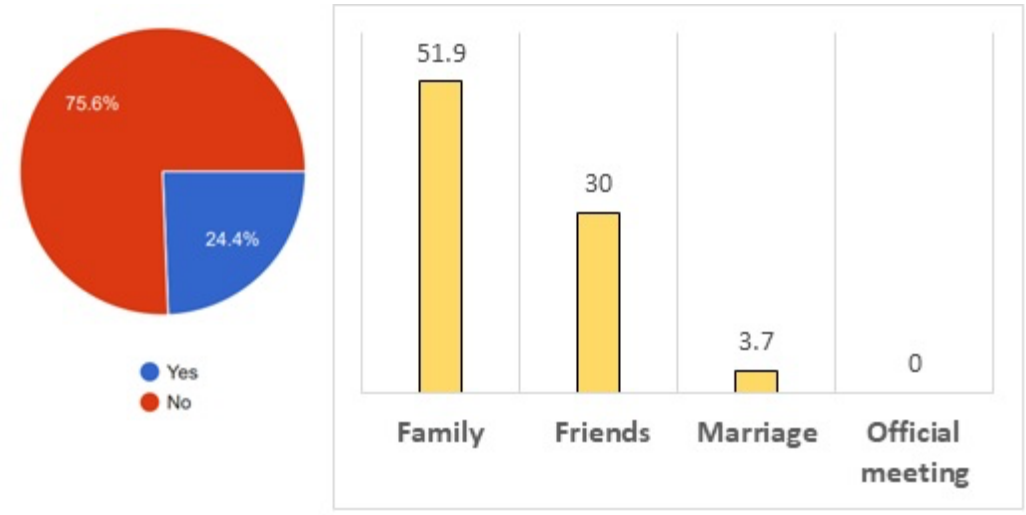
Psychological and Behavior Changes in Humans

The surveys were conducted from June 2020 to September 2020. It was found that 36% of the respondents were subjected to stress during the lockdown period and 32% were unable to decide about their psychological conditions. This indicates that 68% of the respondent's suffered changes in their behavior and tried to overcome stress in different ways (Figure 4a). From the survey, 67% preferred to spend qualitative time with family, 60 % preferred to watch movies or drama, and chat with friends and relatives through social media. From figure 4b, 50% preferred to keep themselves busy with positive workouts, 37% preferred to read books and 31% preferred to relax by taking naps. The above preferences showed that the Covid period helped to strengthen the family bonds, which was a positive effect during Covid lock down and restrictions. From the survey, 75% of the respondents agreed that recovery of patients depends on the psychological wellbeing. The survey results given in figure 5a showed that 76% of the respondents were against social gatherings, 51.9 % preferred family gatherings, 30% friends' gatherings, 3.7 % preferred to attend marriage gatherings and none preferred official meetings as showed in figure 5b (respondents selected multiple options).



(a) Stress experienced b) Activities during the Covid lock down period

Figure 4 Activities and psychological effects of lock down



a) Response for gathering b) Type of gathering

Figure 5. Gathering and Covid lockdown

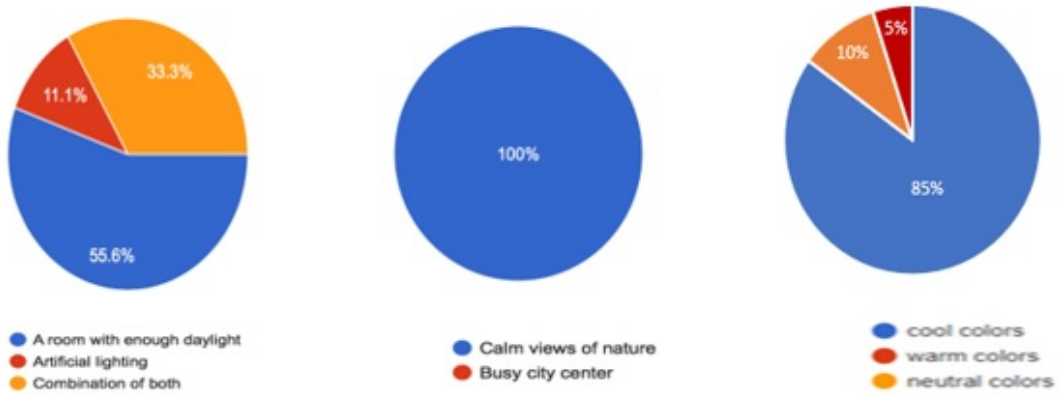
The results of the interviews conducted among Covid affected individuals, their family members and care takers were summarized below.

The Covid infected patients and their family members suffered psychologically more than physical damage. The psychological effects on caretakers were different from the patients and the family members as they suffered more physically due to over work, sleepless nights and not being able to give time to

their families. The common psychological effects noticed were depression, anxiety and loneliness in patients and their family members. Some of the physical damages in Covid patients were loss of weight, appetite, damage of taste buds, loss of sense of smell, fatigue, dizziness, breathlessness, and the extreme damage was the loss of life. Participants from India mentioned that due to fear of ostracization from neighbors and society, they were forced not to disclose the disease to others that had increased the transmission and casualties. Most of the respondents accepted that their children were affected physically and psychologically due to pandemic. Lack of physical activity has increased obesity and continuous use of mobile phones, ipod's or watching TV has affected vision. Also, this pandemic greatly affected the cognitive and interpersonal skills of the children, resulting in lack of interest in their studies, reduction in social interaction, minimal verbal and non-verbal communication, isolation, lack of team work and collaboration with peers. The doctors who treated the Covid-19 patients mentioned that the psychological balance was more important for the well-being of the individuals. Persons suffering from major health problems such as hypertension, cardiovascular diseases, diabetes mellitus, chronic obstructive pulmonary disease (COPD), renal failure, kidney and liver diseases, cancer patients and organ transplant cases suffered more complications during the SAR COV-2.

Preference of Patient's Room

Patients preferred rooms with large windows that allowed adequate daylight, offered a glimpse of the landscape and eradicated boredom experienced by them (Figure 6a and b). Indoor plants brought a feeling of the outside environment inside. The caretakers suggested that a care center need more breathable space as they felt suffocated in small and confined spaces. Most of the patients voted for dim artificial lighting as it did not cause glare or eye irritation. Moreover, patients had showed interest in exercising and moving around in their rooms. The design of the person-centered care center should include an open courtyard, indoor and outdoor gardens. The windows in the patient's room had garden facing or open spaces. Respondents preferred cool colors more than warm and neutral colors (Figure 6 c).



a) Room preferences b) Window facing c) Colors

Figure 6. Design preference of the room.

DISCUSSIONS

Surveys and Interviews

In the article of Bashforth,[27] Dr. Micklewright stresses that "the pandemic is far from over. However, many aspects of our day-to-day lives have returned to normal such as social gatherings, back to work and school. He says people would be forgiven for assuming the pandemic was non-existent now since schools and workplaces are open, stadiums are selling tickets again and international borders have opened. However, the decisions for these aspects of life to resume have been difficult, and careful planning was needed to ensure things opened back safely. While vaccines are helping to reduce intensity of infection and minimize the deaths and spread of COVID-19, the virus is still present". Now it is evident that the virus has mutated into different forms and is expected to mutate more in the near future. The muted Covid viruses are more infectious and spread faster than the original. [28]

"Face masks have been shown to prevent the spread of a number of airborne infections, including influenza and SARS," says Dr. Micklewright.[27] It is very clear that the spread of any airborne infection might be reduced by wearing a face mask against common cold whooping cough and mumps. Temsah et.al [29] reported that the knowledge and adherence to personal hygienic practices reduces anxiety towards Covid-19.

The air quality showed improvement due to a reduction in the use of transport which was one of the positive effects of Covid.

In one of the Covid care centers in India, the asymptotic patients, health workers and covid patients were treated using herbal concoctions, breathing exercises, yogas.[30] The respondents used to take home-made healthy drinks or immunity boasters on a periodic basis.

According to Tang,[31] surgical and N95 masks limit and redirect the projection of airborne droplets. Filtration efficiency of surgical masks is 80% against small particles in correlation with the contaminant. SET-C, 2020[32] mentioned that wearing masks reduces the spread of the flu virus, which is aligned with Bashforth [27]. The respondents preferred to use 3 ply face masks compared to cotton and N95 masks.

Wearing masks has become a global requirement and it has become part of the dress code and most of the public is unaware of safe disposal of used face masks and gloves and the serious consequences of improper disposal of this waste. Jones [33] reported that the used face masks are seen on roads, in front of shopping malls, parks and even on beaches. These are made of TNT material which is a non-woven fabric and takes 400-450 years (approximately) to decompose. If they are not disposed of properly, used masks may result in the spread of diseases and pose threats to aquatic, terrestrial and atmospheric environments. A surgical mask has the potential to release thousands of microscopic fibers into a marine environment. [34]

Actions are required to store, transport and safely dispose of used masks. Used masks should be collected in the smart trash cans such as touchless sensor trash cans with double layered waste bags. The persons handling and transporting these waste bags must wear PPE, gloves and follow other precautionary measures as suggested by UNEP.[35] The used masks can be disposed by dumping in landfills which are separate from the municipal waste landfills and should be covered with soil immediately. The primary and secondary recycling of used face masks are reported by Khan and Kaafil.[36]

Tesmsah et al.,[29] reported that quarantined people experienced numerous emotional outcomes, including stress,

depression, irritability, insomnia, fear, confusion, anger, frustration, boredom, and stigma associated with quarantine, some of which persisted even after end of the quarantine. Based on the interviews, it is evident that the family caregivers were isolated from social networks which created substantial pressure on their mental health. The increase in confusion, anxiety and stress was due to unclear guidance and instructions which kept changing during the Covid -19 pandemic. There were rumors in social media which increased the psychological impact on the people. Humans are a social species who prefer to live in a community to survive and thrive [37], when they get disconnected from the society, they will go into depression and the same is reflected during the Covid period.

Design Details of the Care Center

Based on the results of surveys and interviews, there is a need to set up person centered care center to overcome the psychological and behavioral effects on humans. Coulter and Cepiku [38-39] also suggested a person-centered approach are important in treatment of Covid cases and not just hospital focused treatment. The factors which need to be considered for design of a care center includes type of patients, level of infection, complexity of required care, type of facilities, mobility and risks presented to the patient and caretakers. The bubble diagram or relationship diagram is a diagrammatic representation of initial planning of the care center with different design aspects and facilities which is shown in Figure 7.

The care center has seven units: Unit 1 has facilities to treat people suffering from mild infections, provided they do not have enough space to quarantine themselves in their house. Unit 2 is assigned for patients suffering from severe infections such as breathing difficulties. Unit 3 is designated for critically ill patients who require ventilator and life support treatment. Unit 4 is specifically designed to handle children with different levels of infection. Unit 5 is incorporated for psychosocial wellbeing of patients, their family members and caretakers. Unit 6 is the training center for family and voluntary caregivers, and it is separated from treatment facilities. Unit 7 is for collection and safe disposal of used masks, gloves, PPE and other wastes. Unit 3, 4 and 7 have separate entrances.

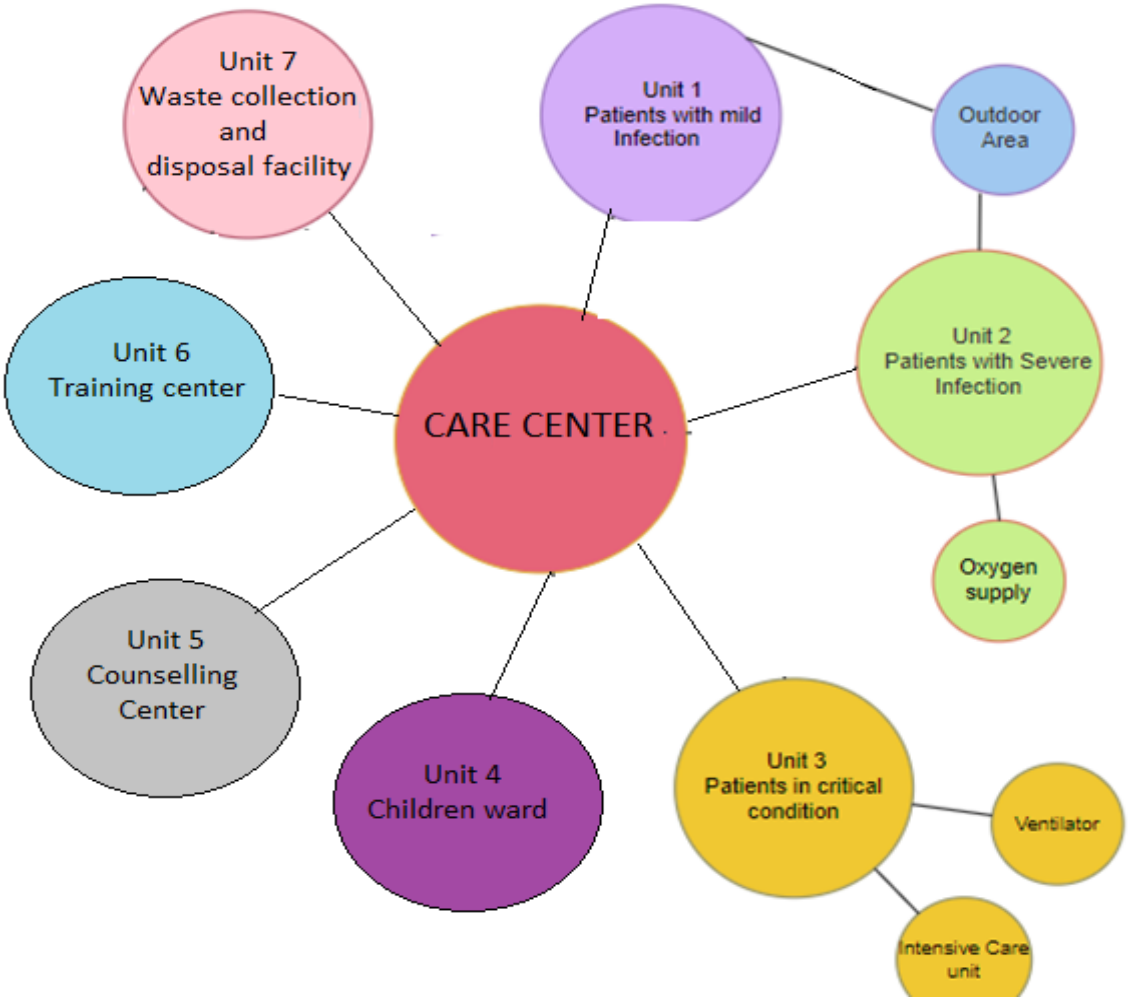


Figure 7. Bubble diagram of care center.

The conceptual diagram of the suggested care center gives more details of each unit with the optimum utilization of space, and it is depicted in Figure 8 which has three main access points to the care center. The first access is to reception areas (unit 1 and 2), emergency section (unit 3) and childcare unit (unit 4). The second access is directed towards the training center (unit 5 and 6). The third access is designated for collection and disposal facility (unit 7). The family members and patients must be involved in making decisions about their care which make the treatment more effective and efficient.[37] The family caregivers play a key role in the wellbeing of patients, with proper training included in the care center. A separate area is assigned for registration, family waiting and staff respite. Doctors have suggested increasing the size of the waiting rooms. The staff respite area includes facilities to store their personnel belongings, change their personnel protective equipment, rest room with garden view and washroom. The care center has an in-house restricted area for medical storage and preparation room with clear signs.

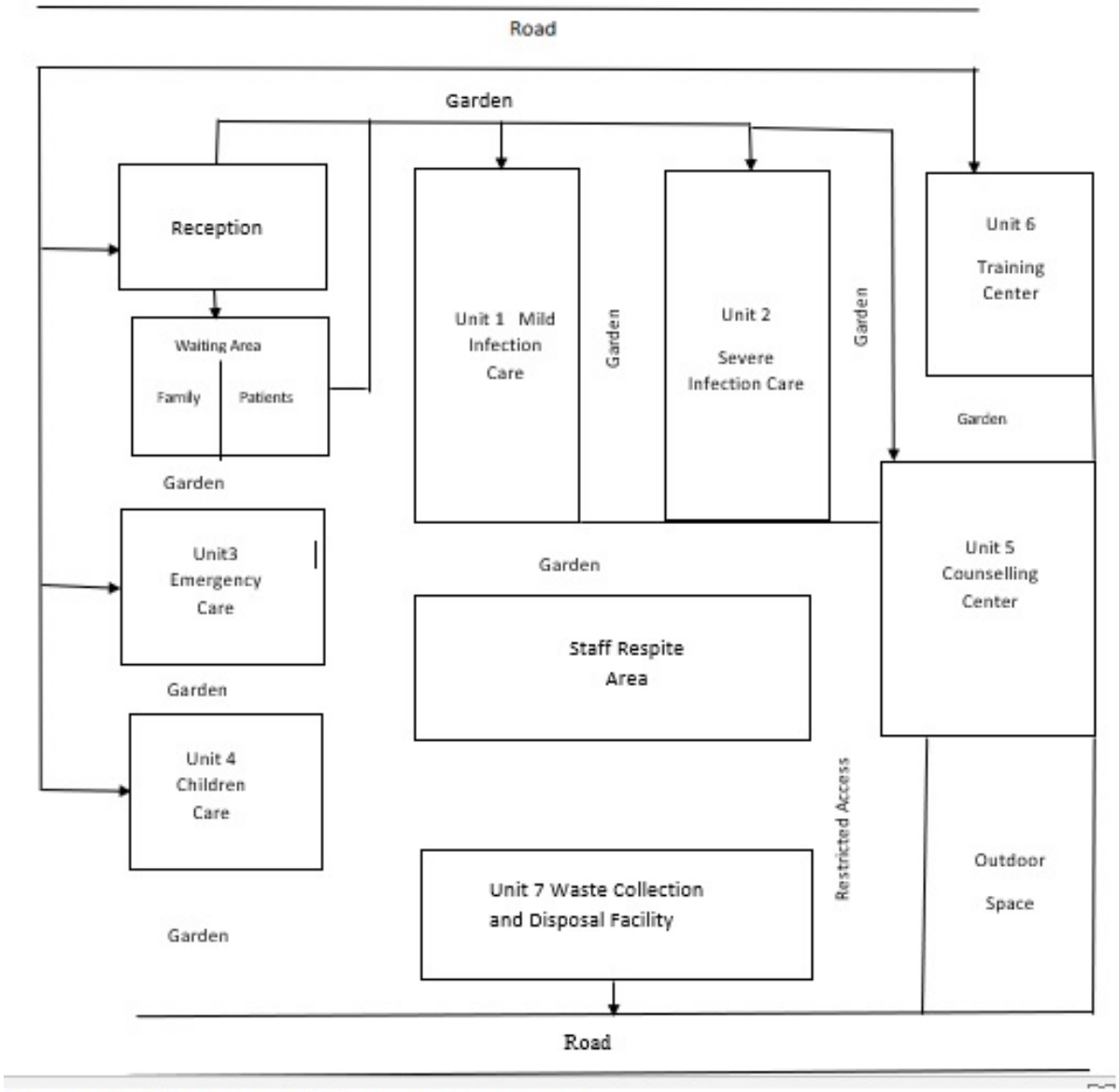


Figure 8. Conceptual diagram of care center.

Building Services in Care Center

Controlled air condition is suggested for heating, cooling of the spaces and circulation, ventilation and filtration of air. It is recommended to use nonthermal-plasma reactors to filter the air instead of the conventional mechanical filters to remove airborne particles through electrostatic capture in highly porous, dielectic media. [40] Ventilation can be done by two principles: dilution and removal to mitigate the risk of infection. Clean air when added to the room dilutes the airborne contaminants present in the room, thus reduces the spread of infection. The indoor air should be removed by an exhaust fan or high efficiency particulate air filter. [41] This reduces the pressure inside the patient's room. Thus, airborne droplets are prevented from escaping into corridors and other adjacent areas and decreases the transmission of virus.

Daylight is an important factor in controlling the viability of infectious pathogens due to UV component of the sunlight. It is recommended to provide large windows facing gardens for the entry of daylight and air circulation. Green

represents health in psychology. It is the most restful color because the eye lens focuses green on the retina, which symbolizes nature and life and is considered the most natural calming, balancing, and relaxing color.[42]

Patient 'drop-off' and pick up points have separate access. The drop-off point is equipped with walk-in facilities and multiple screening stations to screen potentially contaminated patients. The exit and entry points for staff are separated from patients. Parking facilities for staff and other vehicles, EMT access, ambulance drop-off and pick-up are considered in the design. Area housing medical supplies, hazardous materials and equipment is secured with access restricted to staff only. The security doors with a smart lock system are installed at entry and egress points. The entire care center is under CCTV surveillance.

The space provided for collection and disposal of medical, non-medical, infectious waste and hazardous waste is separate from the main building and has restricted access. It provides the facility to clean and disinfect the equipment.

The facilities in the care center are able to cater to corona virus cases and also different emerging pathogens, such as Ebola, Nipah, Zika, MERS-COV, SARS - COV- 2, H1N1 and so on.

The study has several limitations: First, the survey was conducted during specific period. Second, there was no follow up period. Third, the participants of the survey were residing in specific countries. Fourth, the number of samples were limited. Fifth, voluntary participation and digital platform increased selection bias. The final limitation was the paper outlined the overall facilities required in the care center without giving specific design details of each facility.

CONCLUSIONS

From the study, t is evident that the pandemic affected the psychology and behavior of humans which has changed the lifestyle of people. During the pandemic, hospitals, equipment, caretakers, and staff were insufficient in handling the patients. The stakeholders were not sufficiently trained to face the situation. This led to the need of designing a care center which could cater to the treatment and psychological support under a single umbrella. The design details of the space play an important role in the healing process of patients, such as the orientation of the windows, light, wall and furniture colors, indoor plants, and outside views. Also, the design outlines the building services of the care center which include lighting, mechanical and natural air circulation, air filtration and entry- exit access. For staff, it includes a training center, respite area for relaxation as well as an outdoor space. The selection of the elements improves the physical and psychological state of the patients, which enhances the recovery process.

RECOMMENDATIONS

It is recommended to set up at least one care center in each region to handle future epidemics or pandemics due to various emerging pathogens. The care center must focus on person centered treatment with in-house facilities for treatment, care, training, counselling for the psychological wellbeing of individuals and the caretakers who serve the infected people.

REFERENCES

1. World Health Organization WHO Director-General's statement on IHR emergency committee on novel coronavirus (2019-nCoV) [internet]. [cited 2020 June 09]. Available from: https://www.who.int/dg/speeches/detail/who-director-general-s-statement-on-ihr-emergency-committee-on-novel-coronavirus-(2019-ncov)
2. Alonazi WB, Altuwaijri EA. Health Policy Development During COVID-19 in Saudi Arabia: Mixed Methods Analysis. Front. Public Health. 2022; 9:801273. doi: 10.3389/fpubh.2021.801273
3. Hassounah M, Raheel H, Alhefzi M. Digital Response During the COVID-19 Pandemic in Saudi Arabia. J Med Internet Res. 2020;22(9):e19338.
4. Chaturvedi K, Vishwakarma DK, Singh N. COVID-19 and its impact on education, social life and mental health of students: A survey. Child Youth Serv Rev. 2021;121:105866. doi: 10.1016/j.childyouth.2020.105866.
5. Clair R, Gordon M, Kroon M, Reilly C. The effects of social isolation on well-being and life satisfaction during pandemic. Humanit Soc Sci Commun. 2021;8:28.
6. Elmer T, Mepham K, Stadtfeld C. Students under lockdown: Comparisons of students' social networks and mental health before and during the COVID-19 crisis in Switzerland. PLOS ONE. 2020;15: e0236337. doi: 10.1371/journal.pone. 0236337.
7. Cao W, Fang Z, Hou G, Han M, Xu X, Dong J, et al. The psychological impact of the COVID-19 epidemic on college students in China. Psychiatry Res. 2020;287:112934. doi: 10.1016/j.psychres.2020.112934.
8. Yao H, Chen JH, Xu YF. Patients with mental health disorders in the COVID-19 epidemic. Lancet Psychiatry. 2020;7(4):e21. doi: 10.1016/S2215-0366(20)30090-0.
9. Bedford J, Enria D, Giesecke J, Heymann DL, Ihekweazu C, Kobinger G, et al. COVID-19: towards controlling of a pandemic. Lancet. 2020;395(10229):1015-8. doi: 10.1016/S0140-6736(20)30673-5.
10. Reynolds DL, Garay JR, Deamond SL, Moran MK, Gold W, Styra R. Understanding, compliance and psychological impact of the SARS quarantine experience. Epidemiol Infect. 2008;136(7):997-1007. doi: 10.1017/S0950268807009156.
11. Memish ZA, Ahmed QA, Schlagenhauf P, Doumbia S, Khan A. No time for dilemma: mass gatherings must be suspended. Lancet. 2020;395(10231): 1191-2. doi: 10.1016/S0140-6736(20) 30754-6.
12. Fancourt D, Bu F, Mak HW, Steptoe A. Covid 19 Social Study. Results Release 1. University College, London [Internet]. 2020. [cited 2022 Oct 19]. Available from: https://www.nuffieldfoundation.org/wp-content/uploads/2020/05/COVID-19-social-study-results-release-29-May-2020.pdf.
13. Eria - Economic Research Institute for ASEAN and East Asia. Strengthening Waste Management Policies to Mitigate the COVID-19 Pandemic [Internet]. 2020 [cited 2022 Oct 19]. Available from: https://www.eria.org/uploads/media/policy-brief/Strengthening-Waste-Management-Policies-to-Mitigate-the-COVID19-Pandemic.pdf.
14. Grover S, Sahoo S, Mehra A, Avasthi A, Tripathi A, Subramanyan A, et al. Psychological impact of COVID-19 lockdown: An online survey from India. Indian J Psychiatry. 2020;62(4):354-62. doi:10.4103/psychiatry.IndianJPsychiatry_427_20
15. Mihai FC. Assessment of COVID-19 Waste Flows During the Emergency State in Romania and Related Public

Health and Environmental Concerns. Int J Environ Res Public Health. 2020;17(15). doi: 10.3390/ijerph 17155439.
16. Nzediegwu C, Chang SX. Improper solid waste management increases potential for COVID-19 spread in developing countries. Resour Conserv Recycl. 2020;161:104947. doi: 10.1016/j.resconrec.2020.104947.
17. Singh N, Tang Y, Zhang Z, Zheng C. COVID-19 waste management: Effective and successful measures in Wuhan, China. Resour Conserv Recycl. 2020;163:105071. doi: 10.1016/ j.resconrec.2020.105071
18. Sangkham S. Face mask and medical waste disposal during the novel COVID-19 pandemic in Asia. Case Studies in Chemical and Environmental Engineering. 2020;2:100052.
19. Carolina RP, Cristiane PDMK, Valentine CM, Adilaeit LP, Marionda SR, Lucia CBC. The Impact of COVID-19 on the Physical Well-being of Nursing and Medical Personnel: An Integrative Review. Aquichan. 2022; 22(2):e2225.
20. Bentlage E, Ammar A, How D, Ahmed M, Trabelsi K, Chtourou H, et al. Practical Recommendations for Maintaining Active Lifestyle during the COVID-19 Pandemic: A Systematic Literature Review. Int J Environ Res Public Health. 2020;17(17). doi: 10.3390/ijerph17176265.
21. Bourdas DI, Zacharakis ED. Impact of COVID-19 Lockdown on Physical Activity in a Sample of Greek Adults. Sports (Basel). 2020;8(10). doi: 10.3390/sports8100139.
22. Hanke AA, Sundermeier T, Boeck HT, Schieffer E, Boyen J, Braun AC, et al. Influence of Officially Ordered Restrictions During the First Wave of COVID-19 Pandemic on Physical Activity and Quality of Life in Patients after Kidney Transplantation in a Telemedicine Based Aftercare Program-A KTx360° Sub Study. Int J Environ Res Public Health. 2020; 17(23). doi: 10.3390/ijerph17239144.
23. Lesser IA, Nienhuis CP. The Impact of COVID-19 on Physical Activity Behavior and Well-Being of Canadians. Int J Environ Res Public Health. 2020; 17(11). doi: 10.3390/ijerph 17113899.
24. Shaukat N, Ali DM, Razzak J. Physical and mental health impacts of COVID-19 on healthcare workers: a scoping review. Int J Emerg Med. 2020;13(1): 40. doi: 10.1186/s12245-020-00299-5.
25. Ong SWX, Tan YK, Chia PY, Lee TH, Ng OT, Wong MSY, et al. Air, Surface Environmental, and Personal Protective Equipment Contamination by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) From a Symptomatic Patient. Jama. 2020; 323(16):1610-2. doi: 10.1001/jama. 2020.3227.
26. Kampf G. Efficacy of ethanol against viruses in hand disinfection. J Hosp Infect. 2018;98(4):331-8. doi: 10.1016/ j.jhin.2017.08.025.
27. Bashforth E. Should you wear a face mask if you have a cold this winter? Article in Patient Health Information [Internet]. 2021 [cited 2022 Oct 9]. Available from: https://patient.info/ news-and-features/should-you-wear-a-face-mask-if-you-have-a-cold-this-winter.
28. Miller JK, Elenberg K, Dubrawski A. Forecasting emergence of COVID-19 variants of concern. PLOS ONE. 2022;17(2):e0264198. doi: 10.1371/ journal.pone.0264198.
29. Temsah MH, Alhuzaimi AN, Alamro N, Alrabiaah A, Al-Sohime F, Alhasan K, et al. Knowledge, attitudes and practices of healthcare workers during the early COVID-19 pandemic in a main, academic tertiary care centre in

Saudi Arabia. Epidemiol Infect. 2020; 148:e203. doi: 10.1017/S09502688 20001958.
30. Newspaper Article, Mint [Internet]. [cited 2022 Aug 10]. Available from: https://www.livemint.com/news/india/ nearly-6-000-covid-patients-cured-through-siddha-medicine-in-tamil-nadu-11597051467504.html.
31. Tang JW, Liebner TJ, Craven BA, Settles GS. A schlieren optical study of the human cough with and without wearing masks for aerosol infection control. J R Soc Interface. 2009;6 Suppl 6(Suppl 6):S727-36. doi: 10.1098/rsif. 2009.0295.focus.
32. SET-C Science in Emergencies Tasking – COVID-19 Face masks and coverings for the general public: Behavioral knowledge, effectiveness of cloth coverings and public messaging. London: The Royal Society [Internet]. 2020. Available from: https:// royalsociety.org//media/policy/projects /set-c/set-c-facemasks.pdf.
33. Jones MA. Report on More than 1.56 billion face masks could end up polluting oceans, CIV news [Internet]. 2020 [cited 2021 Jun 09]. Available from: https://www.ctvnews.ca/sci-tech/ more-than-1-56-billion-face-masks-could-end-up-polluting-oceans-report-1.5221239.
34. Saliu F, Veronelli M, Raguso C, Barana D, Galli P, Lasagni M. The release process of microfibers: from surgical face masks into the marine environment. Environ Adv. 2021; 4:100042.
35. UNEP, Waste Management during the COVID-19 pandemic. Ministry of Environment (MOE), Government of Japan through United Nations Environment Programme International Environmental Technology Centre (UNEP- IETC) [Internet]. 2020 [cited 2022 Oct 09]. Available from : http://wedocs.unep.org/bitstream/handle/20.500.11822/33416/WMC-19.pdf?sequence= 1&isAllowed=y.
36. Khan SK, Kaafil SF. An effective environmental solution for disposal and recycling of single used face mask. Indian J Environ Sci. 2023;27(1):27-32.
37. The cooperative human, Nat Hum Beha, Editorial Publication. 2018; 2:427–8.
38. Coulter A, Richards T. Care during covid-19 must be humane and person centred. Bmj. 2020;370:m3483. doi: 10.1136/bmj.m3483.
39. Cepiku D, Giordano F, Bovaird T, Loeffler E. New development: Managing the Covid-19 pandemic—from a hospital-centered model of care to a community co-production approach. Public Money Manage. 2021;41(1):77-80.
40. Bergeron V, Reboux G, Poirot JL, Laudinet N. Decreasing airborne contamination levels in high-risk hospital areas using a novel mobile air-treatment unit. Infect Control Hosp Epidemiol. 2007;28(10):1181-6. doi: 10.1086/520733
41. Dietz L, Horve PF, Coil DA, Fretz M, Eisen JA, Van Den Wymelenberg K. 2019 Novel Coronavirus (COVID-19) Pandemic: Built Environment Considerations To Reduce Transmission. mSystems. 2020;5(2). doi: 10.1128/mSystems.00245-20.
42. Jonauskaite D, Tremea I, Bürki L, Diouf CN, Mohr C. To see or not to see: importance of color perception to color therapy. Color Res Appl. 2020;45(3): 450-64.