


## Article

# The Perception of COVID-19 Pandemic Lockdown: An Exploratory Study of New Zealand Home Occupants

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## Abstract

The COVID-19 pandemic imposed unprecedented restrictions on movement and daily life, testing the resilience and adaptability of existing housing stock, as families worldwide were forced to adapt their homes into multifunctional environments. In New Zealand, where lockdowns were among the most stringent globally, homes rapidly transformed into workplaces, schools, gyms, and places of refuge. Little is known about how these adaptations affected the sustainability of homes and occupants' well-being, particularly in the context of future crises. This study examined the economic, environmental, and psychosocial impact of the COVID-19 lockdown on New Zealand households. A questionnaire survey was conducted, and a quantitative analysis method was employed using survey data from 92 valid responses from New Zealand respondents who experienced lockdowns in various types of housing. To find important patterns and connections, descriptive and inferential statistical analyses were conducted. Findings revealed that economic factors had the strongest influence on respondents' perceived experience during the COVID-19 lockdown, with households reporting increased electricity and water use but reduced fuel costs. Environmental factors were also significant, with respondents noting the importance of fresh air, sunlight, acoustic privacy, and more spacious rooms, alongside the critical need for a dedicated workspace. Psychosocial effects included higher distraction levels, monotony, and heightened concern for health. Group differences highlighted the influence of age and the number of bedrooms on the perceived experience of lockdown. This pilot work offers a New Zealand perspective on the intersection of the pandemic with the sustainability of homes. The practical implications of this study highlight the need for sustainable housing retrofits, hybrid work policies that support ergonomic and acoustically adequate home offices, and demographic-sensitive interventions to enhance resilience and occupant well-being in future crises.



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**Keywords:** COVID-19; work from home; respondents; New Zealand; environmental; economic; psychosocial; impacts

## 1. Introduction

The COVID-19 pandemic significantly transformed the nature of interactions home respondents had with their houses, revealing the limits and potential of residential spaces to support sustainable living. During nationwide lockdowns, residential spaces evolved from single-purpose dwellings to multifunctional areas that accommodated work, education, fitness activities, and entertainment. In New Zealand, the imposition of a stringent yet brief lockdown in 2020 profoundly altered daily lives and perceptions of home environments [1].

Regulatory measures instituted by the New Zealand Ministry of Health necessitated prolonged indoor confinement, prompting respondents to reevaluate the extent to which home design facilitates physical, mental, and social well-being [2].

In response to these restrictions, households were compelled to modify their living spaces to enhance the spatial conditions in their homes—privacy, ergonomics, thermal comfort, and noise management. They ‘remodelled’ their homes so that they could be used as classrooms, gyms, businesses, and play areas. In some cases, they repurposed bedrooms, living areas, and even kitchens to create makeshift work or study spaces, raising concerns about ergonomic suitability, privacy, and noise management [1]. While global anecdotal studies suggest that households made both physical modifications and behavioural adjustments to cope with these demands, a significant gap remains in systematic, empirical research that explores how these changes manifested in the New Zealand housing context [3]. This gap is particularly salient given the existence of older, less resilient homes within New Zealand’s housing stock, which presents an intriguing context for investigating how respondents have reconfigured their living spaces [4]. A core issue lies in the ability of these homes to spatially adapt to diverse and often conflicting functions. New Zealand homes, many of which include older, poorly insulated structures, are not necessarily equipped to handle such multifunctionality [5,6].

The perception of comfort is expected to change significantly during this lockdown period, particularly with the increased time respondents have spent indoors. This change is likely to heighten awareness of issues (which might have been previously ignored), such as thermal discomfort, inadequate lighting, and intrusive noise levels. These environmental stressors can have adverse effects on mental well-being and productivity [7,8]. Additionally, energy use patterns are also very likely to be impacted. As daily routines evolved, so would the patterns of heating, cooling, appliance usage, and lighting, likely resulting in higher household energy consumption.

Comprehensive research into spatial, comfort-related, and behavioural adaptations is essential; without it, architects, urban planners, and policymakers cannot access the necessary data to inform resilient housing designs that will support communities during future pandemics or climate-induced isolation events [9]. In view of future scenarios, it is essential that homes are designed as adaptable living spaces that consider how respondents navigate change demands.

This study aims to provide an insight into how New Zealand respondents adapted their homes to achieve comfort and convenience in response to the COVID-19 lockdowns. The abrupt transition to remote work, learning, exercise, and social interaction emphasised both the strengths and weaknesses of existing domestic designs. Many existing residential building designs do not facilitate multifunctional use, often resulting in insufficient privacy, protection, or control over room utilisation. As such, concerns regarding ergonomics, noise levels, lighting, and overall indoor environmental quality were likely to emerge as homes transformed from single-purpose spaces into hybrid spaces. These transformations, in turn, have potential implications for the behaviour and health of building respondents.

Understanding how occupants were impacted and the adjustments they had to make to their living environments offers key insights for sustainable housing design, particularly in creating adaptable, energy-efficient and health-supportive dwellings. Such dwellings are capable of withstanding future disruptions, whether pandemic-related or climate-induced.

## 2. Background

The rapid transformation of domestic life during the COVID-19 pandemic redefined how New Zealanders experienced and valued their homes. International literature highlights a growing emphasis on adaptability, including movable partitions, convertible

furniture, and flexible zoning [10–12]. For instance, Bao et al. [10] noted that the pandemic necessitated an update in residential design to support multi-function use, variable layouts, and improved adaptability. Mechlenboarg and Christensen [12] examined how households renegotiate time and space at home in a post-lockdown context, highlighting adaptation to evolving domestic demands. The authors noted that working from home is not only a matter of flexibility and freedom, but an activity embedded in powerful spatial and temporal practices of home. These discussions resonate strongly in New Zealand, where small house sizes and open-plan designs restrict spatial flexibility.

Before 2020, New Zealand homes primarily served as spaces for leisure and relaxation. They became multifunctional areas due to the onset of lockdowns and prolonged restrictions as households had to balance various work-based and domestic activities [1,13]. This sudden convergence of functions exposed the adaptability and affordability flaws of New Zealand's housing stock—core components of sustainable housing.

For example, living rooms became improvised offices, dining tables doubled as desks and spare bedrooms or garages were repurposed as classrooms or exercise areas. Yet, for many households, particularly those in smaller or open-plan dwellings, creating distinct zones for focused work, study, and relaxation was difficult [1]. These challenges mirror international findings, such as Cook [14] and Kossek et al. [15]. Cook [14] noted that households living in smaller homes or open-plan designs faced challenges in creating distinct areas that facilitated focused work or learning, while Kossek et al. [15] observed that households had to be more innovative and flexible in utilising their spaces, as the lines between work and domestic activities became increasingly blurred during the pandemic. It is essential to note that, although similar situations were evident in New Zealand, the country's long-standing housing inefficiencies and climatic vulnerabilities amplified the experience.

A defining feature of the New Zealand housing stock is its persistent energy inefficiency and poor thermal performance, especially among homes built before 1978, when insulation first became legally required [16,17]. Research shows that around 72% of homes fall into this pre-1978 category, making them vulnerable to mould, dampness, and poor indoor air quality. These conditions became highly visible during COVID-19, as residents spent extended periods indoors. Heating practices further complicated these issues. Many households still rely on unflued gas heaters, which emit both moisture and pollutants such as nitrogen dioxide and carbon monoxide [18]. Inefficient electric resistance heaters remain widespread [19], locking households into high energy bills without delivering adequate warmth. For families confined indoors during lockdowns, the cumulative health risks from poor thermal environments, combined with indoor air pollution, were amplified, undermining the environmental sustainability of homes.

The COVID-19 restrictions also highlighted existing socioeconomic disparities in New Zealand's housing stock. For example, Māori and Pasifika communities, who are disproportionately represented in lower-quality and overcrowded housing, often bear the brunt of substandard housing-related challenges [16] due to their socioeconomic status. Research shows that substandard housing not only compromises thermal comfort but also heightens exposure to respiratory illnesses—an acute concern during a respiratory pandemic [20]. Socioeconomic disadvantage meant many families had limited options for upgrading heating systems or retrofitting insulation.

The New Zealand Healthy Homes Standard program is another example. It was launched just before the COVID-19 pandemic in 2020 by the government to address such long-standing disparities by requiring rental properties to meet minimum requirements for insulation, heating, and ventilation. Yet the programme faced significant setbacks during the pandemic. Many rental properties either failed to meet or only partially adhered to the

insulation, heating, and ventilation regulations. Landlords were delayed in completing detailed compliance statements due to COVID-19 restrictions [21]. Broader disruptions led the government to extend compliance deadlines for both private and public rental providers [22]. For many tenants, this meant continued exposure to inadequate housing conditions during a time when staying home was mandatory, affecting households' health, education, and work productivity. Serjeant et al. [23] and Howden-Chapman et al. [2] noted that thermal discomfort was a widespread issue during lockdown, exacerbated by the poor insulation of many older New Zealand homes.

Global trends indicate that COVID-19 disrupted daily energy consumption patterns, with average household daily electricity consumption increasing by ~12% in 2020 compared to 2019 and shifts in hourly profiles toward more uniform demand [24]. In New Zealand, this trend was similarly evident as households adapted to continuous home use and occupancy. An estimated 40% of New Zealanders worked from home during the lockdown [1]. The impact of an increase in working from home is a potential surge in building use adaptations, which include more frequent cooking, higher laundry loads, continuous internet usage for remote work and schooling, and ongoing operation of heating and cooling systems to maintain comfort throughout the day. Interestingly, Byrd et al. [25] noted the increased reliance on air conditioning in New Zealand prior to the pandemic as a socially stratified comfort technology, where it is affordable for wealthier households but inaccessible for low-income groups. During the pandemic, the social inequity divide became clearer: those who could afford efficient cooling technologies managed to maintain thermal comfort, while others relied on inefficient heaters or endured discomfort. Such stratification risks locking in carbon-intensive cooling systems, rather than encouraging adaptive building design and deepening inequality.

Furthermore, the limitations of NZ conventional house design layouts became stark during the pandemic. Homes not designed for multifunctional use struggled to accommodate simultaneous work, schooling, and leisure activities. Spaces designed solely for dining or sleeping were repurposed as offices and classrooms. However, makeshift adaptations often fell short, affecting privacy, comfort, and productivity. For New Zealand households, especially those in rental accommodation, the lack of control over housing modifications further constrained adaptability [1,26].

The limitations of traditional home layouts in addressing these emerging demands have led to calls for a paradigm shift in residential design philosophy [11]. Scholars worldwide have explored how variations in functional design and spatial organisation influence energy consumption, productivity, mental health, and physical comfort [27,28]. Likewise, there is growing emphasis on future-proofing homes for multi-functionality by incorporating features such as movable partitions, convertible furniture, and flexible zoning into architectural discourse.

Despite the global trend, a notable gap remains in empirical studies investigating how New Zealanders adapted their homes during the COVID-19 pandemic. While recent works evidence the global impact of the pandemic towards preparing homes for future scenarios, significant gaps remain. For instance, although behavioural changes in energy usage have been noted, detailed analyses of these behavioural changes, segmented by demographic, occupancy, and housing differences, are still uncommon, particularly in the Southern Hemisphere. Addressing these gaps is crucial for designing resilient residential environments and equitable energy policies, particularly in anticipation of future crises that may necessitate prolonged periods of home occupancy.

### 3. Methods

This study examined the impact of the lockdown on occupants' comfort and perception of their home. To achieve this aim, this study had the following objectives:

1. To highlight the economic, environmental and psychosocial impacts of the lockdown.
2. To examine respondents' perception of working from home (WfH) during the lockdown
3. To highlight differences in perceived experience based on gender, age, time spent at home, and type of house.

An exploratory pilot study was conducted. According to van Teijlingen and Hundley [29], a pilot study is a scaled-down version of a main study. It enables early assessment of research success. This study employed a quantitative method using questionnaire surveys. The questionnaire was developed based on existing literature and utilised a combination of Likert-scale and open-ended questions.

The questionnaire was categorised into 3 sections. Section A covered background questions about gender, age, ethnicity, location, length of stay in New Zealand, Home typology, number of bedrooms, and length of time spent at home during the COVID-19 pandemic. Section B covered households' perceived experience during the COVID-19 lockdown regarding economic, environmental and psychosocial factors. Section C covered households' perceived experience of working from home. Each section was supplemented with an open comment section, allowing respondents to provide explanations for their ratings. The questionnaire also included an additional question that asked respondents what changes they would make to improve the comfort and functionality of their homes.

As required, the questionnaire was sent to 3 experts, purposively selected, to confirm the content validity of the questions [30]. Feedback from experts was used to refine the measurement items of the survey instruments before administering the questionnaire through the Qualtrics online survey platform [31]. The questionnaire was shared online through emails and on social media outlets. A non-probability convenience sampling method was employed, enabling the voluntary nature of participation and relying on respondents' willingness to complete the survey [32].

For this pilot study, only 127 responses were received, and 92 of these responses were deemed suitable for analysis. Cooper and Schindler [33] recommended sample sizes of 25–100 respondents for a pilot test. For validity, a post hoc power analysis was conducted to determine the sample size required to detect the effect of interest in the population. This is useful in determining whether the sample size was sufficient to detect a medium-sized correlation ( $r = 0.30$ ) at an alpha level of 0.05 [34]. With a total sample size of 92 and using a two-tailed test, the analysis showed a statistical power of 0.84. This indicates that the power level is sufficient for detecting a significant effect. A reliability analysis was also conducted to evaluate the internal consistency of the five-item economic perception scale. The analysis yielded a Cronbach's alpha of 0.79, suggesting that the scale has acceptable internal consistency. Hair et al. [35] noted that the minimum acceptable value of coefficient alpha is 0.60 to 0.70, and Cronbach's Alpha and composite reliability are acceptable in an exploratory study.

The responses were analysed using descriptive and inferential statistical techniques using IBM SPSS Version 29 (Statistical Package for the Social Sciences) [36,37]. SPSS is a good tool for putting together and analysing data from social science studies. The descriptive statistics enabled the use of means, standard deviations and frequency distributions to summarise the demographic data and perceived experiences [38]. The inferential statistics used independent samples *t*-tests and one-way ANOVA test for more exploratory analysis. The *t*-test compared differences in perception between two groups (e.g., gender, time spent at home) [39], while the one-way ANOVA test [37] identified differences in perception among more than two groups (e.g., age, home typology, number of bedrooms).

Most respondents were under 50 years old (81.5%), male (52.2%), and had lived in New Zealand for more than 11 years (65.2%). They are mostly Europeans and Asian (73.9%) and are located in Auckland city (73.9%). The respondents mostly occupied standalone houses (69.6%) with 3–4 bedrooms (65.2%). Interestingly, most respondents (87%) noted that they spent less time at home during the lockdown (Table 1). Time spent at home refers to the collective amount of time the respondent spent within their homes as opposed to outside their homes during the lockdown.

**Table 1.** Demographics of respondents (%).

Gender	Age	Ethnicity	Location	Time in NZ	Home Typology	No of Rooms	Time Spent at Home
Female (47.8)	Below 30 (21.7)	European (42.4)	Northland (3.3)	Less than a year (3.3)	Standalone (69.6)	1–2 bedrooms (30.4)	Less than 50% (87)
Male (52.2)	30–49 (59.8)	Māori (3.3)	Auckland (73.9)	1–10 years (31.5)	Semi-detached (7.6)	3–4 bedrooms (65.2)	More than 50% (13)
Other (0)	50–65 (15.2) Above 65 (3.3)	Asian (31.5)	Waikato (6.5)	11–20 years (26.1)	Townhouse (7.6)	Other (4.3)	
		Pacific People (3.3)	Bay of Plenty (1.1)	More than 20 years (39.1)	Apartment (12.0)		
		Black/African American (5.4)	Whanganui-Manawatu (1.1)		Other (3.3)		
		Middle Eastern (3.3)	Wellington (5.4)				
		Other (10.9)	Canterbury (7.6)				
			Otago (1.1)				

## 4. Results

### 4.1. Descriptive Analysis (Objectives One and Two)

The respondents were asked to rate their level of agreement with statements related to the economic, environmental, and psychosocial impacts of the lockdown (Objective 1). Additionally, they were tested on their perception of working from home (Objective 2). A 5-point scale was used to assess their perception, where 1 is “Strongly Disagree” and 5 is “Strongly Agree”. The total scale range (5 – 1 = 4) was divided by the number of categories ( $n = 5$ ), resulting in an interval size of 0.80 [40]. This approach allows each category of perception to be represented by a distinct mean range.

Accordingly, the following classification was adopted:

- 1.00–1.80 = Strongly disagree;
- 1.81–2.60 = Disagree;
- 2.61–3.40 = Neutral (neither agree nor disagree);
- 3.41–4.20 = Agree;
- 4.21–5.00 = Strongly agree.

Generally, none of the statements were strongly disagreed with by the respondents, as the mean rating for all the comments was above 1.80. Only two comments—“I missed driving or commuting to work” and “I had internet issues”—were disagreed with by the respondents ( $m = 2.45$ ; 2.54).

For the economic impacts, all respondents agreed that they experienced increased electrical ( $m = 4.09$ ) and water usage ( $m = 3.96$ ), and took fewer annual leaves from work ( $m = 3.73$ ) during the lockdown. They strongly agreed to have reduced fuel costs ( $m = 4.40$ ) during this period. However, they were neutral to the statement on saving on childcare costs ( $m = 3.27$ ).

Regarding environmental impacts, the respondents agreed that they needed more fresh air ( $m = 3.64$ ), more sunlight ( $m = 3.54$ ), better acoustic privacy ( $m = 3.70$ ), and more spacious rooms ( $m = 3.51$ ) during the lockdown. Interestingly, they strongly agreed that they needed a dedicated workspace ( $m = 4.25$ ) during this period.

The respondents agreed that during the lockdown, they became easily distracted from work ( $m = 3.44$ ), got tired of monotonous activities ( $m = 3.54$ ) and worried more

about their health ( $m = 3.45$ ). However, they were neutral on the notion that they found it difficult to manage day-to-day activities ( $m = 3.15$ ), had to tolerate interruptions to their tasks ( $m = 3.16$ ), and felt that there were too many people in the same space ( $m = 2.88$ ). Interestingly, they did not strongly agree with any of these statements regarding the psychosocial impact of the lockdown.

Regarding the concept of working from home (WfH), the respondents did not strongly agree or disagree with the notions put forward. However, they agreed that they wanted a mix of working from home and their offices ( $m = 3.45$ ), missed their work colleagues ( $m = 3.74$ ) and enjoyed their breaks from work ( $m = 3.93$ ). The respondents disagreed that they missed driving or commuting to work ( $m = 2.45$ ) and had internet issues ( $m = 2.54$ ). That said, they were neutral on the notion that they found it harder to communicate and collaborate with colleagues ( $m = 3.19$ ), preferred working from home ( $m = 3.23$ ), missed working from their offices ( $m = 3.34$ ) and felt unproductive ( $m = 2.63$ ). Table 2 provides the descriptive analysis of respondents' perceived experience.

**Table 2.** Descriptive analysis of respondents' perceived experience during the COVID-19 lockdown.

		Descriptive Statistics					
		N	Min	Max	Mean	Std. Dev	Rating
Economic	I saved on fuel	92	1	5	4.40	1.195	SA
	I saved on childcare	91	1	5	3.27	0.96	N
	I used more electricity	92	1	5	4.09	1.099	A
	I took less annual leaves from work	91	1	5	3.73	1.23	A
	I used more water	91	1	5	3.96	1.089	A
Environmental	I needed a dedicated workspace	92	1	5	4.25	1.145	SA
	I needed more fresh air	90	1	5	3.64	1.401	A
	I needed more sunlight	92	1	5	3.54	1.354	A
	I needed a better acoustic privacy	92	1	5	3.70	1.273	A
	I needed more spacious rooms	92	1	5	3.51	1.338	A
Psychosocial	I found it difficult to manage day-to-day activities	92	1	5	3.15	1.475	N
	I got distracted from work easily	91	1	5	3.44	1.500	A
	I was more worried about my health	92	1	5	3.45	1.378	A
	I found it difficult to tolerate interruptions to what I was doing	92	1	5	3.16	1.424	N
	I got tired of the monotonous activities	90	1	5	3.54	1.383	A
	I felt there were too many people in the same space	91	1	5	2.88	1.489	N
Work from Home (WfH)	I wanted a mix of working from home and my office	91	1	5	3.45	1.463	A
	I enjoyed my work breaks	90	1	5	3.93	1.110	A
	I missed my work colleagues	90	1	5	3.74	1.223	A
	I missed driving or commuting to work	91	1	5	2.45	1.327	D
	I was harder to communicate and collaborate with colleagues	91	1	5	3.19	1.414	N
	I had internet issues	89	1	5	2.54	1.454	D
	I preferred working from home	91	1	5	3.23	1.407	N
	I missed working from my office	91	1	5	3.34	1.343	N
	I felt unproductive	90	1	5	2.63	1.525	N

SA = strongly agree; A = agree; N = neither agree nor disagree; D = disagree.

- Associated respondents' comments

The analysis of respondents' comments revealed that while some comments did not correlate with the collective mean ratings, there were clear economic trade-offs and significant variations in how home spaces supported or hindered work and study, disrupted routines, social interactions, and personal well-being.

The most consistent theme across comments on economic impact was the rise in domestic utility consumption. The respondents attributed this to the shifted activities typically undertaken elsewhere, such as work, study, and childcare, into the domestic environment. One respondent observed, "Family of 5 people staying at home all the time means using more electricity, water, etc." Others described more specific drivers

of consumption, including “more washings and water play for kids and longer shower time” and “all my family members spent more time in front of the computer to work, study and entertain, apparently there was more power consumption.”. In contrast, many respondents reported savings in fuel and childcare, largely due to travel restrictions and the closure of schools and daycare facilities. “I saved fuel due to travel restrictions and working from home,” explained one respondent, while another noted, “Outgoing cost of fuel and childcare have decreased significantly.” Several respondents reported not taking annual leave, as one put it: “No point of taking annual leave when no plans for travelling and events.” Others described restrictions on leave availability, particularly for essential workers, with one stating, “Could not take leave unless tested positive.”. A striking outlier in the comments was from a respondent living in a Passive House Premium-certified dwelling. They described their home as “beyond Zero Bills,” with reduced heating demand (22 kWh/m<sup>2</sup> per year) and onsite renewable generation sufficient to power an electric vehicle. This highlights the mediating role of housing quality, indicating that energy-efficient homes not only cushion households from higher utility costs but can also generate net-positive energy [41,42]. Finally, a minority of respondents indicated no significant change in their economic circumstances, with one stating, “My situation did not change,” and another pointing to regional variation: “My region does not charge for water.” Others noted being away from home due to essential work, which moderated household consumption patterns.

For environmental impacts, noise and the need for acoustic privacy emerged as significant concerns, supporting the respondents’ ratings. One respondent stressed, “Acoustic privacy is very much essential for me as I am noise sensitive,” while others noted difficulties caused by sharing space with children or other family members: “Sharing space with family makes it hard to have my own dedicated area”, and “I need quietness to edit.” By contrast, those in well-insulated or high-performance homes highlighted superior conditions: “The building is designed to have many spaces that are multi-functional, there is mechanical ventilation with heat recovery. . . external walls exceed the building code by 100% so extremely quiet.” A small group of respondents highlighted factors such as ventilation, daylighting, and thermal comfort. The Passive House respondent noted features such as mechanical ventilation with heat recovery, optimised solar gain, and superior wall insulation, describing the home as exceeding code requirements and eliminating environmental concerns. Another participant reported: “My house is sunny and spacious, not so close to neighbours. We only had two people in the house, and a workplace/study helped me to concentrate more.” These experiences contrast sharply with those in smaller, less efficient homes, where poor daylight, ventilation, and noise control limited functionality. Several respondents identified the availability—or lack—of sufficient space as a central factor shaping their lockdown experience. For some, a large or well-designed home provided adequate room for working: “We have quite a large house, so size not really a problem” and “Already had a spacious room dedicated to studying or doing work and extra space available on the sunny deck with pergola, trees and greens with fresh air, no one around.” In contrast, households in smaller dwellings faced acute constraints: “We lived in a small 2-bedroom unit where the acoustic privacy was bad, making working difficult”, and “We had 2 children in a 2-bed house, with only one table for us both to work at while both working full time.” The respondents also noted that household composition directly influenced their ability to create suitable workspaces. Parents particularly struggled: “Because I am looking after my kids, I cannot stay in a separate place from them to work”, and “I have kids and need a dedicated space of my own to work.” Others commented on overcrowding: “Too many people at the home.” By contrast, smaller households experienced fewer difficulties, as noted by one: “Work was not at home, so no workspace was needed, the house was fine as

only two people were at the time.” A minority of respondents reported that their situation remained largely unchanged, either because they were already accustomed to working from home (“I usually work from home, so nothing changed”) or because their occupation required them to remain onsite (“Not work from home”).

The psychosocial impacts also receive considerable comments. Several respondents emphasised feelings of loneliness or social discomfort. For example, one noted, “Felt more isolated,” while another observed, “During the lockdown, I experienced all sorts of Social/Personal discomforts. . . unnecessary chores and noise disruptions from the neighbours.” For households with children or multiple respondents, managing competing demands created psychosocial strain. Statements such as “Children are distracting!!!” and “All of our family members were at home” illustrate how caregiving and shared space responsibilities can interrupt focus and generate stress. In some cases, overcrowding eroded privacy: “We had people staying with us for the duration of lockdown. . . lost our sense of privacy and space.” Conversely, respondents in smaller households noted fewer issues: “Only 2 people in a 5-bedroom house.” Respondents described psychological fatigue and difficulty sustaining productivity: “psychological fatigue”; “It is a challenge to focus on work while caring for a child. Time management and organisation became critical.” Others reported boredom and monotony: “bored with doing the same household activities all the time.” Yet a minority found lockdown beneficial, with one stating, “I loved lockdown,” and another remarking, “I enjoyed the time spent at home. . . There were always things to do, such as baking, cleaning, and gardening.” One respondent highlighted the buffering effect of living in a high-performance dwelling: “Passive House buildings provide superior indoor environments so respondents have enhanced comfort and wellbeing along with very high levels of energy efficiency.”

Regarding the respondents’ perception of working from home, some reported higher productivity in office environments: “I prefer working in an office over working from home. I feel more productive when I am at the office.” Others noted that WfH introduced distractions: “There was always something else mundane to do rather than work.” Blurred boundaries between home and work were a frequent concern: “hard to achieve work-life balance”; “working at home continuously made work and home blend together.” Some adapted by restructuring hours: “I changed my working hours to late night to work without interruptions.” Despite challenges, respondents also recognised positives. Avoiding long commutes was appreciated: “Never missed work commutes. It’s best not to be stuck in traffic a couple of hours a day.” Others highlighted continued connection through technology: “Occasional office work is beneficial for networking. Due to modern technology, communication with colleagues for work or social life is easy.” Not all respondents worked from home. Some continued to go into the office for work: “Worked from the office”; “During lockdown, I worked through level 3, and it was good. With less traffic, it was fast to get to work.” For these respondents, WfH issues were irrelevant, but lockdown altered their experiences through quieter commutes and reduced social activity.

#### 4.2. Correlation Analysis (Objective Three)

As mentioned earlier (Section 3), an independent samples *t*-test was conducted to compare the mean scores of two independent groups—gender and time spent at home during the lockdown, while a one-way between-subjects ANOVA was conducted to compare the means of more than two independent groups on a continuous variable—age, number of rooms, and home typology (see Table 2).

For each *t*-test, assumptions of normality and homogeneity of variances were examined. Levene’s test for equality of variances was used to determine whether equal variances could be assumed between the two groups. Where Levene’s test was not

significant ( $p > 0.05$ ), the equal variances assumed row of the  $t$ -test output was used. Where Levene's test was significant ( $p < 0.05$ ), the equal variances not assumed row was reported to correct for unequal variances. In addition to statistical significance ( $p$ -values), effect sizes were calculated using Cohen's  $d$  to assess the magnitude of differences between groups. Confidence intervals (95%) were reported for both the mean differences and the effect sizes to aid in interpretation.

For the one-way ANOVA, a statistically significant difference was observed at 0.05, with post hoc comparisons using Tukey's HSD to reveal where the difference lay among the groups. The findings showed that no significant difference was found among the means based on the home typology. The findings showed significant differences between the other groups, which are discussed below and depicted in Tables 3 and 4.

**Table 3.** Correlation analysis of respondents' perceived experience based on gender and the amount of time spent at home during the COVID-19 lockdown.

Variables	Amount of Time Spent at Home				Gender			
	Mean (50% or More)	Mean (Less than 50%)	$p$ -Value	Cohen's $d$	Mean (Male)	Mean (Female)	$p$ -Value	Cohen's $d$
I saved on fuel	4.3	3.11	0.479	1.050	4.03	4.27	0.327	−0.203
I saved on childcare	3.31	3.00	<b>0.002</b>	0.316	3.22	3.13	0.669	−0.09
I used more electricity	4.24	3.11	0.053	1.092	4.13	4.06	0.782	0.058
I took less annual leaves from work	3.74	3.67	0.783	0.062	3.72	3.75	0.932	−0.018
I used more water	4.12	2.89	0.564	1.220	3.82	4.11	0.194	−0.271
I needed a dedicated workspace	4.34	3.67	0.065	0.595	4.33	4.16	0.469	0.151
I needed more fresh air	3.69	3.33	0.845	0.256	3.67	3.62	0.873	0.034
I needed more sunlight	3.56	3.42	0.899	0.107	3.54	3.55	0.989	−0.003
I needed a better acoustic privacy	3.75	3.33	0.423	0.328	3.69	3.7	0.949	−0.013
I needed more spacious rooms	3.53	3.42	0.126	0.081	3.46	3.57	0.695	−0.081
I found it difficult to manage day-to-day activities	3.11	3.42	0.269	−0.206	2.9	3.43	0.08	−0.365
I got distracted from work easily	3.42	3.58	0.731	−0.110	3.31	3.58	0.393	−0.178
I was more worried about my health	3.35	4.08	0.260	−0.538	3.56	3.32	0.396	0.176
I found it difficult to tolerate interruptions	3.14	3.33	0.166	−0.137	2.98	3.36	0.197	−0.269
I got tired of the monotonous activities	3.49	3.92	0.321	−0.310	3.35	3.76	0.157	−0.294
I felt there were too many people in the same space	2.77	3.58	0.576	−0.551	2.91	2.84	0.814	0.049
I wanted a mix of working from home and my office	3.56	2.64	0.572	0.644	3.44	3.47	0.929	−0.019
I enjoyed my work breaks	4.04	3.18	0.101	0.793	3.81	4.07	0.271	−0.232
I missed my work colleagues	3.85	3.00	0.392	0.708	3.58	3.93	0.181	−0.281
I missed driving or commuting to work	2.44	2.55	0.708	−0.081	2.56	2.33	0.395	0.177
It was harder to communicate and collaborate with colleagues	3.16	3.36	<b>0.030</b>	−0.142	3.33	3.02	0.297	0.218
I had internet issues	2.59	2.18	0.061	0.280	2.51	2.57	0.845	−0.041
I preferred working from home	3.30	2.73	0.583	0.408	3.1	3.37	0.369	−0.189
I missed working from my office	3.38	3.09	0.663	0.211	3.27	3.42	0.602	−0.109
I felt unproductive	2.52	3.45	<b>0.014</b>	−0.623	2.75	2.5	0.442	0.162

**Table 4.** Correlation analysis of respondents' perceived experience based on the no. of bedrooms in the houses they lived in during the COVID-19 lockdown and respondents' age groups.

Variables	ANOVA No of Bedrooms			Age			
		df	F	Sig.	df	F	Sig.
I saved on fuel	Between Groups	2	0.752	0.475	3	0.160	0.923
	Within Groups	89			88		
	Total	91			91		
I saved on childcare	Between Groups	2	0.376	0.688	3	1.877	0.139
	Within Groups	88			87		
	Total	90			90		
I used more electricity	Between Groups	2	0.264	0.769	3	0.793	0.501
	Within Groups	89			88		
	Total	91			91		
I took less annual leaves from work	Between Groups	2	0.310	0.734	3	1.044	0.377
	Within Groups	88			87		
	Total	90			90		
I used more water	Between Groups	2	0.569	0.568	3	4.008	<b>0.010</b>
	Within Groups	88			87		
	Total	90			90		
I needed a dedicated workspace	Between Groups	2	0.715	0.492	3	0.448	0.719
	Within Groups	89			88		
	Total	91			91		
I needed more fresh air	Between Groups	2	3.545	<b>0.033</b>	3	8.160	<b>&lt;0.001</b>
	Within Groups	87			86		
	Total	89			89		
I needed more sunlight	Between Groups	2	2.565	0.083	3	7.022	<b>&lt;0.001</b>
	Within Groups	89			88		
	Total	91			91		
I needed a better acoustic privacy	Between Groups	2	1.587	0.210	3	1.931	0.130
	Within Groups	89			88		
	Total	91			91		
I needed more spacious rooms	Between Groups	2	6.041	<b>0.003</b>	3	5.156	<b>0.002</b>
	Within Groups	89			88		
	Total	91			91		
I found it difficult to manage day-to-day activities	Between Groups	2	2.190	0.118	3	1.286	0.284
	Within Groups	89			88		
	Total	91			91		
I got distracted from work easily	Between Groups	2	0.911	0.406	3	1.075	0.364
	Within Groups	88			87		
	Total	90			90		
I was more worried about my health	Between Groups	2	3.631	<b>0.030</b>	3	3.647	<b>0.016</b>
	Within Groups	89			88		
	Total	91			91		
I found it difficult to tolerate interruptions to what I was doing	Between Groups	2	0.090	0.914	3	2.570	0.059
	Within Groups	89			88		
	Total	91			91		
I got tired of the monotonous activities	Between Groups	2	0.813	0.447	3	1.368	0.258
	Within Groups	87			86		
	Total	89			89		
I felt there were too many people in the same space	Between Groups	2	2.612	0.079	3	0.302	0.824
	Within Groups	88			87		
	Total	90			90		
I wanted a mix of working from home and my office	Between Groups	2	1.798	0.172	3	1.311	0.276
	Within Groups	88			87		
	Total	90			90		
I enjoyed my work breaks	Between Groups	2	0.389	0.679	3	0.823	0.485
	Within Groups	87			86		
	Total	89			89		
I missed my work colleagues	Between Groups	2	0.569	0.568	3	0.399	0.754
	Within Groups	87			86		
	Total	89			89		
I missed driving or commuting to work	Between Groups	2	1.232	0.297	3	0.954	0.418
	Within Groups	88			87		
	Total	90			90		
I was harder to communicate and collaborate with colleagues	Between Groups	2	0.021	0.979	3	0.572	0.635
	Within Groups	88			87		
	Total	90			90		
I had internet issues	Between Groups	2	0.519	0.597	3	1.314	0.275
	Within Groups	86			85		
	Total	88			88		

Table 4. Cont.

Variables	ANOVA			Age			
	No of Bedrooms	df	F	Sig.	df	F	Sig.
I preferred working from home	Between Groups	2	3.495	<b>0.035</b>	3	0.846	0.472
	Within Groups	88			87		
	Total	90			90		
I missed working from my office	Between Groups	2	3.147	<b>0.048</b>	3	1.078	0.363
	Within Groups	88			87		
	Total	90			90		
I felt unproductive	Between Groups	2	0.493	0.612	3	0.975	0.409
	Within Groups	87			86		
	Total	89			89		

#### 4.2.1. Based on the Amount of Time Spent at Home

We examined the differences in perceived experiences based on time spent at home during the lockdown. Respondents were divided into two groups: those who spent more than 50% of their time at home and those who spent less than 50%.

Significant differences were found for only three variables tested—saving on childcare ( $p = 0.02$ ), feeling less productive ( $p = 0.014$ ) and difficulty with communicating and collaborating with colleagues ( $p = 0.03$ ).

Specifically, respondents who spent more time at home reported they had significantly greater savings on childcare,  $t(62.64) = 2.15$ ,  $d = 0.32$ . However, they noted feeling significantly less unproductive ( $t(15.75) = -2.45$ ,  $d = -0.62$ ). Those who spent less time at home reported more difficulty with collaboration and communication,  $t(15.07) = -0.54$ , although the effect size was small ( $d = -0.14$ ).

#### 4.2.2. Based on Gender

We also tested the differences in perceived experiences based on their gender (male and female). It is important to note that none of the respondents identified their gender as “Other”. Interestingly, no statistically significant gender differences were found across the 25 variables examined.

However, three variables (difficulty managing day-to-day activities, tiredness from monotonous activities, and missing work colleagues) showed notable patterns. Specifically, female respondents reported significantly more difficulty managing day-to-day activities than males ( $m = 3.43$ ;  $2.90$ ) with  $t(89.95) = -1.77$ . The females also reported slightly higher levels of tiredness from monotonous activities than males ( $m = 3.76$ ;  $3.35$ ). For the third variable, females missed their work colleagues more than males ( $m = 3.93$ ;  $3.58$ ), with  $t(87.53) = -1.35$ .

#### 4.2.3. Based on No of Bedrooms in Their Homes

The one-way ANOVA test showed a significant difference in response based on the no. of bedrooms occupied by the respondents for three variables only.

For the statement “I needed more spacious rooms”, there was a significant effect of bedroom category ( $F(2, 89) = 6.04$ ;  $p = 0.03$ ) on the perceived need for more spacious rooms. Tukey HSD post hoc comparisons revealed that the respondents with 1–2 bedrooms reported significantly higher need for space than those with 3–5 bedrooms ( $p = 0.039$ ). Those in the “Other” category also reported a significantly higher need than those with 1–2 bedrooms ( $p = 0.008$ ).

The statement “I needed more fresh air” also received a difference in perception based on the number of bedrooms in the homes ( $F(2, 87) = 3.55$ ,  $p = 0.033$ ). However, the Tukey HSD post hoc tests revealed a marginally significant difference between the 1–2 bedroom and 3–5 bedroom groups ( $p = 0.057$ ).

The responses differed significantly in how worried they felt about their health ( $F(2, 89) = 3.63, p = 0.030$ ). Similar to the statement on fresh air, the Tukey post hoc comparisons indicated a borderline significant difference between 1–2 bedrooms and 3–5 bedrooms ( $p = 0.065$ ), with higher concern in smaller households.

For the preference of working from home, the number of bedrooms significantly influenced the respondents' perception ( $F(2, 88) = 3.50, p = 0.035$ ). Those in the "Other" category had significantly higher preference for remote work than those who live in 1–2 bedrooms ( $p = 0.027$ ) and those who live in 3–5 bedrooms ( $p = 0.040$ ). Likewise, there was a significant difference in missing the office across bedroom categories ( $F(2, 88) = 3.15, p = 0.048$ ).

#### 4.2.4. Based on Age

The one-way ANOVA test showed a significant difference in response based on the age groups of the respondents for five variables only.

For the statement "I used more water", a significant effect of age group was observed,  $F(3, 87) = 4.01, p = 0.010$ . Tukey's HSD post-hoc test indicated that respondents aged below 30 years old reported significantly higher water use compared to those 30–49 years old,  $p = 0.010$ .

There was a significant effect of group on the need for fresh air,  $F(3, 86) = 8.16, p < 0.001$ . Tukey's HSD showed that respondents aged above 65 years old and 50–65 years old reported a significantly greater need for fresh air than those aged 30–49 and below 30 years old,  $p < 0.05$ .

Group differences were also found for need for sunlight,  $F(3, 88) = 7.02, p < 0.001$ . Post-hoc analysis revealed that the respondents above 65 years old and those within 50–65 years reported a higher need for sunlight compared to those within the age groups of 30–49 and below 30 years old,  $p < 0.05$ .

Significant differences emerged for the need for spacious rooms,  $F(3, 88) = 5.16, p = 0.002$ . Tukey's test indicated that respondents aged 50–65 years old had higher scores than those aged 30–49 years old,  $p = 0.02$ .

The effect of group on worry about health was also significant,  $F(3, 88) = 3.65, p = 0.016$ . Post-hoc comparisons showed that respondents within the age group of 50–65 years reported higher worry about health than those aged 30–49 years old,  $p = 0.01$ .

#### 4.3. Desired Changes to Improve Home Comfort and Satisfaction

For the question where respondents were asked what changes they would make to improve the comfort and functionality of their homes, their answers revealed themes around dedicated workspace, digital infrastructure, furniture and ergonomics, spatial adequacy, environmental quality, and lifestyle amenities. These insights highlight the ways in which lockdown experiences exposed shortcomings in existing dwellings and informed respondents' perceptions of ideal living conditions.

A prominent theme was the desire for separate, dedicated work areas. One respondent explained: "I'd have liked to have a dedicated work space. I had to work out of my bedroom most of the time. . . I faced internet and noise issues; someone's always cooking something. . . the smell annoyed me." Others echoed similar needs: "Dedicated work space," "Have a study space for the kids," and "I need a spacious working room where I can work easily." Several respondents highlighted the importance of reliable internet connectivity, with repeated calls for "Better internet." Comfortable and functional furniture was also raised as an area for improvement: "Change the work station—chair is not comfortable," and "larger work area and comfortable furniture."

Respondents noted the need for larger, better-configured spaces. Comments included: “Spacious,” “more space, better windows, better insulation,” and “I would like a better configuration.” Another participant emphasised the appeal of indoor–outdoor integration: “To have a seamless outdoor and indoor flow will be perfect.” Some respondents emphasised smaller but meaningful changes to improve comfort, including “a bunch of beautiful flowers makes it better” and “having a beautiful garden.” Others expressed a need for quieter, less demanding environments: “Reduction of house chores and noise.” A few respondents desired lifestyle-related additions: “Swimming pool and basketball court to keep me fit” and “Meal prep.”

A minority of respondents indicated satisfaction with their living conditions: “None,” “Not applicable,” and “My home is quite comfortable.” Others noted improvements already made: “I have changed the house and I am comfortable in the current dwelling.”

## 5. Discussion

The COVID-19 lockdown in New Zealand had significant economic, spatial, and environmental impacts on respondents, consistent with international literature.

### 5.1. Impact of the COVID-19 Pandemic Lockdown on Home Occupiers

Our pilot study showed that amongst all the factors examined, economic factors had the most impact on respondents’ perceived experience of the lockdown. These included increased electrical and water usage, reduced fuel costs, fewer annual leaves from work and some savings on childcare costs. This finding supports global trends where increased energy demand during COVID-19 rose globally as a behavioural side-effect of staying home, not as a productivity driver [43]. For example, Mitra et al. [44] demonstrated that higher water and electricity consumption in residential buildings during the COVID-19 pandemic was attributed to altered household rhythms.

Our study also indicated that perceived environmental adequacy, particularly the presence of a dedicated workspace, was a significant factor influencing respondents’ experience during lockdown. The respondents noted that they needed more fresh air, more sunlight, better privacy and more spacious rooms. This finding supports the work of Cook [14], who discussed how interior design features such as acoustics, lighting, scale, proportion, ergonomics, and aesthetics influence well-being. The authors showed that the adequacy of a room is about more than size; the layout, boundaries, and functionality strongly shape well-being and efficiency. Poor access to daylight and suboptimal artificial lighting in makeshift workspaces contribute to eye strain and reduced motivation, especially in homes where work areas were set up in corners or communal spaces not originally designed for such purposes.

Similarly, the respondents note that they were mostly easily distracted from work, which could explain why they needed better acoustic privacy. Literature strongly supports the notion that acoustic interruptions are a major barrier to productivity and mental well-being [45,46]. They also grew tired of monotonous activities and became more concerned about their health. Boyce [47] and Tham et al. [48] argued that the blurred boundaries between home and work, coupled with inadequate setups, can affect mental health and daily functioning.

Regarding the concept of working from home, respondents agreed that they missed their work colleagues, wanted a mix of working from home and in the office, and enjoyed the breaks that working from home offered. This supports recent findings by Pacheco [49] that showed not only was remote working common in New Zealand during the pandemic, but that hybrid working arrangements (a mix of working from home and in the office). International survey studies on work-life boundary management during the COVID-

19 pandemic also found similar patterns, where workers valued flexibility but reported declines in social connection and collaboration. In particular, Yang et al. [50] observed that firm-wide remote work led to more static and siloed collaboration networks, characterised by fewer bridging connections between teams. This could be a result of feeling isolated and lacking workplace collaboration during this period.

Regarding the group differences in perceived experiences, it was apparent from our studies that the respondents who spent more time at home saved more on childcare, although that resulted in feeling significantly less productive. A U.S. study by Barrero et al. [51] found that Americans saved over 60 million commuting hours per workday during the pandemic, allocating about 60% of that time to work-related activities. Interestingly, those who spent less time at home reported more difficulty with collaboration and communication. The importance of space adequacy was further emphasised with the group differences in perceived experience. Respondents of 1–2-bedroom houses reported significantly higher need for space than those in 3–5-bedroom houses. This reflects Cook's [14] work, which argued that household size, spatial adequacy, and the capacity of homes to accommodate multiple functions are central to well-being in high-density living. Age also influenced the differences in perceived experience. While respondents younger than 30 years old reported significantly higher water use, those aged 50 years and above reported a significantly greater need for fresh air, sunlight, and spacious rooms. They also worried more about their health. These findings align with those of Pacheco [49] and Dong [52], who demonstrated that occupancy and resource demand patterns vary with age and household structure.

Some of the issues that emerged from respondents' comments demonstrated that the lockdown period sharpened awareness of housing adequacy and deficiencies. The strongest desires centred on dedicated workspaces, reliable internet, and ergonomic setups, followed by calls for spatial and environmental improvements such as insulation, windows, and indoor–outdoor flow. Specifically, poor digital infrastructure hindered work, study, and entertainment, amplifying stress in shared households. This aligns with international studies that have noted the exacerbation of digital inequities and productivity challenges during the COVID-19 pandemic [28].

## 5.2. Beyond the COVID-19 Pandemic Lockdown

Although the COVID-19 pandemic lockdown has ended, the lessons it revealed about housing resilience are relevant to the sustainable design and retrofitting of residential buildings. The lockdowns highlighted the tension between flexibility and functionality, as while homes became sites of work, schooling, and leisure, many were not designed to accommodate these multiple roles. This exposed critical gaps in design related to acoustics, privacy and spatial zoning [53,54]. These shortcomings highlight the unsustainability of static housing models, which fail to account for diverse occupant needs and evolving lifestyle patterns.

Also, the pandemic accelerated the prospects of flexible working arrangements as a promising option to the traditional onsite work pattern. Such hybrid models (including remote work) are likely to become a cornerstone of future employment models [55]. Their success will depend on resilient housing design, robust digital infrastructure, and workplace cultures that support both autonomy and connectedness amongst workers. This extends beyond the current energy efficiency focus of sustainable designs to optimisation of environmental performance and worker experience, especially in WfH scenarios.

That said, embedding resilience into housing design would require a rethink of business-as-usual housing designs. Recent studies recommend creating environments that can adapt to changing occupant needs while maintaining health, well-being, and

productivity [53,56]. These strategies position housing not merely as shelter but as an active agent in advancing sustainable living and societal resilience.

## 6. Conclusions

This study examined the impacts of the COVID-19 lockdown on home respondents, focusing on economic, environmental, and psychosocial factors. Overall, the findings confirm that the COVID-19 lockdown reshaped household experiences in the following key findings:

- Economic considerations had the strongest influence on households' perceived COVID-19 lockdown experiences.
- While they saved on fuel costs during this period, they needed a dedicated workspace away from distractions.
- As such, they wanted a mix of working from home and in their offices, as they needed to collaborate with their work colleagues.
- Perceived COVID-19 lockdown experiences were significantly shaped by age, the number of bedrooms, and the time spent at home during the pandemic.

As this is a pilot study, it is limited by the reliance on self-reported experiences, which are prone to response and social desirability bias. It is also marred by sample bias, with 87% of respondents spending less than half their time at home during lockdown. This underrepresents households that spent more time at home, who are likely to experience greater spatial, energy, and productivity challenges. Furthermore, the sample is context-specific to New Zealand, meaning generalisability to other housing markets and climates should be made with caution.

Future studies should aim to target a more representative sample to examine experiences over time spent at home more accurately. That said, the results contribute to the growing international evidence that resilient, adaptable, and health-supportive housing will be crucial in mitigating the impacts of future similar disruptions.

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**Informed Consent Statement:** Informed consent was obtained from all participants involved in the study. The questionnaire used was anonymous, and participants were informed that completing it was regarded as consent to participate in the survey and to publish the findings.

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