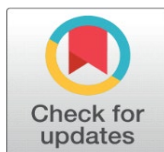
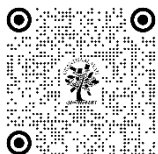


APPRIISING THE CHANGE IN OCCUPANTS' AND DESIGNERS' APPROACH APROPOS SPATIAL LAYOUTS POST-COVID-19

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ABSTRACT

The purpose of the study provides thought to change in occupants' approach in reference to internal spatial layouts post-covid-19 and re-examines the factors that influenced the change in internal spaces of residences and offices. Five constructs are identified to prove the change in occupants' approach in reference to spatial layouts post-covid-19 in internal spaces.

The Design methodology includes 400 participants of Chandigarh-Tricity responded to the questionnaire. The questionnaire was finalized after a pilot study and considered standard scale items referred from the literature review. A chi-square, one-ANOVA test research tool has been applied for the analysis of the proposed research model.

The findings show that there is a need for transformation of the internal housing spaces required post-covid-19. Many of the indicators have shown significant changes in behaviour due to characteristics of the house, neighborhood amenities, income levels, occupation types and household size. The change in occupants' approach during the pandemic offers an opportunity for aspiring interior designers, practicing interior designers, and academicians to reconsider their approach towards the planning of internal spaces in housing.

The research study has shown a strong change in (i) the occupant's approach in reference to spatial arrangements post-covid and (ii) the interior design approach post-covid and (iii) achieving much-required resilience through design from future Pandemics shocks.

The change in occupant's and designer's approach during covid-19/post-covid-19 has offered to consider reimagining interior layouts, work-from-home spaces, flexible spaces, convertible furniture, in-house recreational spaces, work-out spaces, and spaces suitable for self-isolation for medical purposes.

Keywords: Covid-19, Post-Covid, Occupant's Approach, Housing, Interior Planning

1. INTRODUCTION

Past pandemics like the European influenza epidemic in 1889-the 90, the Spanish flu, Russian Flu, influenza 1918, US Pandemic Influenza A (H1N1) 2009, and Bubonic plagues have proved deadly the human history [Munnoli et al. \(2022\)](#), [Taubenberger & Morens \(2006\)](#), [Alexander \(1974\)](#). Past pandemics have given a new approach regarding spatial arrangements in internal space. Quarantine spaces, emergency spaces, and new ways of working i.e., working from home shall be

remembered due to the pandemics [Munnoli et al. \(2022\)](#), [Taubenberger & Morens \(2006\)](#).

The covid-19 pandemic disturbed the overall functioning of cities in the world and offered lockdowns, restrictions in movement, social distancing, and a changed behaviour [Sharifi & Khavarian-Garmsir \(2020\)](#), [Zaher \(2020\)](#). People, in many ways, were not habitual to sudden changes and therefore faced issues during the pandemic [Sharifi & Khavarian-Garmsir \(2020\)](#). Many of the sectors like commercial, transportation, housing, and public/private institutions in the cities were affected [Niu et. al \(2021\)](#). Smart cities, digitization and urban policies also favoured the change in the functioning of the cities and demanded certain changes in the basic approach to the design and functioning of cities [Sharifi & Khavarian-Garmsir \(2020\)](#), [Zaher \(2020\)](#), [Chugh and Kumar \(2022\)](#) .

The structure of the town is bound to be changed due to coronavirus. [Tom Ravenscroft \(2021\)](#). During the pandemic, cities suffered and so did the housing, but this was the time when housing had shown its strengths and weaknesses and offered opportunities to rethink regarding internal planning of a house [Niu et. al \(2021\)](#), [Valizadeh et. al \(2022\)](#). A house is divided into a few major components vis-a-vis basic needs, psychological needs, and self-fulfilment needs; therefore, a house may offer relaxation needs, occupational needs, and safety needs at the same time [Alhadedy & Gabr \(2022\)](#). The pandemic has offered a new opportunity to see a space uniquely which may further offer multiple benefits at the same time [Alhadedy & Gabr \(2022\)](#), [Valizadeh et. al \(2022\)](#).

Also, studies have shown that the people with spacious houses along with neighbourhood facilities were more resilient during the outbreak as compared to poor and marginalized people where proper housing was not available [Oluwatosin et al. \(2020\)](#). Therefore, the change in the internal planning of a house may vary according to the income class to make it more efficient while a pandemic-like situation [Oluwatosin et al. \(2020\)](#).

Many occupants faced multiple issues during the pandemic and were not prepared for this challenge, either in terms of the need for a space or for their change in lifestyles [Yun et al. \(2021\)](#). Health issues, space issues, presence of family at home and related disturbances, shortage of space for office work/domestic work/online classes and change in lifestyle were a few to count which demanded a transformation in the design of built-up areas and their internal planning [Alhadedy & Gabr \(2022\)](#), [Oluwatosin et al. \(2020\)](#), [Valizadeh et. al \(2022\)](#) .

2. THEORETICAL BACKGROUND AND HYPOTHESES DEVELOPMENT

2.1. THEORETICAL BACKGROUND

The widely available literature on Covid and similar issues have pointed towards change in occupant's lifestyle, social attitude, behaviours and raised the demand for a new approach to housing design [Yun et al. \(2021\)](#), [Oluwatosin et al. \(2020\)](#). Some of the pieces of literature have also pointed out issues during covid-19 regarding mental health, discomfort, depression, and odd behaviours due to sharing internal spaces which resulted in an increase in domestic violence [Yun et al. \(2021\)](#). The requirement of extra rooms for health emergency when a member of the house fallen sick due to covid-19, that time has pressurised the whole family and demanded extra spaces, flexible spaces, and sanitation [Oluwatosin et al. \(2020\)](#). People having large houses have the flexibility to change their spaces into healthcare/isolated spaces. On the other hand, people having low income and small

houses, and slums have faced severe challenges to mitigate this crisis at the domestic level due to a lack of enough spaces for emergency uses [Oluwatosin et al. \(2020\)](#). That time of health emergency has given a hope to change or upgrade their spaces to resilient spaces for such critical situations [Alhadedy & Gabr \(2022\)](#), [Aldossary et al. \(2023\)](#). Covid-19 was the time when occupants and designers realised to change the approach towards domestic and official activities together [Zaher \(2020\)](#). Issues like sleeping, cooking, studying, and playing have faced a lack of space which can be tackled only by changing the design approach towards interior spaces [Alhadedy & Gabr \(2022\)](#).

Many of the research papers have shown a way of designing convertible spaces and adaptable spaces, i.e., during the daytime a space is an office and in the evening it's a bedroom [Alhadedy & Gabr \(2022\)](#), [Gür \(2022\)](#). Similarly, in the daytime, it's a drawing room and at night it's a bedroom. With this approach, the usage and efficiency of internal space can be optimized [Alhadedy & Gabr \(2022\)](#), [Gür \(2022\)](#).

This cannot be denied by epidemiologists, doctors, and scientists that there shall be no future pandemic, instead, they pointed to dealing with more such pandemics in the nearing future and the impact may be larger as compared to recent/current pandemic [Sharifi & Khavarian-Garmsir \(2020\)](#). They have discussed the governments, policymakers, and citizens to be ready in such a situation of a health crisis, and accordingly improvise the housing spaces to tackle the situation [Sharifi & Khavarian-Garmsir \(2020\)](#).

There are case studies where extra bedrooms have a door to exteriors and are later converted into isolation areas to protect the other family members from infection [Alhadedy & Gabr \(2022\)](#). Medical emergencies may be tackled through designing effectively [Nancy et al. \(2022\)](#). Isolated areas with all basic facilities in a space i.e., enough natural light, washrooms, working spaces, greenery etc are resilient at the time of covid [Nancy et al. \(2022\)](#).

Therefore, interior designing is currently facing a wave of change in design approaches which can withstand future challenges and become resilient for the occupants for future use [Nancy et al. \(2022\)](#), [Alhadedy & Gabr \(2022\)](#). Housings which were considered only for relaxation were considered for office work, recreation, play areas, online classes, and exercise areas [Alhadedy & Gabr \(2022\)](#). The pandemic has offered a new thought process to see an internal space uniquely which may further offer multiple benefits at the same time [Alhadedy & Gabr \(2022\)](#).

2.2. HYPOTHESES DEVELOPMENT

H1: There is a positive and significant change in occupants' approach in reference to housing post-covid.

The designed survey questions were taken care of to get valid results and the conducted survey has shown a positive relationship with the occupant's changed approach in dealing with the spatial internal arrangements post-covid [Alhadedy & Gabr \(2022\)](#), [Valizadeh et al. \(2022\)](#), [Gür \(2022\)](#). Therefore, the results after the survey have pointed towards significant results. Hence, the null hypothesis is rejected.

3. RESEARCH METHODOLOGY

3.1. SURVEY INSTRUMENT

A city-based cross-sectional study design was conducted among households in Chandigarh-Tricity from October 2022 to January 2023. The pilot study of 40

participants was selected by a systematic random sampling technique from equally allocated sectors of Chandigarh. Data were collected through face-to-face interview techniques and were entered carefully and analysed by using a statistical package for the social sciences version 24, considering P-values < 0.001 as statistically significant.

3.2. DATA COLLECTION

After the Pilot study of 40 participants, an overall 400 participants were included in the survey including general citizens, architects, and interior designers in the city of Chandigarh-Tricity.

3.3. DEMOGRAPHIC PROFILE

The demographic details during the survey are as followed in [Table 1](#), where 226 male participants with 174 female participants from varied residential areas of Chandigarh-Tricity.

Table 1

Table 1 Demographic Profile of Surveyed Participants			
		Frequency	Percent
Gender	Male	226	56.5%
	Female	174	43.5%
Age	<=19	57	14.25%
	20-29	141	35.25%
	30-39	96	24.0%
	40-49	74	18.5%
	>50	32	8.0%
	Total		400
		Frequency	Percent
Number of Occupants inc. children	1-3	29	7.25%
	4-5	120	30.0%
	6-7	184	46.0%
	>7	67	16.75%
	Total		400
Residence Type		Frequency	Percent
	Low-income, Mid income, High-income Sectors	211	52.75%
	EWS Sectors/ villages in urban areas	189	47.25%
		400	100.00%

4. DATA ANALYSIS

4.1. RESEARCH DATA ANALYSIS

The results were analysed, and the data is statistically significant in measuring the occupant's and designer's approach towards spatial arrangements using Chi-squared majorly and one-way ANOVA-test. Characteristics of space, size, and

context have shown results in deciding change in occupant’s approach. The results are shown in [Table 2](#), [Table 3](#) & [Table 4](#) where the results of the survey and analysis have shown significance under chi-square tests hence, it can be mentioned that there is a change in occupants’ and interior designers’ approaches regarding a house.

Category of the house (COH) Vs Change in behaviour & lifestyle (CBL) have shown a negative perfect relationship where reduction of one factor is responsible for an increase in other factors i.e. Reduction in size of a housing unit resulted in hygiene and safety during covid-19(HSC), Kids were facing problems during online classes (KFC), a family member was facing problems while at home (FFW), awareness regarding maintaining the house for cleanliness (AMC), experimented new things during the stay at home (ENH). Hence, the results are significant as per the size of a house in [Table 2](#).

Table 2

Table 2 Size of the House Vs Change in Behaviour & Lifestyle					
Category of the house (COH) Vs Change in behaviour & lifestyle (CBL)					
Category of the house	Change in behaviour & lifestyle	Gamma	p-value	Co-relation	Results
0-99 sqyds	HSC	-.389	.0001	negative perfect relationship	Significant
100-199 sqyds	HSC				
200-299 sqyds	HSC				
300-399 sqyds	HSC				
400-499 sqyds	HSC				
More than 500	HSC				
0-99 sqyds	KFC	-.702	.0001	negative perfect relationship	Significant
100-199 sqyds	KFC				
200-299 sqyds	KFC				
300-399 sqyds	KFC				
400-499 sqyds	KFC				
More than 500	KFC				
0-99 sqyds	FFW	-.589	.0001	negative perfect relationship	Significant
100-199 sqyds	FFW				
200-299 sqyds	FFW				
300-399 sqyds	FFW				
400-499 sqyds	FFW				
More than 500	FFW				
0-99 sqyds	AMC	-.532	.0001	negative perfect relationship	Significant
100-199 sqyds	AMC				
200-299 sqyds	AMC				
300-399 sqyds	AMC				
400-499 sqyds	AMC				

More than 500	AMC				
0-99 sqyds	ENH	.047	.389	positive perfect relationship	Significant
100-199 sqyds	ENH				
200-299 sqyds	ENH				
300-399 sqyds	ENH				
400-499 sqyds	ENH				
More than 500	ENH				

Category of the house (COH) vs Attitude reg pandemic (ARP) have shown a significant relationship, with a p-value showing 0.0001, which resulted in the factors have a significant relationship in [Table 3](#).

Table 3

Table 3 Category of the house Vs Change in Behaviour & Lifestyle							
Category of the house (COH) vs Attitude reg pandemic (ARP)							
Category of the house	Attitude reg pandemic	N	Mean	Std. Deviation	F-value	p-value	
0-99 sqyds	ARP	120	4.330	0.521	5.863	.0001	Significant
100-199 sqyds	ARP	160	3.841	0.882			
200-299 sqyds	ARP	44	3.960	0.909			
300-399 sqyds	ARP	36	3.826	0.916			
400-499 sqyds	ARP	24	4.055	0.874			
More than 500	ARP	16	4.093	1.145			

Category of the house (COH) and usage of spatial layout in the house (USH) have shown a positive perfect relationship and resulted in significant in [Table 4](#). The size of a house was compared with the usage of rooms (UOR), usage of open areas (UOA), case of an infected family member in a health emergency (CIH), and Area used to sanitize groceries (AUG). The above results are also discussed in the literature studies. [Gür \(2022\)](#)

Table 4

Table 4 Category of the House and Usage of Spatial Layout in the House						
Category of the house (COH) and usage of spatial layout in the house (USH)						
Category of the house	Usage of spatial layout in the house	Gamma	p-value	Co-relation	Results	
0-99 sqyds	UOR	12.39	.010	positive perfect relationship	Significant	
100-199 sqyds	UOR					
200-299 sqyds	UOR					
300-399 sqyds	UOR					
400-499 sqyds	UOR					
More than 500	UOR					

0-99 sqyds	UOA	.291	.0001	positive perfect relationship	Significant
100-199 sqyds	UOA				
200-299 sqyds	UOA				
300-399 sqyds	UOA				
400-499 sqyds	UOA				
More than 500	UOA				
0-99 sqyds	CIH	-.498	.0001	negative perfect relationship	Significant
100-199 sqyds	CIH				
200-299 sqyds	CIH				
300-399 sqyds	CIH				
400-499 sqyds	CIH				
More than 500	CIH				
0-99 sqyds	AUG	-.238	.0001	negative perfect relationship	Significant
100-199 sqyds	AUG				
200-299 sqyds	AUG				
300-399 sqyds	AUG				
400-499 sqyds	AUG				
More than 500	AUG				

5. DISCUSSION AND IMPLICATIONS

5.1. DISCUSSION

Participants during the survey and the analysis have shown new trends in occupants' approach towards handling a space during post-covid-19. They have said that there were issues like disturbances at home, shortage of spaces, no provision of handwashing at the entry of the house, no grocery washing spaces, no recreation within the house except a few, limited or no natural light and ventilation during their stay at home which is line with the literature studies [Gür \(2022\)](#). Therefore, they felt that a few major social elements are missing in the design of the house which need to be fulfilled. Flexible spatial arrangements and furniture might be the required gaps which are frequently not available which is also mentioned in one of the literature studies [Alhadedy & Gabr \(2022\)](#). Spatial arrangements which have the capacity to Convert themselves, where a drawing room can be converted easily into a workout space have become meaningful during covid, as also mentioned in the literature studies [Alhadedy & Gabr \(2022\)](#).

The findings suggest that Covid-19 as a health emergency resulted in a change in occupant's and designer's approaches towards spatial arrangements [Alhadedy & Gabr \(2022\)](#). The situation of covid-19 has given an option to the residents, designers, and housing industry leaders to think and provide design solutions with flexible, and adaptable options. The new interior design approach is to be focused more on flexibility and resilience in designing any internal space as also mentioned in the literature studies [Alhadedy & Gabr \(2022\)](#). As pointed out in the survey, people were spending more time during covid-19 in indoor environments and hence an ideal design requires more attention to take care of mental health, and

psychological health which is mentioned in the literature studies as well [Yun et al. \(2021\)](#). A house as a spatial arrangement has become more important during the pandemic as a multi-functional space where an occupant can spend time for relaxing, working and recreation, as discussed in the research [Alhadedy & Gabr \(2022\)](#).

Furthermore, a changed approach towards interior design may result in more resilience during the pandemic through design [Alhadedy & Gabr \(2022\)](#). The usage of natural light, ventilation, and convertible and open spaces may increase the efficacy of a residential space when designed in line with learnings from covid-19 [Alhadedy & Gabr \(2022\)](#).

6. RECOMMENDATIONS

6.1. THE POLICY LEVEL

After analysing and studying the issues during the pandemic, it can be recommended to have a few structural changes in the national building code 2016, where the provision of flexible spaces to achieve resilience can be considered. Enough provision to be introduced to the designers and the occupants so that they can opt for flexible spaces, easy-to-adapt spaces. City level/State level Building by-laws may be amended at the housing and workspace level where convertible spaces may be considered to have proper sanitation, natural light, and natural ventilation.

6.2. THE COMMUNITY LEVEL

Occupants, Interior Designers, Housing industry leaders, and furniture manufacturers are to be given free-hand to experiment with the flexi-furniture and spaces as also discussed in the literature [Alhadedy & Gabr \(2022\)](#). Advertisements can be broadcast to generate awareness towards convertible living with the help of industry leaders.

With the help of interior designers and industry leaders, affordable options in furniture can be devised so that all economic sections can use it regularly or during emergencies as mentioned in the literature [Alhadedy & Gabr \(2022\)](#). Natural light, natural ventilation, and recreational spaces are to be promoted to balance the internal environment, reduce mental stress, and improve mental health as discussed in the literature [Alhadedy & Gabr \(2022\)](#).

6.3. THE DESIGN LEVEL

6.3.1. INTERIOR LAYOUTS & FURNITURE TYPES

Internal Spaces with the potential to convert from a drawing room to a bedroom or to an office and vice versa, having proper sanitation, natural light and ventilation can be promoted, as shown in [Figure 1](#), [Figure 2](#) & [Figure 3](#). Categorically, economic class residential sizes can be created as a sample drawing to which the empaneled/non-empaneled Architects/interior designers can refer.

Figure 1

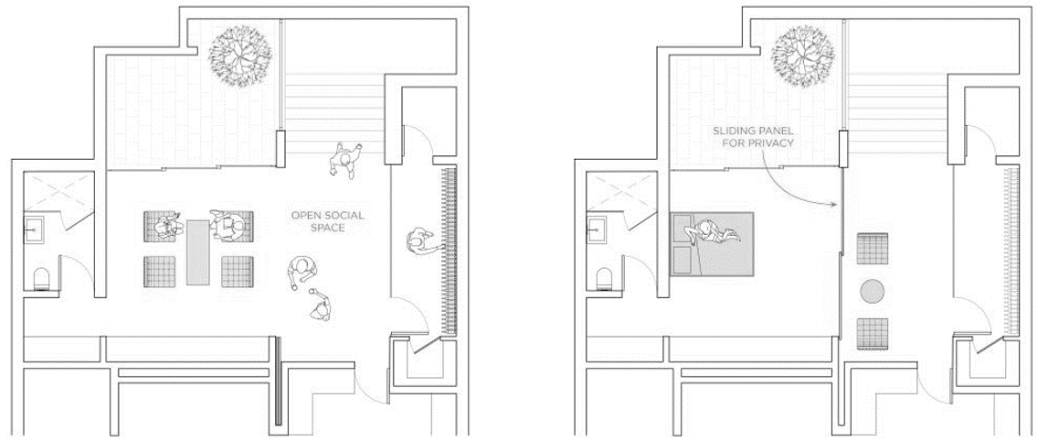


Figure 1 Conceptual Example of Convertible Spatial 2d Layout in a Residential Space.

Source <https://connect.eyrc.com/blog/post-pandemic-home-design.com>

Figure 2



Figure 2 An Example of Convertible Spatial Arrangement in a Residential Space

Source <https://connect.eyrc.com/blog/post-pandemic-home-design.com>

Special provisions can be planned in the interior layouts of residential, commercial and office buildings wherein the provision of flexibility, adaptability and convertibility are provided to handle any space constraints during a health crisis. There are such situations during health emergencies where the layout should have provision to adapt itself when there is a change in requirement.

Figure 3

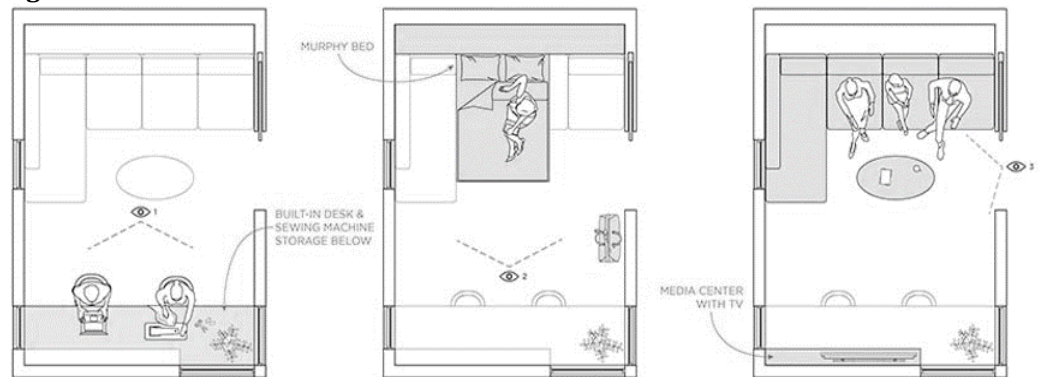


Figure 3 Conceptual Plan Showing a Spatial Arrangement in a Residential Space

Source <https://connect.eyrc.com/blog/post-pandemic-home-design.com>

Few Solutions to enhanced design strategies may be incorporated into the guidelines:

- 1) Quantum of flexibility can be given in the form of guidelines.
- 2) Cost-optimization techniques can be mentioned in the design guideline manuals.
- 3) Social need-based designs to be more focused during the designing process [Alhadedy & Gabr \(2022\)](#).
- 4) Overall, the design to prepare us for a better quality of life, as it should not be limited to normalcy during medical emergencies as well [Alhadedy & Gabr \(2022\)](#), [Aldossary et al. \(2023\)](#).

As shown in [Figure 4](#), flexible/convertible furniture is the way out where there is a lack of space for domestic activities. Furniture like sofa sets and beds can be converted from one form to another form for efficient space planning. With convertible solutions, a space can be effective and may enhance the performance/activities at home.

Figure 4



Figure 4 Conceptual View Showing Convertible Furniture in a Residential Space.

Source <http://ghar360.com/blogs/architecture/multipurpose-convertible-furniture>

Portable office pods can be positioned during the fear of spread and the employer needs people in the offices to work and it can also be used at home during work from home. Working from home might be a challenge for some but given the option of work pods may change the face of designs for an office & residential area during health emergencies. The isolated workspace shown in [Figure 5](#) & [Figure 6](#) is also known as Pivot space.

Figure 5



Figure 5 Conceptual View Showing Adaptable Furniture in a Workspace.

Source <https://hushoffice.com/en-gb/pivot-space-a-new-trend-in-office-arrangement>

The pivotal spaces shown in [Figure 6](#) are promoting individual spaces to work at a workplace or at residences with minimum resources required. Social distances can be maintained easily during the pandemic at workplaces.

Figure 6



Figure 6 Conceptual View Showing Pivotal Spaces in a Workspace.

Source <https://www.gensler.com/blog/10-critical-spaces-to-create-a-great-workplace-experience>

CONFLICT OF INTERESTS

None.

ACKNOWLEDGMENTS

None.

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