



## Article

## Cool? Young people investigate living in cold housing and fuel poverty. A mixed methods action research study



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## ABSTRACT

**Background:** Living in cold housing conditions and risk of fuel poverty presents a range of physiological and psychosocial health risks. Limited research has specifically investigated the effects of fuel poverty on children and young people, and even less has been conducted with youth input into the research process.

**Methods:** The Cool? Study used mixed methods, participatory action research carried out with youth researchers involved at all stages through questionnaire design, analysis, qualitative design, e-interviewing and dissemination of results. This article reports on results of an online survey of 656 adolescents aged 14–16 years completed at 17 schools in New Zealand. Sampling was based on selecting schools for invitation, with the probability of selection weighted proportional to school size, within strata defined by climate zone. Results from a small e-mail interview study of survey respondents who consented to follow-up are also reported.

**Results:** The study found that almost half of the survey respondents (47%) felt their home was sometimes cold during the winter; a further 40% felt their home was often or always cold. More than two thirds of respondents (70%) had shivered inside at least once during winter. Respondents were more likely to report key indicators of fuel poverty depending on their self-reported ethnicity, with Māori at increased risk. Living in private rental housing or state-owned housing also increased risk of fuel poverty compared to those in owner-occupied dwellings. Participants of email interviews expressed concern about the widespread problem of cold housing for youth and a desire for Government intervention.

**Conclusion:** The integrated results confirm that cold housing and risk of fuel poverty are important problems for young people in New Zealand. Results contribute to the evidence-base for policy targeting of schemes such as the Government-sponsored retrofitting of insulation to households with dependent children.

### 1. Introduction

The effects of inadequate housing – from building quality and energy efficiency, suitability of size and access for occupants, housing costs and maintenance, to the availability and affordability of end-use services such as water and energy – are increasingly being linked to poor health outcomes (Marmot Review Team, 2011; Hilary Thomson & Thomas, 2015). Fuel poverty, both a consequence of and contributor to inadequate housing, can be broadly described as energy insecurity, where households are unable to achieve sufficient energy to meet accepted standards of living (Bouzarovski & Petrova, 2015). This includes adequate heating, generally accepted to be the World Health

Organization-recommended 18–21°C range in order to maintain good health (Ormandy & Ezratty, 2012). Building and appliance energy efficiency, energy costs, income as well as other demographic, social, and behavioral factors all combine to cause this multi-faceted problem (Liddell, Lagdon, McKenzie, Morris, & Walker, 2014).

Fuel poverty affects an estimated 25% of the New Zealand's (NZ) population (Howden-Chapman et al., 2012), comparable with recent estimates of fuel poverty in Southern and Eastern European countries such as Portugal, Romania, and Cyprus (Thomson & Snell, 2013). Important local drivers of fuel poverty include weak building regulations and poor building quality, as well as the cost of residential electricity and lack of consumer protections or price regulation, and

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heavy reliance on electrically-powered heating (Howden-Chapman et al., 2012). Payment for heating in New Zealand is almost always the responsibility of the occupants, rather than the property owner, in residential properties. District heating is not used, and the majority of residential dwellings are detached, and heated independently of other buildings/housing. Despite this, fuel poverty is not officially defined, or measured in New Zealand, and neither is fuel poverty explicitly targeted in any Government policy.

Negative health effects of fuel poverty for children include reduced caloric intake (Bhattacharya, Currie, DeLeire & Haider, 2003); increased risk of undernutrition, overweight, or acute hospitalisation (Frank et al., 2006); poorer health and development outcomes (Cook et al., 2008); increased mental health problems and antisocial behavior among adolescents (Liddell & Morris, 2010; Marmot Review Team, 2011). Children and young people are recognised as being at increased risk of fuel poverty due to spending more time at home and having increased physiological vulnerabilities to cold than adults (Tod et al., 2016). However research investigating fuel poverty has prioritised the voices of adults, and particularly older adults (see for example (Brunner, Christanell & Spitzer, 2012; Burholt & Windle, 2006; Day & Hitchings, 2011; Gilbertson, Stevens, Stiall, & Thorogood, 2006; Harrison & Popke, 2011; O'Neill, Jinks, & Squire, 2006; Royston, 2014; Rugkasa & Shortt 2007)).

Very little fuel poverty research has previously been undertaken with children living in cold homes (Children in Wales, 2011; Gibbons & Singler, 2008; Liddell, 2008). Child participation in research and as co-researchers, achieving “deep participation”, is growing in childhood and youth studies, often driven by consideration of the “participation” Article 12 of the United Nations Convention on Rights of the Child (Horgan, 2016). Research privileging children's knowledge finds them capable, willing, research collaborators (Ergler, 2011; Oliver et al., 2011). Local evidence that fuel poverty affects a significant proportion of New Zealand's children and young people warranted further investigation (Howden-Chapman, Pierre, & Baker, 2013; McChesney, 2013; O'Sullivan, Howden-Chapman, Hales & Stanley, 2013).

The Cool? study aimed to explore the experiences and insights of New Zealand youth living in, or at risk of fuel poverty, using mixed methods action research (O'Sullivan, Telfar Barnard, Viggers, & Howden-Chapman, 2016). Our collaborative process allowed a group of young people in the study to be co-researchers, from helping to design the survey and interview questions through to research dissemination (Alderson, 2001; Eng, Israel, Parker & Schulz, 2012; Eng, Israel, Parker, Schulz & Satcher, 2005; Jacquez, Vaughn, & Wagner, 2013; McCarry, 2011; Schäfer & Yarwood, 2008). We outline the integrated research results, and discuss policy implications of these, which strongly support government intervention to improve housing and thermal comfort for young people in New Zealand.

## 2. Methods

Ethics approval was obtained (Reference number: 14/178) through the University of Otago's Human Ethics Committee (Health), and research consultation with Māori, the indigenous population, was undertaken prior to the research beginning.

We held three sets of classroom workshop sessions with young researchers during 2015 at a school ranked in the 10–20% of New Zealand schools with the highest proportion of students from low-socioeconomic communities (O'Sullivan et al., 2016).<sup>1</sup> During the workshops the young researchers developed a quantitative survey in consultation with senior researchers, which was followed by a qualitative e-interview study. Survey questions included some of those used in previous studies by He Kainga Oranga/Housing and Health Research

Programme,<sup>2</sup> and questions for comparison with the NZ Census. New questions to explore youth experiences of fuel poverty were developed during group and class discussions. The youth researchers strongly favoured the inclusion of multi-answer questions, with an “other, please describe” option, as they felt that this would be more likely to encourage survey completion. Multi-answer responses were based on previous qualitative research on fuel poverty to provide common strategies for coping with the cold, for example, and through brainstorming typical youth experiences within the research team. Open questions were included in the survey to further explore fuel poverty and financial security indicators.

### 2.1. Target population, sample frame, and sampling methods

The Cool? survey was conducted as a complex survey. Selection of schools was stratified by Climate Zone, with school selection conducted using probability proportional to size (PPS) sampling, and student respondents clustered by school (students were from one or more classes within that school). This gave a total population (N) of 59,200 year 10 students (aged 14 to 16 years) in three climate zones across NZ (22,779 in zone 1, the warmest region comprising the upper North Island; 22,965 in zone 2, most of the rest of the North Island; and 13,456 in zone 3, the coolest region including all of the South Island and the mountainous Central Plateau of the North Island). The climate zones correspond to specifications in the regulation of Building Standards for insulation for new-build housing (Department of Building & Housing, 2011), and correspond roughly to NZ climatic regions. Stratified sampling allowed for reasonably precise estimates in each of these zones.

### 2.2. Recruitment of schools and students

Selected schools were contacted by emailing principals with a letter and information outlining the study and URL linking to a trial version of the online survey. However, of 36 schools contacted in the first recruitment round, only one responded positively. A second recruitment round was more successful, with 16 schools recruited by contacting department heads of social sciences or health by phone and/or email including a presentation about the research for classes and the trial survey URL. Year 10 students in each school were invited to participate. Participants were offered the opportunity to enter a prize draw to win one of 10 NZ\$25 gift cards as an incentive for completing the survey.

Qualtrics internet survey platform was used to administer the survey (Qualtrics LLC, Provo, Utah). We used the Complex Survey procedure of SPSS Version 22 to analyse survey data (IBM Corp, 2013). Estimates for the target population (all Year 10 students in NZ) were calculated using methods to deal with the sampling design (strata for climate zone, clustering by school, and inverse sampling weights derived from each school's relative probability of selection into the sample).

Respondents to the survey that indicated difficulty achieving thermal comfort at home, consented to follow-up and provided email addresses, were invited by email to take part in an email interview study. Email was selected as the interview medium, to facilitate asynchronous data collection and reduce scheduling issues impeding the study (Kazmer & Xie, 2008). Potential interviewees were provided with a set of guidelines for the interview (Mason & Ide, 2014). Email interviews were confined to a total of 10 emails once the email began (five from the researcher and five from the participant). Up to three new questions were included in each email from the researcher, unless the participant indicated they wished to have further discussion. Email interviews were undertaken by KO'S and LM (young researcher) at the

<sup>1</sup> (<http://www.education.govt.nz/school/running-a-school/resourcing/funding-staffing-and-allowances-handbook/chapter-1-operational-funding/decile-ratings/>)

<sup>2</sup> (<http://www.healthyhousing.org.nz/>)

choice of the interviewee. Supervision for peer-to-peer interviewing included prior discussion of email interviewing techniques and the interview guide, and constructive critique of responses to be sent from LM to the participants, prior to the response being sent. Participants were supplied with an email address and password to be used for the interview to enhance privacy. These email accounts were suspended at the conclusion of the study. Participants were offered a \$25 iTunes gift code offered as an incentive for completing the interview.

### 2.3. Methods for analysis

Qualitative description was used to analyse qualitative data from open survey questions and email-interviews (Andersen, Neergaard, Olesen, & Sondegaard, 2009). This is a less transformative approach to qualitative analysis, resulting in a descriptive, data-near analysis and was selected to best preserve youth voices in the results. Youth researchers performed inductive thematic coding of qualitative survey data in small break-out groups in class workshop sessions. To ensure consensus, codes and corresponding quotes selected by the break-out groups were discussed as a full research team to check for inter-coder agreement (Ivankova, 2015). Initial email interview data were also discussed in relation to the identified codes within the group. Remaining data from the email interviews and qualitative survey questions were analysed by KO'S.

Integration of qualitative and quantitative methods and data, a key feature of mixed methods action research, is achieved by the study at several points. We used a sequential Quantitative-Qualitative mixed methods study design, where potential participants for the e-interview study were identified by their responses to selected survey questions (Ivankova, 2015). Quantitative and qualitative results are combined here to develop integrated study conclusions informing our policy recommendations. We present qualitative data anonymously using several direct quotes to preserve youth voices in the results. Data from interviews are indicated in parenthesis.

## 3. Results

Overall, 17 schools were recruited into the study, with 656 respondents to the survey. Results are presented as estimated proportions/ means and their 95% confidence intervals.

All participants were aged 14–16 years. More females (65.0%, 95% CI 43.2–81.9%) than males (33.3%, 95%CI 17.3–54.4%) responded to the survey, and a small number of respondents (1.7%, 95%CI 0.8–4.0%) identified as “other” gender.

Six survey respondents were recruited into the email study and began the interviews (from 14 invited). Only two full email interviews were completed, both by females, with attrition occurring at different stages among the other four participants, two of whom were male, two female. One email was conducted under supervision by LM, a member of the young research team at the preference of the interviewee; responses did not appear to vary between this interview and the interviews conducted by KO'S. We include data from ‘incomplete’ interviews in our analysis.

### 3.1. Housing characteristics

Housing tenure of survey respondents was roughly similar to that of the general population in the 2013 New Zealand Census (Statistics New Zealand, 2014), with just over two thirds reporting living in homes owned by their family or family trust (67.6%, 95% CI 58.2–75.7%), and few living in state-owned social housing (5.2%, 95% CI 12.5–22.5%). As with the general population, those not living in owner-occupied housing most commonly reported living in private rental housing. Reported heater types used were also broadly consistent with the general population with the majority using electricity (69.9%, 95%CI 55.0–76.9%), followed by wood, and gas. Only 2.5% of young people

**Table 1**  
Indicators of levels of thermal comfort among young New Zealanders.

Variable (% of Total)		Percentage*	95% Confidence Interval
Frequency of heating use	Never	3.9	1.9%–7.7
	Less than monthly	1.3	0.6%–2.7
	Once monthly	1.4	0.6–2.9
	2–3 times/month	2.3	1.0–5.3
	Weekly	3.6	1.2–10.4
	2–3 times/week	16.1	12.7–20.3
How much say do you have over when the heating is turned on?	Daily	71.4	62.2–79.1
	None	15.0	9.3–23.5
	Little	13.5	9.7–18.7
	Some	36.6	33.3–40.0
House feels cold during winter	A lot	34.8	26.2–44.6
	Never	22.7	17.9–28.4
	Sometimes	47.2	40.0–54.5
Feel home colder than friends homes	Often	18.4	15.4–21.9
	Always	11.6	7.2–18.2
	Never	40.5	37.1–43.9
Home still cold when using heating	Sometimes	45.5	41.1–50.0
	Often	10.6	6.2–17.3
	Always	3.4	2.0–5.9
Number of days/nights have shivered inside during winter	Never	35.3	27.5–43.9
	Sometimes	48.2	42.2–54.4
	Often	9.2	6.6–12.8
	Always	4.8	3.0–7.4
Number of days/nights can see breath inside	We don't use heating	2.5	1.1–5.7
	Never	29.6	23.9–36.1
	Once	28.1	25.1–31.3
	2–3	29.4	24.1–35.3
Number of days/nights can see breath inside	Four+	12.9	9.2–17.6
	Never	53.9	46.8–60.8
	Once	20.2	17.1–23.6
	2–3	14.4	11.3–18.2
	Four+	11.5	7.8–16.8

self-rated their housing condition as poor or very poor. Visible mould was reported by 23.2% of survey respondents (95%CI 17.7–29.7%).

### 3.2. Thermal comfort

Thermal comfort was assessed through asking a range of indicator questions (Table 1). Open questions provided a means for young people to comment generally about living in cold homes in winter. Previous research has suggested that cultural expectations of cold housing during the temperate winters typical in Australasia compared with Europe and North America play a role in coping behaviours and resistance to improving energy efficiency in the residential sector (Cupples, Guyatt, & Pearce, 2007; Hitchings, Waitt, Roggeveen, & Chisholm, 2015). These attitudes were also represented in open-text survey responses through the use of ironic humour and pop culture references by youth, for example:

“The lounge is real warm and great, but every night I have to embark on the dangerous journey up the stairs to my bedroom, I would say it's the New Zealand equivalent of Mt. Everest.” #504, Male, Climate Zone 3

“It's bloody cold. Winter has been coming and I didn't listen to the Starks... now it's freezing.” #247, Female, Climate Zone 2

There were also comments consistent with the cultural idea of being tough or “hardening up”, with one respondent describing the idea of “adjusting” to the cold:

“It's cold at winter but I am used to this kind of environment so it doesn't make me shiver or make me say I'm cold.” #127, Female, Climate Zone 1.

**Table 2**  
Effects of cold indoor temperatures on daily life of young people.

		Percentage <sup>a</sup>	95% Confidence Interval
Activities restricted by cold	Having friends over	4.0	2.5–6.4
	Doing homework	5.2	3.6–7.4
	Getting out of bed	35.9	30.7–41.5
	Using bathroom	19.1	13.4–26.4
	Other	2.5	1.3–4.9
Methods for coping with cold	Activities unrestricted	48.3	41.9–54.8
	Using blankets when not in bed	66.4	57.8–74.0
	Wearing more clothes	55.6	43.5–67.1
	Having hot drinks or food	44.7	35.1–54.8
	Going home later than you would	1.3	0.3–5.9
	Going to bed early	15.2	10.2–22.1
	Other	9.1	7.1–11.6
Cold restricts room use	Never	48.0	38.0–58.2
	Sometimes	34.8	29.5–40.6
	Often	12.3	8.7–17.0
	Always	4.9	3.3–7.2
How do you feel cold affects you?	Feeling grumpy or irritable	18.7	14.3–24.1
	Feeling sad, down, or depressed	13.4	8.1–21.5
	Feeling stressed or worried	4.4	2.9–6.8
	More colds or illnesses	29.2	22.9–36.5
	Asthma worse	7.2	4.3–11.7
	Other health problems	3.8	2.3–6.3
	Other effects	10.5	6.2–17.1
	Unaffected by cold	41.2	36.0–46.6

<sup>a</sup> Answers are independent – each student respondent yes/no to each item within a “stem”

These data combine to show that difficulty achieving thermal comfort is a common problem among young people. Almost half (47.2%) of the young people surveyed reported feeling their home was sometimes cold during the winter, while a further 40% felt their home was often or always cold – almost double the number of adults (21%) reporting that their home is often or always cold (Statistics New Zealand, 2015). Even when heating was on, almost half (48%) said their home was still cold sometimes and a further 15% often or always. More than 40% of respondents had experienced shivering inside on at least two occasions during the winter. More than a quarter (26.1%) of respondents reported being able to see their breath indoors on at least two occasions during the winter.

### 3.3. Coping with cold

Inadequate indoor temperatures are attributable for a range of negative physical health outcomes for children and young people. Cold housing and feeling cold has been associated with poor mental health and developing multiple mental disorders among adolescents (Liddell & Morris, 2010; Marmot Review Team, 2011). Table 2 provides results of questions exploring the ways in which cold indoor temperatures affected day-to-day living among young people.

Over half of the survey respondents felt that at least some of their home activities were restricted by cold and a small number reported restriction on activities especially important to young people – doing homework or having friends over.

At least one of the typical methods for coping with the cold was used by the majority of survey respondents, and these were explained in open-text responses, for example:

“In the winter I find it cold upstairs (where all our bedrooms are)

because we only have one gas heater which is downstairs in the lounge. I really want to get a heater for my room but they are just so expensive so instead I turn my electric blanket on or put extra clothes on.” #49, Female, Climate Zone 1.

Some respondents showed through their open-text survey responses that they coped with cold by downplaying the gravity of their personal situation by comparing it to those of people who were far worse off, or to ‘focus on the positives’.

“Sometimes it’s cold but it’s bearable. Compared to homeless people and people who have uninsulated houses I have it easy. It’s cold but not unbearable cold. Just a bit chilly.” #136, Female, Climate Zone 1.

“It’s all good I guess like I complain about the cold all the time and I never get out of bed and when I do it’s for food or to shower or to stand by the fire, but other than that we get warm food and enough blankets.” #277, Female, Climate Zone 2.

Because of the cold, more than half (52.0%) of the survey respondents reported ‘spatial shrink’ or restricting room use at least sometimes, and one in six (17.2%) did this often or always. This was also reflected in open-text responses as a method of coping with cold, with respondents describing keeping to the central “living room”, even for sleeping in the winter:

“The living room is the warmest as it has the fireplace. In the down stairs, master, bedroom it is too cold to even walk down to it and in one of the three upper bedrooms it is freezing all year round and in winter even under blankets.” #325, Female, Climate Zone 2

“We have no insulation or double glazing at all and one log burner in one room so we sometimes all sleep in that room because it’s too cold in our bedrooms.” #305, Female, Climate Zone 2.

“My whole family sleeps in the biggest room because heating is too expensive.” #45, Female, Climate Zone 1.

Consistent with other research, almost three in five of the young people surveyed attributed at least one negative physical and mental health indicator to being cold at home. The open-text responses also reflected this, with a theme emerging regarding cold homes and health, as illustrated by the comments of these respondents:

“My sister has asthma and the cold can bring onsets of coughing.” #317, Other, Climate Zone 2.

“I get chill-blains every few winters making my feet sore and cold throughout the days and nights” #278 Female, Climate Zone 2

“My dad feels the cold really easily so we have to live in a warm house for his health. We know if the house is cold if his finger-tips go purple, or he starts complaining about why the fire isn’t on.” #283, Female, Climate. Zone 2.

Interview comments also directly attributed health effects to being cold:

“[Being cold at home] affected me by making me become sicker way easier, also I’m a brittle asthmatic who’s been in [Intensive Care Unit, Hospital] over 100 times, the cold air dramatically affects me, also I was born with a weak immune system and the cold doesn’t help this.” (Interview, Male 1).

Another theme present in the open-text responses was that cold affects study/school, with several respondents indicating that they had no access to heating in their bedrooms, as is typical of New Zealand homes where only one room is commonly heated. Comments highlighted that this was a source of stress for young people, as these respondents describe:

“Every room in the house is warm except for my room because it has absolutely no sun and the heaters waay too far from it and when I want to study alone it’s often too cold to go so I usually study in my parents’ room.” #546, Female, Climate Zone 3.



“Stressed that it is too cold in my room to do homework or study.” #344, Male, Climate Zone 2.

“Get stressed about homework because it's too cold to do it, too cold to think.” #325 Female, Climate Zone 2.

Interviewees all agreed that being cold at home had effects on physical and mental health for young people, and all but one agreed that schooling and social lives were impacted by this, with comments about being “irritable” with family, friends, and teachers, for example:

“I think constantly being cold can make people a bit less at ease because their body is constantly in hyperish drive trying to keep them warm and I believe it can make young people tired and irritable and this can affect their social life. Also I think it can affect their education ... being tired can cause them to not think and perform to the best of their ability.” (Interview, Male 1).

When asked how important interviewees thought electricity and heating was, especially for teenagers, responses indicated that heating is a clear priority for young people, though they are often unable to control this:

“It's not fair as us teens don't get a say at anything. I would use more electricity if I could... Most young people will go anywhere that has a heater to sleep near if it's cold and most young people would have lights on and the T.V on but my parents would tell me to turn the lights off if I was watching T.V.” (Interview, Female, 5)  
 “For teenagers, it can seem very important as we're at a stage where moods affect us and not having heating becomes the most of our worries... We would want to study in an environment that is warm.” (Interview, Female 6).

### 3.4. Financial security

Younger members of the collaborative research team felt that asking young people what their household income was intrusive and would be unknown to many young people. Instead, we asked a series of questions indicative of financial hardship and/or electricity self-rationing (Table 3), a common phenomenon among fuel-poor households that can severely compromise their capability to achieve living standards at modern societal norms (O'Sullivan, Viggers, & Howden-Chapman, 2014).

Interview data also supported that the experience of financial stressors and cold housing while widespread, were viewed as private issues by teenagers:

“I haven't noticed anyone really talking about it being cold at home,

we all complain about the cold at school during winter, and how horrible the weather is, but nobody tends to say anything about what it's like at home. I feel like dealing with cold housing is an issue that people my age would want to keep private, perhaps out of embarrassment of knowing their family can't afford the heating, or even because it's something they take as being normal because they've lived in cold homes for their entire lives.” (Interview, Female 3).

Almost one in five respondents (18.4%) reported that they were restricted from using heating at home because it was too expensive. Interview data also demonstrated this, for example:

“I've heard of a lot of people in my area having to turn off heaters or stop using the fire because the cost of electricity/gas/wood and coal etc being too expensive to buy and run.” (Interview, Female 3).

One interviewee pointed out that living in cold housing can be a year-round problem with flow-on effects during the school day:

“As for my family we and a couple of friends I know do struggle even in summer. Getting up in the morning is the hardest and it becomes so cold in winter that I don't even bother to make my lunch as the kitchen was just too cold. I would then be hungry at lunch and wouldn't be able to focus in class. I can imagine many kids would also be having problems getting out of bed therefore resulting in them more likely to miss or be late for school.” (Interview, Female 4).

More than a third of respondents (34.6%) reported that their families juggled between paying for food or other bills and electricity at least sometimes. More than one in eight youths (13.2%) contributed to paying for household bills at least sometimes. When these respondents were given the opportunity through open-text questions to explain more about contributing to household bills, the data centred around six themes identified by the young researchers. These included comments about *Jobs*: “I [have this job], I'm 14 but sometimes my parents need my money.” (#81, Female, Climate Zone 1); or *Pocket Money*: “Extra pocket money I give in.” (#198, Male, Climate Zone 1). There was a contrast between those who *Feel Obligated* “I feel like I should help pay the bills as I do use some of the electricity at home.” (#123, Male, Climate Zone 1) and those who *Have To* contribute to household bills, for example “Dad may take money from my account if he needs it, which is rare” (#444, Female, Climate Zone 3); and a second quote “Because I'm more or less forced to.” (#608, Male, Climate Zone 3). Others commented on contributing to other household expenses including *Food* “When I have spare money I buy extra food.” (#606, Male, Climate Zone 3); or *Other Bills* “because I always get sick so I have to go to doctors by myself so I pay for it” (#538, Female, Climate Zone 3).

Hot water heating accounts for around 30% of household energy use and makes up a significant portion of electricity costs in New Zealand, with most houses using electric hot water cylinders. Restricting hot water use is a common local method for reducing electricity expenditure among fuel poor households (O'Sullivan et al., 2014). While more than half of the survey respondents reported having to limit their hot water use, the open-text answers explaining reasons for doing so described that this was a more complicated behavior that was not clearly influenced by financial necessity. Themes identified by the young researchers included restriction related to the hot water storage and heating, for example, whether an electric or gas cylinder could reheat fast enough for other family members, or if solar hot water was limited in some weather conditions. Cost was one of the themes identified, however, as illustrated by one respondent “we just try not to use it to save money because instead we could be using cold water for like washing our hands as an example” (#49, Female, Climate Zone 1).

**Table 3**  
 Indicators of financial security in households with dependent youth.

		Percentage	95% Confidence interval
Does your household juggle food/other bills for electricity?	Never	65.3	57.7–72.3
	Sometimes	26.2	22.5–30.4
	Often	5.3	2.8–9.8
	Always	3.1	1.7–5.8
Do you contribute to paying for household bills?	Never	86.7	78.9–91.9
	Sometimes	11.2	6.7–18.2
	Often	0.5	0.2–1.5
	Always	1.5	0.5–4.6
Do you have to limit your hot water use?	Never	43.2	38.4–48.1
	Sometimes	38.6	34.5–42.8
	Often	10.1	8.0–12.7
	Always	8.2	5.0–13.2
Is heating restricted due to cost?	No	81.6	76.1–86.1
	Yes	18.4	13.9–23.9
Has your electricity been disconnected for nonpayment?	No	93.6	88.7–96.5
	Yes	6.4	3.5–11.3

**Table 4**  
Relationships between key fuel poverty indicators and demographic groups.

Fuel poverty indicator	Demographic group	Mean / Percentage	95% Confidence interval	Test statistic	p-value			
Feel house is cold during winter (1=no to 4=yes, always) <sup>*</sup>	Tenure Owner-occupied	2.10	1.97–2.24	F(2, 18)=6.882	0.013			
	State-owned rental	2.45	2.06–2.85					
	Private/other rental	2.45	2.11–2.78					
	Ethnicity NZEuro	Māori	2.07	1.94–2.21	F(4, 16)=8.843	0.001		
		Pasifika	2.48	2.12–2.84				
		Asian	2.30	2.13–2.46				
		Other	2.46	2.21–2.70				
		Climate Zone 1 – Warmest	2.43	2.02–2.83				
		2 – Middle	2.36	2.04–2.68			F(2, 20)=1.400	0.270
		3 – Coldest	2.09	2.02–2.16				
Restricting heating due to cost (yes/no – yes responses presented)	Tenure Owner-occupied	2.10	1.96–2.24	X <sup>2</sup> =3.262	0.154			
	State-owned rental	18.1%	13.9–23.3					
	Private/other rental	17.85%	7.3–37.1					
	Ethnicity NZEuro	Māori	25.2%	17.4–35.1	X <sup>2</sup> =14.32	0.068		
		Pasifika	18.3%	14.1–23.6				
		Asian	18.3%	14.1–23.6				
		Other	30.9%	14.9–53.2				
		Climate Zone 1–Warmest	10.4%	6.4–16.7			X <sup>2</sup> =0.717	0.774
		2–Middle	13.3%	6.9–24.1				
		3–Coldest	33.1%	15.0–58.1				
Juggling paying for food/bills to pay for electricity (1=never to 4=Always) <sup>*</sup>	Tenure Owner-occupied	17.0%	12.3–23.0	F(2, 18)=17.938	0.001			
	State-owned rental	20.0%	11.6–32.3					
	Private/other rental	18.1%	13.6–23.8					
	Ethnicity NZEuro	Māori	1.39	1.28–1.50	F(4, 16)=6.806	0.002		
		Pasifika	1.72	1.41–2.02				
		Asian	1.62	1.45–1.79				
		Other	1.40	1.24–1.55				
		Climate Zone 1–Warmest	1.75	1.43–2.06			F(2, 20)=1.794	0.192
		2–Middle	1.62	1.36–1.88				
		3–Coldest	1.37	1.27–1.46				
Number of occasions of shivering inside (1 = never to 4 = 4+ times) <sup>*</sup>	Tenure Owner-occupied	1.39	1.30–1.48	F(2, 18)=0.630	0.666			
	State-owned rental	2.23	2.06–2.39					
	Private/other rental	2.40	2.05–2.76					
	Ethnicity NZEuro	Māori	2.36	2.10–2.62	F(4, 16)=3.455	0.032		
		Pasifika	2.18	2.04–2.31				
		Asian	2.18	2.04–2.31				
		Other	2.41	1.92–2.89				
		Climate Zone 1–Warmest	2.42	2.16–2.68			F(2, 20)=0.929	0.411
		2–Middle	2.53	2.16–2.89				
		3–Coldest	2.19	1.49–2.89				

<sup>\*</sup> For readability these items are reverse scored from presentation in the survey

### 3.5. Does the risk among youth of experiencing fuel poverty indicators vary by demographics?

We explored whether certain demographic characteristics might be useful for targeting policy. Chi-squared or analysis of variance tests were used to determine whether risk of experiencing four key indicators of fuel poverty differed by tenure, ethnicity, and climate zone (Table 4).

We tested two other variables against ethnicity. Restricting room use due to cold, which has been commonly reported in recent media regarding cold housing, particularly following the Coroner's Report linking the death of toddler Emma-Lita Bourne to her cold, damp housing conditions (Matenga, 2008), differed significantly by ethnicity (F (4, 16)=6.959, p=0.002). Respondents identifying as Māori were significantly more likely (mean = 2.04, s.e.=0.296) to report restricting room use due to cold, than respondents of other ethnicities. Being able to see breath condensing indoors also had statistically significant differences in mean response by ethnicity was (F (4, 16)=5.281, p=0.007), and respondents identifying as Pasifika (mean=2.65, s.e.=0.154) were most likely to report this.

Overall, we conclude that geographic region appears not to have an effect on experiencing factors broadly indicative of fuel poverty. However, there were significant differences between risk of fuel poverty

and ethnicity, with those identifying as Māori at greatest risk, as well as some statistically significant differences by tenure, with those in rental tenure at greatest risk of fuel poverty, followed by those in state-owned housing. These results have important implications for appropriately targeting fuel poverty policy.

### 3.6. Young people support policy to reduce cold housing and fuel poverty

The above data demonstrate that cold housing and fuel poverty are widespread and negatively affect youth health and wellbeing. A clear theme of the qualitative results identified in both the open-text survey responses and interviews was that youth are very aware of cold housing as a youth health issue, even when they are not experiencing it themselves, and that they support increased Government policy action to address cold housing. When asked if they thought cold housing was an important problem for young people, interviewees unanimously agreed, for example:

“Considering I have at least 5 friends who complain about [cold housing] I feel it is a problem. I've been at their houses for the night and it was absolutely numbing. We were in sleeping bags under many blankets. In winter they are constantly sick with coughs and

general colds and are miserable.” (Interview, Male 2).

A final question in the survey asked respondents if they had any other thoughts or comments about what it is like at home during the winter that they would like to share, which also gave rise to comments discussing the need for Government action:

“It gets really cold at night, and the Government should help out especially when some people are dying in their own homes because of the coldness because not many people can afford heating with their bills.” #149, Female, Climate Zone 2

“It's so cold at my house during the winter. If they [Government] could do something for everyone not to be as cold it would benefit their education too. Being sick really limits where you go.” #583, Female, Climate Zone 3.

Interviewees supported Government action on cold housing for those unable to afford insulation and heating improvements on their own:

“I think that there should be a law stating each house should have at least one pre-installed heating system in one of the main living areas. Maybe decrease taxes on heating systems? Just so more families can afford it.” (Interview, Male 1).

Initial qualitative results were presented by the research team in October 2015 (video available at: <https://www.youtube.com/watch?v=wsYNdbKYWis>) at a public presentation well-attended by researchers, public health workers, building sector workers, and policymakers. The youth researchers were unanimous that research about youth issues should include young people in the research process, and are continuing involvement in the dissemination of the research and policy advocacy at Local Government and Government level. Overall, data from the workshops, survey, and interviews find that youth support Government intervention and suggest that young people also support policy targeting of funding for housing improvements.

#### 4. Limitations

The most significant limitation of this study overall, was the difficulty in recruiting and retaining participants into the e-interview study, which has important implications for future research. Potential e-interview participants were identified from survey responses, and purposively sampled with consideration of factors such as gender, ethnicity, risk of fuel poverty, and climate zone (geographic location). Emails were sent to 29 potential participants who had provided their email addresses and consented to follow-up, only 6 were recruited into the study. These participants were provided with a special email address only for using for the interview, and interviewers also used a special email address. This additional step was included to avoid privacy concerns of having a young researcher and participants exchanging personal email addresses. Despite this, one participant, who chose to be interviewed by the adult researcher, preferred to use a personal email address hosted by their school, after being reminded that this would mean the researchers would not be able to delete the account when the interview was completed. Only this participant, and one other who used a special email address completed the full 10 email exchange. We believe that using the special email addresses hindered the other participants from completing the study, as they would need to remember to sign into the account to check for new mail. Reminders were sent to the special email address, and after no response, were also sent to the personal email addresses, which did result in some further exchanges.

We would suggest that in future using dedicated email addresses is not necessary for participants, and that only a young researcher involved in such a study should use a dedicated email address. Participants indicated that they were not concerned about using their

personal email accounts, and in future, we would suggest that allowing participants to create their own dedicated email address using a server of their choice and informing the researchers that they would like to proceed with another email address would better facilitate e-interview completion. We would also suggest limiting the length of the interview exchange to 6 emails – three containing questions, and three in response expected from the participants.

Although the number of participants in the email interviews was small, the data from these interviews complements that from the open-responses in the survey, strengthening the findings from the survey. Most of the data presented here is taken from the first two email responses from the participants, only one participant dropped out of the study after sending the first email response. Questions in these initial emails to participants further explored whether fuel poverty is an important issue for youth and some of the difficulties around coping with cold youth identified in survey responses.

#### 5. Discussion

This study presents the first systematic collection of data of youth experiences of cold housing and fuel poverty risk factors conducted with a collaborative team of young researchers. Overall, the study finds that many young New Zealanders struggle with cold housing and that cold housing has important effects on day-to-day living within and outside the home. Young people commonly reported using many of the same actions and behaviours for coping with cold typical of adults, and in overseas studies of young people identified in current fuel poverty literature. This suggests fuel poverty and energy insecurity research with young people, particularly in the UK, Europe, and North America, may identify similar challenges to those identified here.

Due a history of weak building and housing regulations (Bierre, Bennett, & Howden-Chapman, 2014), housing quality in New Zealand is relatively poor compared to other countries, especially that of private rental housing, which is of measurably poorer quality than state-owned rental or owner-occupied housing (Howden-Chapman, 2015). New Zealanders tend to overestimate the quality of their housing, and 18% of participants of the Housing, Insulation, and Health study self-rated their dwelling in poor or very poor condition, compared with 53% of dwellings rated by a qualified building inspector (Howden-Chapman et al., 2005). Respondents to our survey identified poorer self-rated housing conditions and problems with cold than adults aged over 15 in a recent Statistics New Zealand survey (Statistics New Zealand, 2015). While 36% of adult New Zealanders over 15 years reported no repair or maintenance to their home was needed (Statistics New Zealand, 2015), just 28% of our young respondents did (28.3%, 95%CI 23.2 – 34.0%). In total, 87% of our young survey respondents reported that their homes were at least sometimes cold. Young people were almost twice as likely as adults to report that their home is often or always cold. More than two thirds of our respondents (70%) had shivered inside at least once during winter. Even without indoor temperature measurement, these results clearly indicate that being unable to achieve thermal comfort at home is a widespread problem among young New Zealanders.

Consistent with qualitative research of children and young people on poverty (Children in Wales, 2011; Egan-Bitran, 2012), young people in this study showed awareness of financial stress their families might be under. One third reported that their family juggles between paying for food and electricity at least sometimes and one in eight contributed to paying for household bills at least sometimes. Electricity disconnection for nonpayment in the past 12 months was reported by 6.4%. This coupled with the other stressors of cold housing and associated coping strategies that restrict privacy and activities may contribute to risk of poor mental health among adolescents as highlighted in other research (Liddell & Morris, 2010; Marmot Review Team, 2011).

Comparison of results between demographic groups found fewer statistically significant differences in experiencing key fuel poverty

indicators than expected – particularly for geographic area compared by using the three climate zones for building insulation standards in new-build dwellings, where no differences were found. This was particularly unexpected, given that use of heating, average indoor temperature, and estimates of fuel poverty are geographically patterned across the country (Howden-Chapman et al., 2009; Howden-Chapman et al., 2012). However, our results found that young people living in private rental housing and state-owned social housing were at increased risk of fuel poverty. Local research has consistently provided an evidence-base to support a mandatory warrant of fitness and policy targeting of retrofitting improvements for private rental housing (Bennett et al., 2016). Our findings support those recommendations. The results also suggest that targeting remedial policy could especially benefit those self-identifying their ethnicity as Māori, Asian, and or Pasifika. Although no differences were found between the experience of key fuel poverty indicators and the number of dependent children, the overall study results support other evidence that policy targeting of housing improvements to households with dependent children is justified (Children's Commissioner's Expert Advisory Group on Solutions to Child Poverty, 2012; O'Sullivan et al., 2016; O'Sullivan et al., 2013).

Government intervention is imperative to improve household conditions for children and young people as they have limited capacity for action to address the key challenges of their energy vulnerability (Middlemiss & Gillard, 2015). In addition to the physical building and energy efficiency, as well as socio-economic factors that influence the extent to which they experience fuel poverty, more than a quarter of young people felt they had little to no say over when heating is used in their home environment, for a variety of reasons. Other structural factors may also limit young people's ability to achieve thermal comfort, for example, it is culturally less common for heating to be used in bedrooms, with bedrooms on average cooler than living rooms. In addition, post-war New Zealand houses traditionally face the sun (North), but while 'master' bedrooms are in the front of the house, children's bedrooms are placed in the back of the house facing South. Young people indicated a strong preference for the results of the study to be presented to government and for government to address the issue of cold housing for young people in New Zealand. This research adds young people's voices to the call to action for Government-led housing and energy efficiency improvements to improve youth public health.

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