

COLOUR AS AN AGENT TO MANAGE DEPRESSION, ANXIETY AND STRESS LEVELS OF MOBILITY IMPAIRED INDIVIDUALS IN HEALTHCARE FACILITIES

Insights from a Rehabilitation Centre at Ragama, Sri Lanka

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Abstract: Individuals with physical disabilities, especially with impeded mobility have to deal with an array of physical, social, cultural and economic challenges, consequently leading to psychological imbalances, disorders and more inclined to attempt even suicide. Incorporating disabled-friendly design interventions, facilitating optimal healing in their healthcare facilities, is crucial to overcome most of these challenges and ensure their psychological well-being. Within this backdrop, this investigation focused on the impact of interior colours in health care facilities to manage depression, anxiety, and stress levels of disabled individuals. The investigation was executed with reference to wall colour of bedrooms of patients with limb deformities of a selected rehabilitation centre, at Ragama. Three hues (blue, yellow, and green) were tested by installing colour panels on the sidewall of the beds, allowing the patients to be exposed to each colour for three consecutive days. DASS-21 self-report scale was adopted to measure depression, anxiety, and stress levels of the patient. Green colour was found to be significantly supportive in inducing favourable impacts to manage depression, anxiety, and stress levels of patients over blue and yellow. Extending this study to test different tints, shades, and intensities of green colour, incorporating large samples with long-term exposure in an array of health care facilities, is recommended.

Keywords: *Mobility impaired patients, Interior Colour, DASS-21, Optimal healing environments*

1. Background to the Research

Most people experience some form of a disability at some point during their lifetimes. As specified by the protection of the rights of persons with disabilities act (No. 28 of 1996 - sect 36), any person who, as a result of any deficiency in his physical or mental capabilities, whether congenital or not, is unable by himself to ensure for himself, wholly or partly, the necessities of life is identified as a person with disability. According to World Health Organisation (2020), over 1 billion individuals worldwide experience some form of disability. 110 million -190 million individuals; one-fifth of the global population experience significant disabilities. WHO (2020) further specifies that a higher disability prevalence rate is reported in developing countries. As revealed by 2012 statistics, around 8.7% of the total population above the age of 5 years in Sri Lanka live with disabilities. It is estimated that about 300,000 people in the age group between 18 to 60 have some form of disability, out of which around 57% are males while 43% are females (Department of Census & Statistics, 2012).

1.1 MOBILITY IMPAIRMENT

Individuals with impeded mobility; physically disabled community falls under the larger umbrella of people with disability (Masridin, 2019). According to Census (2012) 734,213 individuals over the age of 5 years were reported to have mobility related disabilities in Sri Lanka.

1.2 CHALLENGES OF THE MOBILITY IMPAIRED

People with disabilities are more likely to encounter adverse physical, psychological, social, economic, and other issues over people without disabilities including higher poverty rates, higher rates of unemployment, reliance on

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FARU Journal: Volume 09 Issue 1 DOI: <http://doi.org/10.4038/faruj.v9i1.122>

government assistance (Brault, 2005), poor health outcomes (Scott, 2007) and lesser opportunities in education. Further, mobility impaired individuals encounter barriers in transportation, access to places/environments, obtaining financial resources, obtaining awareness of activities, and finding accommodation (King, 1997). These factors, combined with functional limitations, considerably affect the day-to-day lives of individuals with mobility impairments (Rode, 2012).

1.3 PSYCHOLOGICAL CHALLENGES OF THE MOBILITY IMPAIRED

As highlighted by Weiss (2012), individuals who encounter a disability for the first time may have to cope with a process of adjustment to an array of life transitions including changes in the system of living, value changes, and experience an array of disability related issues across their life span, causing enormous distress. They also will have to deal with sociological challenges related to the role of family, cross-cultural issues, adjustments, social treatment, social status, and the consequences of negative attitude towards people with disabilities as a whole. As a consequence, individuals with disabilities are reported to experience frequent mental distress often over individuals without disabilities. Reduced mental health is one of the major burdens in populations with disabilities (Scott et al, 2007, Idrees and Ilyas, 2012).

Psychological distress is considered to be a major setback for the disabled in comparison to the physiological problems, being the deciding factor on the way they think about themselves, their goals, and the overall attitude towards life ahead. Accordingly, mobility impaired are less likely to have high purpose in life (Musich, 2018). On the other hand, disabled people have always been discriminated and stigmatised across cultures (Idrees and Ilyas, 2012) and the negative stigma these groups must confront is still considered to be very high. Weiss (2012) clarifies that, similar to enduring a grieving process associated with loss or major life changes, the involvement of an injury that leads to a physical or mental inability is associated with the sequential stages of grief; shock, denial, anger/depression, bargaining and acceptance. During this process an individual will grieve for the changes in their body image, function, loss of future expectations or former satisfaction, based upon any function that has been lost (Weiss, 2012).

The struggle in coping up with such stressors leads to psychiatric issues such as depression, anxiety, stress and losing their will to live. Mobility impaired individuals are more likely to develop depression (Lee, et al. 2012., Musich, 2018). A statistically significant association with depression in a convenience sample with 4 diagnostic groups with physical disabilities; spinal cord injury, multiple sclerosis, muscular dystrophy post-polio syndrome (n = 1676) was identified in a study conducted by Rosenberg (2013). On the other hand, many researchers have highlighted an array of stressors encountered by those with disabilities in a broader sense, compared to those without disabilities. Individuals with disabilities are reported to have significantly higher rates of stress-related health conditions over the general population, namely hypertension, diabetes, obesity, sleep disturbances...etc (Rasch, 2008). A study executed by (Jones, 2014) indicated that physical disability is a predictor of anxiety and depression. Physical disability was found to induce anxiety and depression in varying extents based on the individual's age, gender, cause of the ailment and the duration of the ailment (Jones, 2014).

Various psychological management interventions such as Cognitive Behavioural Therapy (CBT) can aid individuals with mobility impairments to advance through the stages of disability and help them with settling any difficulties they may encounter along the way. The result can be an increase in the person's self-esteem and confidence (Weiss, 2012), ensuring mental well-being characterised by reduced levels of depression, stress, and anxiety. However, this process of healing and empowerment should be done holistically with friendly and supportive people/society around, as well as a conducive living environment ensuring optimal healing, for a positive outcome.

2. Research Need

It is vital that mental wellbeing is given due attention in caring for people with mobility impairments so that all their health needs can be met (Johan, 2014). This investigation focused on exploring the manner as to how the patients affected with mobility impairments should be supported via incorporating Architectural design interventions to overcome their psycho-physiological challenges, ensuring psychological health and well-being. In view of this, the role of Architects would be to design disabled-friendly, conducive, 'Optimal Healing Environments' (OHE) with psychophysically comfortable sensory experiences to uplift the patients' overall healing process.

3. Review of Literature

Creating an optimal healing environment conducive for patients as well as healthcare providers is a necessity agreed by the world-wide researchers in the healthcare sector. Literature discusses several models defining parameters of OHE. A framework for an OHE was first introduced by Samueli Institute in 2004, elaborating the parameters which stimulate and enhance the intrinsic healing capacity of patients, families, and healthcare providers (Sakallaris et al, 2015) which has been adopted and amended later by many scholars. This is a holistic conceptual framework applicable to patients, their families, and healthcare providers (organisations and systems) to optimise the potential

for healing. OHE framework identifies 8 concepts under 4 environments that work synergistically to enhance healing as highlighted below (Sakallaris et al, 2015).

Table 1 - OHE Framework Source: Samueli Institute (2004)

Internal	Interpersonal	Behavioural	External
Healing intention	Healing relationships	Healthy lifestyles	Healing space
Personal wholeness	Healing organisations	Integrative care	Ecological resilience

An OHE as elaborated by Kreitzer and Zborowsky (2014), should be designed considering the deep and dynamic interplay of the parameters of patients, the healing process, culture as well as the place to achieve maximum positive outcome for the patients.

3.1 PARAMETERS OF HEALING SPACES IN OHE MODELS – THE EXTERNAL COMPONENT

The element of place in OHE focuses on the physical spaces where care is provided for the mobility impaired, namely healthcare facilities, halfway homes, hospitals ...etc and the context that surrounds the patient, family, and caregivers. According to the OHE model of Samueli institute (2004), healing spaces which are recognised under the external component include evidence-based design and healing principles to optimise and improve the quality of care, outcomes, and experiences of patients and staff. These are not just aesthetically pleasing or pleasant spaces but should provide a total sensory experience to support the engagement of its occupants internally, interpersonally, and behaviourally (Sakallaris et al, 2015). According to the OHE model of Zborowsky and Kreitzer (2014) parameters of place includes access to nature, positive distractions, aesthetics, ambient environment, and eco-system sustainability as elaborated below.

Table 2 - Elements of place: Design parameters which impact the process of facilitating OHE
Source: Zborowsky and Kreitzer (2014)

OHE Place Component	Definition
Meets functional requirements	Functional requirements are identified during the programming phase of the design process. These requirements include patient and staff safety, space for social support, and staff work areas, among others. (www.fgiguilines.org)
Access to nature	Actual or visual access to natural settings or designed nature settings. Access to daylight.
Positive distractions	Includes elements of the design environment that are of a 2-D or 3-D nature; artwork, water features, fireplaces.
Aesthetics	Includes the design elements of colour, texture, shape, form and volume; furniture, fabric, room layout etc.
Ambient environment	Includes the elements of artificial light, sound, odour, air temperature, air quality.
Supports a sustainable ecosystem	Includes the economic, social, and ecological impact of the design elements of the building and the impact of any construction.

Elaborating the OHE model of Samueli Institute (2004), Ananth (2008) has explained 7 aspects to be considered in enhancing sensory inputs in OHEs, namely; nature, colour, light, artwork, architecture, aroma and music. Similarly, Oberlin (2008) identified colour, shape, lighting, smell, sound and feel as factors to be considered in creating an OHE.

3.2 COLOUR AS AN AGENT FOR OPTIMAL HEALING

Out of the array of parameters of healing spaces discussed under OHE models the current investigation mainly focuses on the impact of colour to induce therapeutic/healing effects on physically disabled patients. Diverse colours present in the place component defines the human visual perception of the natural and man-made environment and plays a critical role in how the spaces are being perceived by the individuals and how the responses, reactions or behaviours are triggered based on the thoughts, emotions, psychological and biological reactions that stem corresponding to each colour/colour combinations. Accordingly, colours play a decisive role in an individual's overall visual sensory experience to create the conducive ambience for healing.

In the OHE model discussed by Zborowsky and Kreitzer (2014), colour has been identified as an aesthetic design element only. Although the concept of OHE was developed in 2004, most of the research executed on the

attributes of healing places/spaces have not recognised the significance of colour in enhancing the healing process of patients. However, in a study conducted recently, Park (2007) identified the contribution of colour as an important component for OHE in creating better environments for paediatric patients and their families. Ananth (2008) has identified colour as a parameter to enhance sensory input in building healing spaces under OHE model, which also is highlighted by Oberlin (2008).

The role of colour in Architectural spaces is not confined to decoration alone (Mahnke, 1996). Colours are used in Architecture beyond visual attraction as a tool of communication and to create ambiance of space associated with corresponding moods, feelings, emotions, and behaviour (Mahnke, 1996) based on the fact that they are warm colours characterised by long wave, low frequency, less energy or cool colours which are short wave and high frequency. Accordingly, warm colours (red, orange and yellow) are established to have a stimulating, arousing and energising effect on individuals while cool colours (blue, green, purple) are found to have a pacifying, calming and relaxing effect (Wexner, 1954, Itten, 1973, Birren, 1988, Mahnke, 1996).

3.3 IMPACT OF COLOUR ON HEALING/PATIENT RECOVERY

Colours have been recognised to be having healing impacts on humans since olden days. Nightingale (1860), recognised the impact of colour in healthcare environments on patients recovery. Chromotherapy is a method of treatment that uses colour to heal ailments, which has been practiced since the emergence of ancient Greek, Egyptian, Chinese, and Indian civilisations. As elaborated by Klotsche (1993), chromotherapy distinguishes seven pulsating energy points in the human body identified as "Chakras" which energise and sustain certain associating major endocrine glands and organs corresponding to states of consciousnesses, personality types and endocrine secretions. Each chakra is found to be responsive to a different colour associated with specific healing impacts on the human's physical health as well as mental health (Richardson, 2019).

Potential of colours to induce positive effects on the recovery of patients with psychiatric imbalances has been recognised since the distant past. New York Times (1902) has reported that, patients with acute mania were kept in black rooms, melancholia in red rooms, boisterous in blue and green rooms while white rooms were used for individuals who are practically well. Colour sensitivity was explained to be significantly correlated to individuals with mood disorders (Barrick, Taylor and Correa, 2002). Literature establishes that certain colours are supportive in managing depression, anxiety and stress levels of individuals while also recognising certain colours which could aggravate these levels as elaborated below.

3.4 IMPACT OF COLOUR ON DEPRESSION, ANXIETY AND STRESS.

Gerard (1958) cited in Lubos (2012) revealed the impact of red colour in producing feelings of arousal and disturbing anxious or tense subjects, while blue was found to generate feelings of tranquillity and well-being, inducing a calming effect. Higher anxiety scores were observed under red and yellow conditions than in the green and blue situations in a study executed by Jacob and Suess (1975). As elaborated by Mahnke (1996), most of the participants associated red light with anxiety and blue and green with a calming effect. Yellow was found to produce statistically significant biological responses and higher anxiety-state scores (Dearing and Singg, 1996). Contrastingly, Nolan, et al (1995) recognised yellow as a soft warm colour which could reduce the anxiety levels of patients.

As elaborated by Mahnke (1996), calmer emotions were generally noticed by patients who were exposed to a blue room; pleasant, calming, restful and supporting concentration, thinking and meditation, suggesting the colours' ability to reduce stress levels. Blue colour was found to induce a stronger effect on the reduction of stress levels (Lubos, 2012). Subjects in red room conditions were reported to have higher stress rating scores compared to green or white room conditions (Kutchma, 2003). Spending time in natural green environments or even looking at pictures of green scenery in nature has been found to be linked with stress relief (Gamble, Howard and Howard, 2014).

Woodson (1981) while identifying blue as a colour which induces cool, comfort, protective and calming psychological impacts, has also discussed the slightly depressing nature triggered by darker versions of it. As cited in Kutchma (2003), depressing effects of blue has been also identified by Hamilton and Newport (1989). Aligned with above, some patients found blue to be cool, depressing, and sad in a study executed by (Mahnke, 1996). Accordingly, some studies have stated that patients with depressive disorders should not be exposed to blue or other cold colours as it could worsen the conditions (Zhou, 2013). On the other hand, depressed patients were found to be preferring cool colours, suggestively attributable to the psychological belief that cool colours can stabilise/calm down a restless/uneasy mood (Nagumo, 2006). Accordingly, it is vital to integrate conducive colours which can induce positive impacts on distressed, depressed, and anxious individuals in their most inhibited healthcare settings.

After scrutinising the literature on the psychological impacts of different colours on depression, anxiety and stress levels of individuals, a shade of green, blue and yellow were selected to test the favourable impacts on patients with mobility impairments.

4. Objective of the Research

The objective of this study is to investigate the impact of colour as a parameter of OHE in reducing depression, stress, anxiety of mobility impaired patients with reference to wall colours of common residential-healthcare accommodation spaces.

5. Theoretical Framework

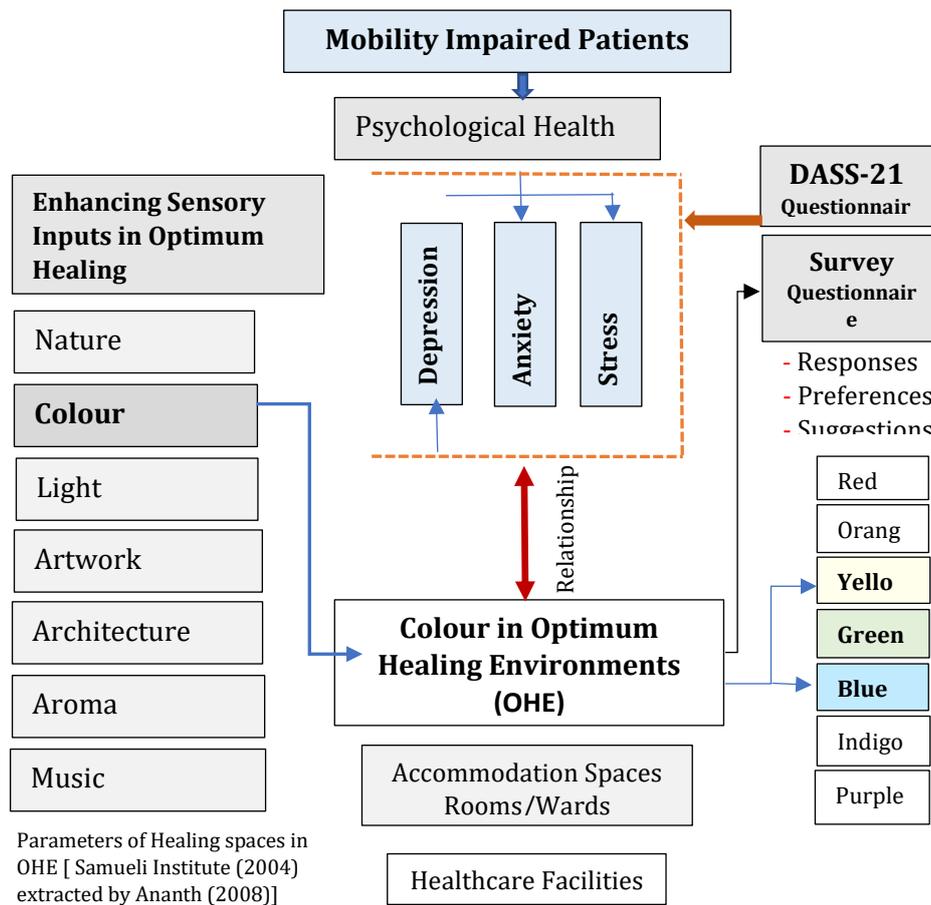


Figure 1, Theoretical framework derived from the review of literature.

6. Scope and Limitation

The study investigated the impact of three selected hues; green, blue, and yellow that were identified through the literature review as having a positive impact on the psychological state of individuals, focusing on their depression, anxiety, and stress levels. A specific shade per hue was further selected for testing based on the preference of the study sample (Blue - RGB:153,222,255, yellow - RGB:253,246,165 and green RGB: 151,221,109), to ensure minimum adverse impact on the participants. The survey was limited to a sample of physically disabled patients (n=15) suffering from the same illness (limb deformities) and residing within accommodation spaces (bedrooms) in same premises with similar dimensions, finishes, textures, volumes, materials, and lighting, in a rehabilitation centre for male patients at Ragama, Sri Lanka. Covid related restrictions had an impact on the original research design planned for a larger sample size with male/female participants and an alternative methodology had to be adopted with a reduced sample size and only male participants.

7. Methodology

The selected facility housed a group of male patients with limb deformities and transferred from Ragama Teaching Hospital after treatment and undergoing rehabilitation and vocational training. All the patients tested were aged between 35 Years - 40 Years and had been residing in the said facility for a period of over one year. Taking the sensitiveness of the patients into consideration special care was taken not to introduce any shades of the selected colours perceived as irritating or inducing adverse effects. In doing so, an initial investigation was conducted with the patients with limb deformities, of the same rehabilitation facility. The participants were provided with a colour palette with three different shades of green, blue, and yellow; a dark shade, a moderated shade and a lighter shade and were requested to choose the colour that they prefer the most as conducive to be incorporated in their bedrooms.

Analysing the data, three final shades were selected based on the preference of most participants as shown in below figure 2.



Figure 2, Selected shades of blue (RGB:153,222,255), yellow (RGB:253,246,165) and green (RGB: 151,221,109)

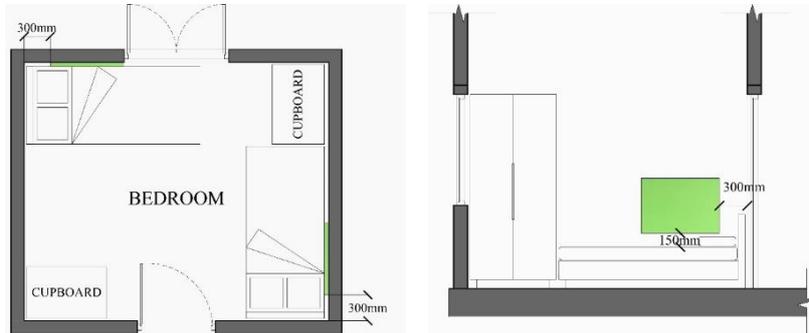


Figure 3, Details on colour installation – Green colour panels

In order to ensure that the overall well-being and the daily routine of the inmates in the rehabilitation centre was not compromised, all necessary ethical guidelines were followed in formulating the methodology. A1 size (594x 841 mm) colour panels were installed in 7 bedrooms of 15 patients in identical locations as shown in figure 3 without any physical interference or damage to the interior finishes of the room. Colour panels were placed on the sidewalls of the bed, being the most visible area providing maximum visual impact to the patient. Other contributing parameters such as room temperature, lighting level, humidity and wind velocity were maintained at a constant level. The data collection was done during the daytime with natural lighting conditions (9.00 a.m – 11 a.m).

Data was collected with reference to the existing colour scheme (white) as a control condition, followed by exposure to blue, yellow, and green colour conditions respectively. The patients were exposed to each colour condition for a period of 3 days. Both quantitative and qualitative methods were used in the data collection. Depression Anxiety Stress Scale (DASS-21S) (Lovibond and Lovibond,1995); Q1 was adopted to measure the self-reported emotional state of depression, anxiety, and stress levels of participants under each colour exposure. The DASS identifies depression, anxiety, and stress under a spectrum of five levels: Normal, Mid, Moderate, Severe and Extremely Severe. DASS initiated by Lovibond and Lovibond (1995) has been translated in to 26 languages and successfully adopted worldwide including the Sinhala translation which was adopted and validated among University Students in Sri Lanka (Rekha,2012). Another questionnaire survey was incorporated (Q2) to figure out the data on preference, perceived comfort, and satisfaction with reference to the introduced colour conditions.

8. Data presentation and analysis

8.1 DATA ANALYSIS – DASS 21

Findings of DASS 21 demonstrated substantial differences in the self-reported depression, anxiety, and stress levels of participants with reference to the exposure of existing colour conditions over the introduced blue, yellow, green colour conditions.

8.1.1 Depression Levels

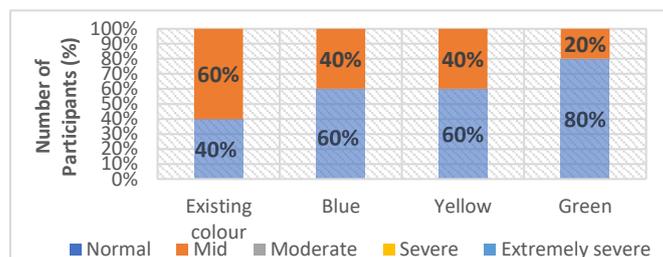


Figure 4, Summary of depression levels of participants in existing and introduced colour conditions.

As shown in Figure 4, Colour green was found to induce the most conducive impact on the participants where 80% of the participants reported a normal level free of depression compared with yellow and blue conditions (60% each) and followed by the existing colour condition (40%). Only 20% reported a mid-depression level when exposed to green while in blue and yellow exposure 40% each were reported. A majority experienced a mid-depression level (60%) under the existing white coloured condition. Therefore, Colour green was revealed to be supportive in the overall improvement of psychological health, considering the depression levels. The propensity of colour blue to intensify depression levels (Woodson,1981., Hamilton and Newport,1989., Zhou, 2013 and Mahnke, 1996) was not verified in the current study supposedly as the blue hue tested was a lighter version. None of the subjects experienced moderate, severe, or extremely severe depression levels under the colours tested.

8.1.2 Anxiety Level

As shown in Figure 5, Green colour condition was having the most conducive impact on managing anxiety levels of participants (normal: 60%, mid: 33% and moderate: 7%) followed by yellow (normal: 60% and mid:27% and moderate: 13%) and blue (normal: 53%, mid:40% and moderate: 7%). Again, colour green was seen as the best colour choice for the overall improvement of anxiety levels followed by blue as also observed by Gerard (1958) and Mahnke (1996). 13% of the participants experienced a moderate level of anxiety during exposure to colour yellow compared to other colours (7%). This observation supports the findings of Jacob and Suess (1975) and Dearing and Singg (1996) where colour yellow was found to be aggravating levels of anxiety.

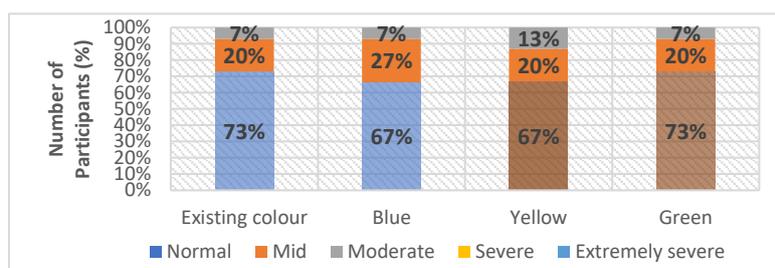


Figure 5: Summary of Anxiety levels of participants in existing and introduced colour conditions.

8.1.3 Stress levels

As shown in Figure 6, Stress levels of the participants across all colour conditions did not demonstrate a significant improvement compared to the stress levels under the existing colour condition. Colour green showed the most conducive result. (normal: 73%, mid: 20% and moderate: 07%) which however was similar to the DAS levels of the existing colour condition. Colour blue demonstrated positive impacts (normal: 67%, mid: 27% and moderate: 07%) followed by colour yellow (normal: 67%, mid:20% and moderate: 13%). Therefore, even though not demonstrated in a significant level, out of the introduced colours green was found to be supportive in managing stress levels of participants and in consistency with the findings of Kutchma (2003) and (Gamble, Howard and Howard, 2014), followed by colour blue, in alignment with Lubos (2012). On the other hand, colour yellow was found to be aggravating stress levels, even though not significantly, compared to other colours, supposedly due to its stimulating effect on individuals as explained by (Wexner, 1954.,Itten, 1973.,Birren, 1988., Mahnke, 1996).

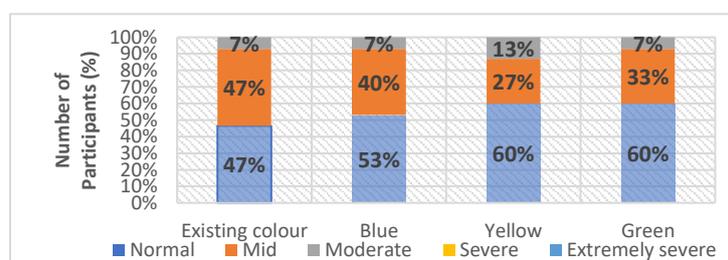


Figure 6: Summary of stress level of participants in existing and introduced colour conditions.

Accordingly, as identified by DASS -21, colour green was found to be managing depression, anxiety and stress levels of patients compared to blue and yellow.

8.2 DATA ANALYSIS - Q2

Findings of the data - Q2 as presented in Figure 7 and Figure 8, demonstrated similar impacts aligned with findings from DASS 21, revealing the conduciveness of colour green for healthcare facilities. Many of the participants (80%) were satisfied with the impact of introduced green colour in their bedrooms followed by blue (73%). Only 47% of participants were satisfied regarding the exposure to yellow colour. The perceived comfort was seen as high with

reference to green (73%), followed by blue (47%) and yellow (40%). On the other hand, a majority perceived colour yellow as inducing an uncomfortable experience (53%) compared to blue (20%) and green (20%). Yellow was identified to be an inappropriate colour for healthcare facilities.

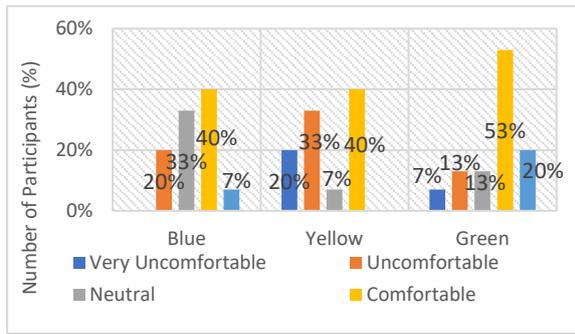


Figure 7: Perceived level of comfort in exposure to introduced colour conditions.

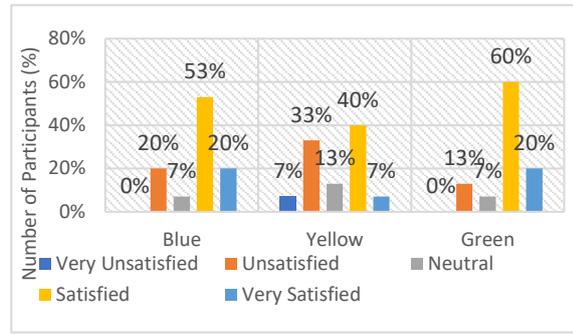


Figure 8: Perceived level of satisfaction in exposure to introduced colour conditions.

9. Conclusions and future recommendations.

Aligned with literature, the shade of green tested was found to be inducing favourable impacts on physically disabled patients to effectively manage depression (80%), anxiety (60%) and stress (73%) in a normal level, followed by colour blue (60%, 53% and 67% respectively). The positive impact of green was evident when combining the findings of both DASS – 21 and Q2. Patients’ perceived level of satisfaction and comfort was found to be significantly high during exposure to green (80% and 73%) in their respective bedroom spaces, compared to blue (73% and 47%) and yellow (47% and 40%). On the other end, the possible impact of colour yellow in aggravating the perceived stress (mid;20%, moderate 13%) and anxiety (mid;27%, moderate 13%) levels was displayed through the findings of DASS 21, though not in a statically significant level, which was reaffirmed by the findings from Q2 (uncomfortable total: 53%, unsatisfied total: 40%). The positive impact of colour green on mental well-being can be supposedly associated with its connection to nature and the established pacifying, calming and relaxing effects (Wexner,1954., Itten,1973.,Birren, 1988, Mahnke,1996 and Gamble, Howard and Howard, 2014).

Accordingly, the current investigation clearly identifies the potential of incorporating colour as a significant element in OHE beyond being merely an aesthetic agent. It is suggested to further explore the impact of colour green by expanding this study to hospital/healthcare environments, halfway treatment centres/homes with patients having several physical disabilities, incorporating larger sample sizes representing both genders, covering a cross section around the country including different socio-cultural backgrounds. Further, continuing this study with different values and intensities of colour green with prolonged time of exposure, applied in an array of proportions on different surfaces, finishes, textures and materials is suggested.

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