

# Housing renovation and satisfaction with the dwelling: Intermediate results of the evaluation of a social housing regeneration program in Viña del Mar, Chile

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## Introduction

The poor habitability and deterioration of social housing villas built in Chile in the 1980-90s is today widely recognized. In response, a housing renovation program has been implemented, aiming to solve key habitability problems.

The literature has shown association of health and wellbeing with dwelling and neighborhood conditions (1, 2). Further, capitalizing urban regeneration programs as natural experiments, several studies have shown specific increases in satisfaction with housing, improvements in the perceived quality of life, reduction of violence and mental health benefits (3).

The Regeneración Urbana, Calidad de Vida y Salud - RUCAS project is a longitudinal whose aim is to evaluate an integral regeneration program conducted currently in Chile on social housing neighborhoods in advanced state of deterioration.

## Objective

In this study we assess the impact of housing regeneration on thermal discomfort, indoor environmental noise, and on satisfaction with the dwelling (overall, with acoustic insulation, thermal insulation and apartment size).

The housing intervention consists in expanding and insulating the dwellings to improve thermal and acoustic performance, and improvement of roofs and sanitary instalations.

## Methodology

Data come from the first three waves (April 2018, September 2018, March 2019) of the RUCAS study (5), in a social housing villa in Viña del Mar, Chile. The RUCAS survey is applied in person to one informant per household. Data come from dwellings that participated in at least the baseline measurement wave, totaling 625 observations.

We adjusted GLMM's for the outcome variables (thermal discomfort: dwelling too hot in summer or too cold in winter most days; indoor noise (from neighbors) most days; dissatisfied or very dissatisfied with indoor temperature, indoor noise, dwelling size and dwelling overall) by intervention status (I: intervened (expanded and insulated), UI: under intervention (insulated) and NI: non-intervened) controlling for key informant characteristics (sex and age), household characteristics (head of household's socioeconomic status (educational level) and dwellers per bedroom), and seasonality (if the outcome variable was measured in both summer and winter).

A random intercept (household level) was included to model the correlation between measurements over time on the same household.

## Results

Table 1: Intervention status and number of households per measurement wave

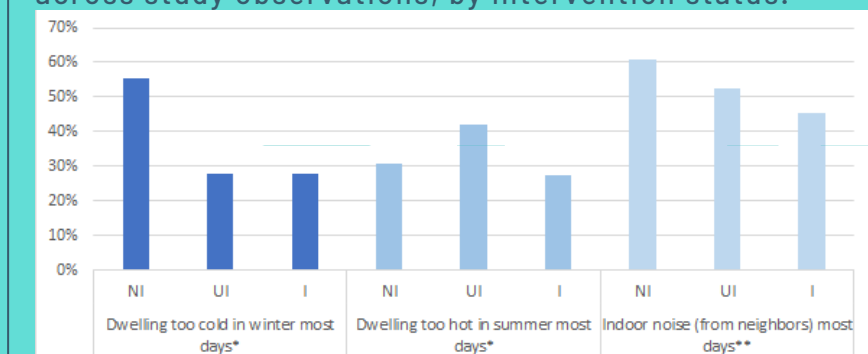
	Wave 1	Wave 2	Wave 3	Total
Non-intervened (NI)	188	165	142	495
Under intervention (UI)	19	0	0	19
Intervened (I)	31	44	36	111
<b>N (Households)</b>	<b>238</b>	<b>209</b>	<b>178</b>	<b>625</b>

Table 2: Characteristics of the study sample at baseline

Key informant	N	%	
Sex			
Male	65	27,3%	
Female	173	72,7%	
Age			
18-24	15	6,3%	
25-44	83	34,9%	
45-59	77	32,4%	
≥ 60	63	26,5%	
Educational level			
<8 years	50	21,0%	
8 - 12 years	155	65,1%	
> 12 years	33	13,9%	
Household level			
Educational level of household			
<8 years	87	18,5%	
8 - 12 years	340	72,3%	
> 12 years	43	9,1%	
People per bedroom			
≤ 1	77	43,5%	
1 - 2	93	52,5%	
2 - 3	7	4,0%	
Outcomes (% of Yes)			
Dwelling too cold in winter most days	Yes	105	46,3%
Dwelling too hot in summer most days	Yes	79	33,3%
Indoor noise (from neighbors) most days	Yes	136	57,1%
Dissatisfaction with indoor temperature	Yes	53	22,4%
Dissatisfaction with acoustic insulation	Yes	147	62,0%
Dissatisfaction with dwelling (overall)	Yes	61	25,6%
Dissatisfaction with dwelling size	Yes	99	41,6%

### Thermal discomfort and indoor noise

Figure 1. Reported thermal discomfort and indoor noise across study observations, by intervention status.



\*Measured in waves 1, 2 & 3. \*\*Measured only in waves 1 & 3.

Table 3. Association between intervention status and reported thermal discomfort and indoor noise.

		OR adj	CI 95%
Dwelling too cold in winter most days*	NI	1	-
	UI	0,310	(0,069 - 1,388)
	I	<b>0,141</b>	<b>(0,057 - 0,349)</b>
Dwelling too hot in summer most days*	NI	1	-
	UI	2,027	(0,568 - 7,233)
	I	0,818	(0,396 - 1,689)
Indoor noise (from neighbors) most days**	NI	1	-
	UI	0,650	(0,195 - 2,164)
	I	<b>0,411</b>	<b>(0,189 - 0,895)</b>

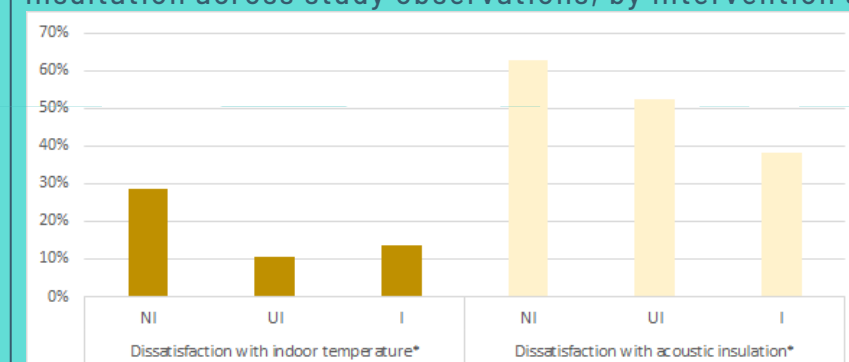
\*Adjusted by age & sex of key informant, SES of household, people per room & season.

\*\*Adjusted by age & sex of key informant, SES of household & people per room.

Results show improvements in all three indicators associated with insulation. Adjusted OR's show an almost 86% reduction in dwellings reported very cold in winter, 60% reduction in reported indoor noise, but no significant association with excess heat in summer. Dwellings under intervention report similar improvements, except for indoor heat in the summer.

### Dissatisfaction with indoor temperature and acoustic insulation

Figure 2. Dissatisfaction with indoor temperature and acoustic insulation across study observations, by intervention status.



\*Measured in waves 1, 2 & 3.

Table 4 Association between intervention status and dissatisfaction with indoor temperature and acoustic insulation .

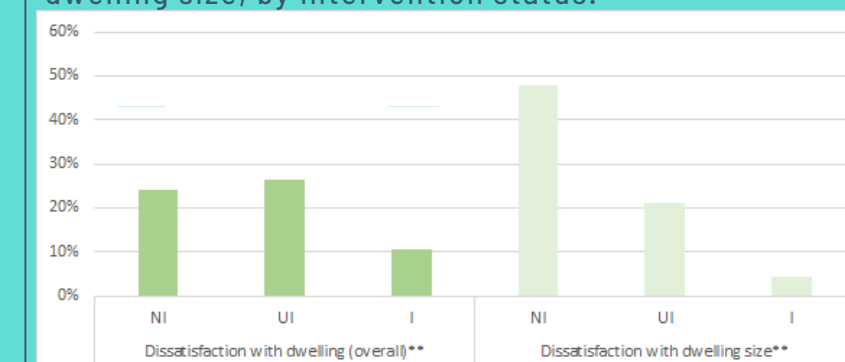
		OR adj	CI 95%
Dissatisfaction with indoor temperature*	NI	1	-
	UI	0,414	(0,074 - 2,314)
	I	<b>0,250</b>	<b>(0,105 - 0,596)</b>
Dissatisfaction with acoustic insulation*	NI	1	-
	UI	0,435	(0,106 - 1,774)
	I	<b>0,226</b>	<b>(0,098 - 0,52)</b>

\*Adjusted by age & sex of key informant, SES of household, people per room & season.

Results show improvements in both indicators associated with insulation. Adjusted OR's show a 75% reduction in dissatisfaction with indoor temperatures and a 77% reduction in dissatisfaction with acoustic insulation in intervened dwellings. Dwellings under intervention report similar improvements, although to a lesser extent.

### Dissatisfaction with dwelling (overall) and dwelling size

Figure 3. Dissatisfaction with dwelling (overall) and with dwelling size, by intervention status.



\*Measured only in waves 1 & 3.

Table 5. Association between intervention status and dissatisfaction with dwelling (overall) and dwelling size.

		OR adj	CI 95%
Dissatisfaction with dwelling (overall)**	NI	1	-
	UI	1,401	(0,361 - 5,436)
	I	<b>0,305</b>	<b>(0,106 - 0,876)</b>
Dissatisfaction with dwelling size**	NI	1	-
	UI	0,154	(0,027 - 0,871)
	I	<b>0,011</b>	<b>(0,001 - 0,076)</b>

\*\*Adjusted by age & sex of key informant, SES of household & people per room.

Results show improvements in both indicators associated with housing improvements. Adjusted OR's show a 70% reduction in overall dissatisfaction with the dwelling and a 98% reduction in dissatisfaction with dwelling size. Dwellings under intervention also report improvements relative to size.

## Discussion

Low temperatures in winter and indoor environmental noise are highly frequent complaints among dwellers of these social housing residents. Dissatisfaction with acoustic insulation and lack of space affect over 60% and 40% of them, respectively.

Results show very important reductions in dissatisfaction with different features of the dwelling after renovation, in particular concerning insulation and expansion. Beneficial results are also observed for dwellings under intervention given they had all received insulation and some had been expanded, although the expansion was not yet in use. General satisfaction with the dwelling however only improves in completely intervened dwellings, most likely due to the inconveniences caused by the intervention works (residents remained in their houses while they were being intervened).

## Conclusions

In the short term (ranging from 1 month to 1 year) after dwelling renovation, significant reductions in dissatisfaction with the household are observed in several dimensions.

Beneficial health effects such as improved respiratory health and mental health should result from these improvements. Results provide support to the benefits in quality of life and the potential health benefits of urban regeneration programs in low and very low-income neighborhoods.