



Article title: Effect of lockdown on activities of daily living in built environment and well-being

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Keywords: work from home, diet, sleep, stress, entertainment, television viewing, Built environment

Sir

We are submitting a manuscript titled 'Effect of lockdown on activities of daily living in built environment and well-being' to be considered for publication in UCL Open: Environment. It is submitted solely to UCL Open: Environment; the manuscript or a substantial portion of it is not under consideration and has not been published elsewhere.

COVID-19 pandemic has been unlike anything most of us have encountered in our lifetimes. Without a vaccine or drug to prevent or to treat, physical methods are the only methods of prevention. By default, built environmental factors have been brought to the forefront in dealing with it. Currently, published studies have focussed on the layout and construction of workspaces to enable physical distancing, with comments on transportation modes and distance from places of residence. The largest and most strict lockdown ever, aspects of micro built environment, or the place of living and its impact on the people was important for effective implementation of the lockdown. There has not been a formal documented of this subject. The current exploratory work assessed the effect of the immediate built environment on the daily living during the initial weeks of the lockdown. This social experiment can offer insights into how aspects of daily living are impacted by the immediate surroundings. While the effects of built environment on health (well-being, physical exercise, access to food, sleep and shift work) are recognised, this offers an unusual opportunity to assess how these were affected by voluntary isolation. Further longitudinal studies can provide information into the long-term implications, when economic burden begins to be felt as a result of the forced lockdown. In addition, transdisciplinary interactions of built environment, workplace design, distance from place of residence, stress at work and at home, hours of sleep, place for relaxation can provide a comprehensive framework for further design of spaces.

Thanking you

Yours truly,

GR Sridhar

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Effect of lockdown on activities of daily living in built environment and well-being

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Abstract

In an effort to arrest the spread of COVID-19 infection, a nation-wide lockdown was declared in India in March 2020. To assess how personal built environment affected the citizens in the first few weeks, an explorative online survey was conducted, eliciting responses about the work habits before the lockdown, the psychological well-being, time spent in various activities, characteristics of those who worked from home and sleep patterns. The major difference entailed by the

lockdown was a reduction of time and distance to go to their workplace, which was an average of 8.9 km. In terms of diet, subjects who were vegetarian did not experience any difference, unlike those who were non-vegetarians, who reduced the intake of meat. Forced social isolation did not alter the television channels that were viewed. Among those who worked from home, most preferred to work from their bedroom. There was no change in the quality or quantity of sleep during the lockdown. This study in the early weeks of the lockdown documents the way in which individuals lived through it in terms of the built environment at home.

Keywords: work from home, diet, sleep, stress, entertainment

Introduction:

The coronavirus (Covid-19) epidemic, identified at the turn of 2020 has an ability to spread by droplet transmission. There is as yet no vaccine to prevent it, or drugs to cure the infection. The only measures to reduce the transmission consist of physical distancing, frequent washing of hands with soap and water, and avoiding touching the face. Though these are simple to itemize, it is difficult to implement. In an attempt to prevent community spread of infection, India imposed a lockdown, beginning on 22nd March 2020. Depending on the situation, the lockdown has been modified over the course of time.

The uncertainty about the disease coupled with lockdown across the nation led to a stressful situation for the common good. It is understandable that apprehension and anxiety could result from being lonely due to social isolation, fear of being infected, economic impact and uncertainty about the future course (1). A report that compared psychological distress and loneliness in 2018 and in April 2020 showed that the prevalence of serious psychological distress increased three-fold in April 2020 (1).

Following the outbreak of Covid-19, a number of studies were published on knowledge, attitude and practices (KAP) about the condition from across the world, including different parts of India (2,3,4).

Built environment, refers to “environments that are modified by humans, including homes, schools, workplaces, highways, urban sprawl, accessibility to amenities, leisure and pollution (5). It is conceivable that the response to the pandemic and measures to slow its spread can be modified by built environment. To our knowledge, there have not been any studies evaluating the effect of built environment on daily living and psychological stress during the lockdown. A report from Brazil studied the spatial correlation between the incidence of Covid-19 and human development (6). Doshi et al reported that fear about Covid-19 was low due to lack of knowledge, although women, lower educational status and being a healthcare worker were associated with higher fear levels (7). In situations such as these, physical interviewing is neither feasible nor desirable. Earlier studies have shown that social media platforms can be employed to recruit as well as to communicate about Covid in both developed and developing countries (8,9). Therefore we have conducted an online survey to assess the effect during the early weeks of lockdown on living habits, attitudes and other aspects influenced by the built environment.

Methods:

The twin aims of the study is to evaluate how activities of daily living (ADL) have a bearing on well-being during lockdown and how spaces at home support ADL during the “stay home stay safe” strategy. The second phase of lockdown beginning 15th April 2020 till 03rd May 2020 had stringent restrictions of “stay home” with 3-4 hours of relaxation in the morning to take home essential commodities. A structured questionnaire was developed covering different sections in sequence, namely demographics, food intake, activities of daily living, built environment (specifically homes), leisure and entertainment, and health and wellbeing.

This self-reported questionnaire survey designed in Google forms (available in Appendix at the end of the manuscript) was administered online from 19th April 2020 to 07th May 2020, i.e. during and beyond 4 days of the second phase of

lockdown (Figure-1). The online questionnaire was circulated to the contacts of the authors by online social media.

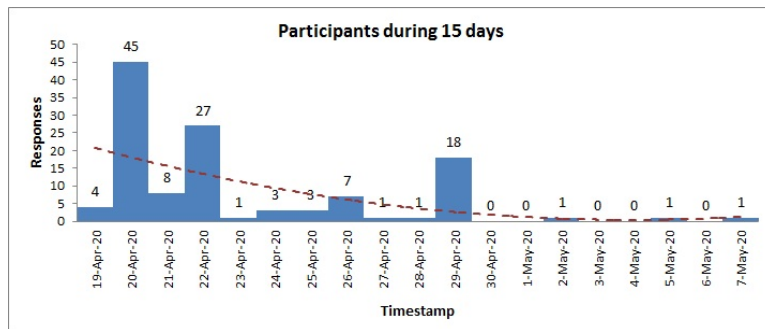


Figure 1: Duration of online survey

The section of Demographics has data pertaining to Age, Gender, Height, Weight, Marital status, Education and Employment. The Food intake section is related to information on changes of intake in principal meals and any change in intake of vegetarian and non-vegetarian food items. Information of activities of daily living covered day-to-day tasks. Questions on the Built environment section related to where their residence is located (area, floor level), type of house (rented/owned, individual/apartment etc.), what spaces do they have and where they spent most of the time during lockdown. Watching television and spending time with family at home being common leisure and entertainment activities, questions were included on the preferences of channels like movies, sports, education, spiritual, serials/drama, music, environment and news. Lastly the section on health and well-being relate to whether they are taking any medication along with six questions on well-being (Feeling in general; Energy, pep or vitality; Feel any tension; Happy, satisfied or pleased with personal life; Feel healthy enough and Concerned or worried about health and well-being). Following the objectives of the study, the wellbeing of the subjects is assessed for the activities of daily living (ADL) and how spaces at home support them using linear regression.

Statistical analysis

Of the 121 responses received, there is considerable demographic representation of age, gender, food habits, profession (Table-1a) and age with physiological parameter of Body Mass Index, BMI (Table-1b). Linear or multiple

regression analysis was employed to evaluate the relationship of dependent variables with predictor variables. Statistical analysis using excel is carried out for the parameters of demographics, food intake, ADL, built environment, leisure and entertainment, and health and wellbeing.

Results:

Demographic variables are presented in Table 1a and 1b

Table-1a: Details of responses by gender, food habits and profession

	Gender		Food Habits		Profession		
	Male	Female	Vegetarian	Non-vegetarian	Employee	Student	Home based
Percentage	63%	37%	27%	73%	70%	22%	7%
Number	76	45	33	88	85	27	09

Table-1b: Age and Body Mass Index (BMI)

	Age (in years)	Body Mass Index (BMI)
Mean	35.5	26.3
Standard Deviation	12.9	4.6
Minimum	18.0	15.7
Maximum	70.0	49.9
Number of Subjects	121	121

Food habits: Questions on whether there is any change in food intake were asked. Items like chicken, mutton fish etc. were considered for non-vegetarian and various types leafy vegetables, tubers, vegetables etc. were considered for vegetarian subjects. Table below shows the responses of change in average intake of various items by vegetarian and non-vegetarian subjects (Table-2). Also the mean food intake of vegetarian and non-vegetarian show a significant

variability. There is significant reduction in intake of non-vegetarian items (Figure-2).

Table-2: Average intake of food items

Food Intake During Lockdown					
Non-vegetarian			Vegetarian		
Intake	Number	Percentage	Intake	Number	Percentage
Never had	14	15.9%	As usual	20	60.6%
Started	08	9.1%	Light increase	05	15.2%
Stopped	15	17.0%	Moderate increase	07	21.2%
Increased	11	12.5%	Heavy increase	01	3.0%
Remained the same	24	27.3%	Total	33	100%
Reduced	16	18.2%			
Total	88	100%			

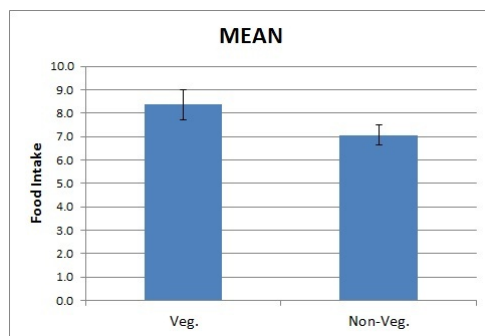


Figure 2: Food intake during lockdown

Health and Wellbeing: Self-reported questions on perception of well-being parameters include “energy, pep, vitality”, “happy and satisfied personal life”, “feel healthy to work”, “generally tensed” and “worried about health”. However, a question “feeling in general” is asked which includes overall perception of health. A regression analysis of different predictor well-being parameters that contribute to “feeling in general” is analysed for both before and during lockdown. The result of 121 subjects show a significance of $p < 0.02$ with predictor variables of “energy, pep, vitality” and “feel healthy to work” to the dependent variable of “Feeling in General”, with $R^2 = 0.60$ during the pandemic situation. Whereas the predictor variables of “energy, pep, vitality”, “happy and satisfied personal life”, “feel healthy to work” show significant relation $p < 0.02$

with dependent variable of “feeling in general” is observed before lockdown with $R^2=0.51$ indicating a greater reliability. There does not seem to have any influence of “Generally tensed” and “Worried about health” parameters indicating that the subjects feel safe during lockdown and experience the same confidence as before lockdown in absence of the epidemic (Table-3).

Watching television-TV: There is significant positive relation with 95% confidence interval and $R^2=0.18$ to “Feeling in General” for the news channels of “News updates on COVID-19 cases” with ($p<0.05$) and “General news updates” with ($p<0.01$) (Table-3). There is significant relation to “Happy and satisfied personal life” with ($p<0.01$) at 95% confidence interval and $R^2=0.14$ for channels related to “spirituality”.

Table 3: Regression results

Dependent Variable	Predictor Variable	Coefficients	Standard Error	t Stat	P-value
Feeling in General	During Lockdown				
Sample size=121	Energy, pep or vitality	0.305	0.122	2.504	0.014**
$R^2=0.509$	Happy, satisfied personal life	0.149	0.096	1.556	0.123
Significance, $F=2.21E-16$	Feel healthy to work	0.374	0.098	3.802	0.000**
Intercept=1.704	Generally tensed	-0.115	0.072	-1.586	0.115
	Worried about health	-0.124	0.073	-1.699	0.092
Feeling in General	Before Lockdown				
Sample size=121	Energy, pep or vitality	0.501	0.088	5.687	0.000**
$R^2=0.601$	Happy, satisfied personal life	0.193	0.071	2.739	0.007**
Significance, $F=1.89E-21$	Feel healthy to work	0.207	0.083	2.484	0.014**
Intercept=1.189	Generally tensed	-0.066	0.051	-1.285	0.202
	Worried about health	-0.080	0.056	-1.441	0.152
Feeling in General	Watching TV (News Channels)				
Sample size=121	News updates on COVID-19 cases	0.269	0.126	2.130	0.035**
$R^2=0.189$	News updates COVID-19 health precautions	-0.173	0.140	-1.234	0.220
Significance, $F=0.00002$	General new updates	0.311	0.113	2.740	0.007**
Intercept=3.383					
Happy, satisfied personal life	Watching TV (Leisure Channels)				
Sample size=121	Movies	0.155	0.080	1.938	0.055
$R^2=0.145$	Music	0.055	0.080	0.689	0.492

Significance, F=0.001	Spirituality	0.201	0.077	2.610	0.010**
Intercept=4.069					
Feel healthy to work	Mode of Transport				
Sample size=121	Public transport (Bus/Metro etc.)	-0.190	0.114	-1.665	0.099
R2=0.119	Para transport (Autorickshaw)	0.115	0.136	0.850	0.397
Significance, F=0.023	Company vehicle	0.066	0.076	0.871	0.385
Intercept=4.112	Personal Car	0.161	0.067	2.395	0.018**
	Personal 2-wheeler	0.084	0.068	1.236	0.219
	Shared transport (friends vehicle)	0.014	0.083	0.174	0.862
WfH	Employees living at individual houses irrespective of ownership				
Sample size=22	Bed room	3.253	1.355	2.401	0.029**
R2=0.526	Balcony/Sit-out/Utility	-1.631	0.815	-2.001	0.063
Significance, F=0.024	Front/Back yard	-1.932	1.379	-1.401	0.180
Intercept=10.698	Toilet	-1.752	1.131	-1.550	0.141
	Other Rooms	-1.746	0.958	-1.823	0.087
WfH	Students staying at own houses				
Sample size=21	Bed room	1.540	1.041	1.480	0.160
R2=0.481	Balcony/Sit-out/Utility	1.727	0.803	2.152	0.048**
Significance, F=0.057	Front/Back yard	-2.164	1.212	-1.785	0.095
Intercept=7.882	Toilet	-2.488	1.030	-2.415	0.029**
	Other Rooms	-0.717	0.799	-0.898	0.384
Sleep Pattern	Night sleep				
Sample size=121	Generally tensed	0.007	0.003	2.682	0.008**
R2=0.057					
Significance, F=0.008					
Intercept=0.313					
Sleep Pattern	Siesta				
Sample size=121	Generally tensed	0.007	0.002	3.417	0.001**
R2=0.089					
Significance, F=0.0009					
Intercept=0.032					
**indicates significance at 95% confidence interval					

The expectations of the people when the lockdown is released show Mode of transport in personal car has a positive relation with “Feel healthy to work” ($p < 0.02$) with $R^2 = 0.12$ (Table-3).

Built environment and Work from Home (WfH): Of the 121 samples 62% of them own the residence, 37.2% stay in rented houses and 0.8% stay in quarters provided by the employer. The breakup of different types of residential buildings are Apartment/group housing (52.9%), Individual/independent houses (40.5%) and (6.6%) of Row housing. The generally available spaces are kitchen, living and dining with 2-3 bedrooms, 1-2 balcony or sit-out spaces and 1-2 toilets. Few of them have exclusive store space, home theatre, garage, terrace and back/front yard. We assessed the response of the participants on WfH and found that people whose homes are of group housing/apartment type have no significant relation. Those staying in individual houses (22 respondents) irrespective of the ownership prefer WfH from their bed room space ($p < 0.05$ and $R^2 = 0.52$) with 95% confidence interval (Table-3). As for the students, those who stay at their own houses (21 samples) prefer balcony/sit-out spaces to perform their activities ($p < 0.05$ and $R^2 = 0.48$ with 95% confidence interval)

Sleep Pattern: There is a significant relation in sleep patterns to the well-being parameter of “Generally tensed” indicating poor quality of sleep due to stress or anxiety. Night sleep and siesta were significant at a $p < 0.01$ at 95% confidence interval with R^2 of 0.06 and 0.09 respectively (Table-3).

Discussion

We report an exploratory view of how the built environment was impacted by the world’s biggest lockdown following the covid pandemic; rather than take a narrow technical deep view of architecture per se in terms of construction, transmissibility and other micro-environmental factors, we considered the different ways in which people responded at home and for work in their immediate built environment.

Essentially we observed that the major difference entailed by the lockdown was a reduction of time and distance to go to their workplace, which was an average of 8.9 km. In terms of food intake, those who ate only vegetarian food did not experience any change, unlike those who were non-vegetarians, who reduced the intake of meat. This was necessitated both by the cost as well as an (unfounded)

fear of transmission through meat. To fill the time available on hand during the lockdown, watching television at home was a common past-time. Forced social isolation did not alter the channels watched (movies, sports, educational, spiritual, soap operas, music, environment or news).

The unprecedented lockdown led to the family staying at home, and accomplishing all their usual activities in an environment for which it was not originally designed, viz employment work, studies, entertainment and leisure all at once by all the family members. Among those who worked from home, most preferred to work from their bedroom. Students preferred to study outside the house, in balconies or in sit-outs.

Sleep is one of the compromises in the modern world, where people are accused of 'gorging themselves with food and starving themselves of sleep' (10). Here was a situation where there was ample time available for sleep, without the distractions of work or the forced circadian disruptions of shift work. However there was no improvement of quality or quantity of sleep during the lockdown. Dependent variables of "night sleep" and "siesta" are significantly related to predictor variable of "generally tensed" and hence poor sleep), but the small sample sizes makes it difficult to reach valid conclusions. However, factors including fear of being infected, economic uncertainty could have played a major role. It was a period of forced isolation, not volitional vacation; in addition the period of study could have been too short for any changes to be perceived.

Following the recognition of covid-19 pandemic, attention has focused on built environment trends to lower the risk of transmission by the design of buildings (11), as well as other tactile surfaces such as doorknobs, switches, toilet handles and faucet knobs (12). More broad based concerns about the construction of smart cities which can deal with future pandemics consisted of popularization for health science, improving emergency health systems, and keeping in place multi-industry coordination mechanisms, to deal with pandemics (13).

The concept and application of built environment owes its origin to epidemics and pandemics in the past: bubonic plague in the 14th century, yellow fever in

the 18th and cholera and small pox in the 19th all resulted in innovations such as broad boulevards, sewer systems, plumbing and urban sprawls (14).

Besides healthy workplaces, telecommuting and online accessibility of various services including telemedicine, distance learning, online shopping and online entertainment are bound to evolve. Houses are not just physical structures, but they are part of a broader social sphere; pandemics disturb the structures and routines that are closely inter-related, which is an interesting macro feature to consider (15). Some of the potential ways covid-19 will impact built environment consist of a shift away from large city offices, a reduced reliance on cars for transport to jobs and development of new forms of public spaces (16).

Ultimately these must lead to rethinking of design, operations, behaviour and maintenance to ensure that first the workplace and thence the economy is less susceptible to disruptions caused by disease (17).

To convert the crisis into an opportunity, one must plan to respond to such unexpected events, re-calibrate transport facilities, the work places to improve spatial distancing, as well as re-design of the environment by fusing blue and green infrastructure (18,19).

Our exploratory study has limitations in having a small sample of subjects along with inherent biases in the recruitment of subjects who had access to internet, were conversant in English and agreed to participate in the study. Nevertheless, it confirms the principles of built environment on well-being and health (20) and hopefully provides an impetus for development based on sound biopsychosocial concepts.

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Appendix:

Online link to Questionnaire:

https://docs.google.com/forms/d/e/1FAIpQLSdNFuo3S8x4zUE1UG7RtRF52dpONvvJG_T58AYbzCUElzbXjg/viewform?vc=0&c=0&w=1

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Data Statement: Data is available in **Appendix** as an Excel file (Data, Sudhir et alLock-down - .xlsx)

Declarations

COI: The authors declare no conflicts of interest with this work

Ethics: Consent for participation in the study and future publication of anonymised data was provided by the individual participants in the questionnaire (Appendix referred to above)