



## Original research article

# Fuel poverty, policy, and equity in New Zealand: The promise of prepayment metering



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## ARTICLE INFO

## Article history:

Received 5 September 2014

Received in revised form 29 March 2015

Accepted 31 March 2015

## Keywords:

Fuel poverty

Prepayment metering

Policy

Mixed methods research

## ABSTRACT

Fuel poverty is a complex and pervasive policy problem, in part due to the difficulty of identifying households experiencing fuel poverty to target for remedial action. This paper explores the extent to which the use of prepayment metering for electricity can be used as a proxy for identifying fuel poor households. We hypothesised that as prepayment metering in New Zealand is typically used by low-income households, yet is a more expensive payment method; households using prepayment metering have constrained choices and are at higher risk of fuel poverty than the general population. To explore this question, we used information from multiphase mixed methods research on prepayment meter use, which included two postal surveys, complemented by data from an interview study, to explore three different methods of measuring fuel poverty. We conclude that as households using prepayment metering are experiencing greater levels of fuel poverty using all three measurements, prepayment metering can be used as a useful proxy for targeting remedial fuel poverty policy in New Zealand.

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## 1. Introduction

Fuel poverty is a complex problem as it is caused by several contributing factors, including the thermal performance of the dwelling envelope and appliances, household income, and the price of energy [1,2]. A basic definition of fuel poverty is that a household is fuel poor if it cannot afford adequate household energy, including heating to World Health Organization recommended indoor temperatures (at least 18 °C), for a reasonable expenditure of household income. More specific definitions have also been used, most notably the required energy expenditure for a 10% household income threshold after housing costs in England (referred to hereafter as the Boardman definition) [1,2]. More recently England has updated its definition to a 'low income, high costs' model, where a household is in fuel poverty if the required energy expenditure is above the national median and would leave the household with an income below the poverty line (60% median) [3,4].

A key fuel poverty policy problem, even in England where required data on the thermal performance and energy requirements of individual dwellings is identifiable in the English House Condition Survey and Energy Performance Certificates, has been

the translation of monitoring definitions into the identification of fuel poor households for targeting remedial policies [2,5]. Policies using blunt targeting, for example the English Winter Fuel Payment for those over 65, have been criticised for providing unnecessary support to households that do not require it, while leaving other groups such as low income families with young children at high risk of fuel poverty [2,5]. Some success using area level modelling to find pockets of fuel poverty in communities and target local remedial policies has been shown [6]. However, these techniques are sensitive to differing household composition, occupancy, income, and energy requirements and behaviours, which can cause otherwise similar households to experience divergent severity of fuel poverty [6,7].

In New Zealand, while fuel poverty is estimated to affect 25% of households [8], fuel poverty has not been officially defined, measured, or explicitly targeted, and its crucial effect on children is largely unrecognised [9]. Identifying households in, or at risk of fuel poverty, has to date been difficult due to insufficient information about the thermal performance and energy requirements of individual dwellings that could be provided through a scheme such as the Housing Warrant of Fitness currently under development [10]. In the local setting, more so than in other countries, electricity prices are an important driver of fuel poverty, with housing predominantly heated using electric resistance heating [8,11]. The use of heat pumps has increased among the general

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population, however these more efficient heating devices are less commonly used among those purchasing electricity through prepayment metering [12].

Households that have been disconnected from electricity services for late or non-payment of electricity bills may only be offered electricity services again through using prepayment meters, a form of payment where the meter is credited in advance of electricity being used. There are many potential advantages to using prepayment metering, for example the increased ability to monitor and therefore control or reduce consumption, and budgetary management and avoidance of debt [13,14]. However, prepayment meters are not without disadvantages, such as increased transactional costs, including time and travel to outlets to purchase credit and increased pressure on households already experiencing financial hardship and other bill stress. Of particular concern are the inconvenient and potentially harmful outcomes of “self-disconnection”,<sup>1</sup> or running out of credit and going without electricity, as well as “self-rationing” behaviours where householders ration their electricity use sometimes to extremes, even where self-disconnection may be avoided [9,15–17]. Self-rationing of energy involving restricting heating may leave householders exposed to unhealthily cold homes [12,18], which is a particular problem for New Zealand where homes are typically underheated [8,19].

Previously qualitative research indicated that prepayment metering posed specific problems for fuel poor households in New Zealand [20]. Key stakeholders suggested that lower income households are more likely to use prepayment metering, as did surveys of retailers offering prepayment metering undertaken by the previous regulatory body, the Electricity Commission [21,22]. These results were also supported by overseas evidence of problems associated with prepayment metering [16]. Despite these drawbacks, prepayment metering remains a popular payment method among consumers, who appreciate the feedback and sense of control over their budgets and electricity use it provides [16,17]. This evidence suggested that exploring prepayment metering, as a means of investigating the outcomes of fuel poverty among a specific and easily identifiable group, was warranted.

We undertook a multiphase mixed methods research programme to investigate the advantages and disadvantages of using prepayment metering to pay for electricity from a consumer perspective [23]. The results of each of the research phases have included a price comparison [24], a nationwide postal survey [9], a follow-up postal survey [12], an integration of survey datasets to explore outcomes specifically for prepayment households with children [9], and a study using in-depth interviews [17]. This paper provides a summary integration of these datasets to explore whether in the current absence of more specific data; the use of prepayment metering is a useful proxy for identifying fuel poor households.

## 2. Methods and results: estimating fuel poverty rates among prepayment meter users in New Zealand

The first survey dataset was from a primarily quantitative nationwide postal survey undertaken in 2010 with the support of three major electricity retailers in New Zealand, who provided an anonymised random sample to investigate the advantages and disadvantages of using prepayment metering from a consumer perspective [9]. The 2010 survey sample included a total of 768

customers, calculated presuming a response rate of 50% (384), providing adequate study power assuming 50% frequency of self-disconnection in the population. The final response rate for the 2010 survey, which included a rigorous protocol of repeat mailings, was 47.9%. Of the 359 respondents to the 2010 survey, 324 (90.2%) agreed to postal follow-up and were included in the 2011 sample. The 2011 survey, also fully described elsewhere, achieved a response rate of 61.0% using a similar protocol [12]. In both years respondents were offered a \$20 supermarket voucher to thank them for completing the survey, which were sent by the researchers on receipt of the survey form.

Survey data for both years were entered into a Microsoft Access database and analysed using Epi Info version 3.4 (Center for Disease Control, Atlanta, GA). The uncorrected chi-squared test was used for significance testing, with an alpha level of  $\leq 0.05$ . Compared to the general population (based on Census 2006 data), Māori and Pacific ethnicities were over-represented in the sample, home ownership and employment was lower, and there were fewer retirement age respondents [9].

A qualitative research phase followed in 2012, in which a series of semi-structured interviews were carried out with 12 individuals, either recruited through the survey or through a local family budgeting agency (see [17] for a full description). Interviews were undertaken in participants' homes, and participants were offered \$25 supermarket vouchers for each interview in acknowledgement of their contribution to the study. Interviews were digitally recorded and fully transcribed, and analysed using qualitative descriptive methods that have been identified as useful for mixed methods studies [25–27]. The analysis was informed by the survey results and with a sociotechnical approach [28,29] to explore the influences of interactions with prepayment meters and an alternative in-home display device on household energy behaviours. Household reporting sociotechnical interactions with prepayment meters were provided with increased feedback that influenced budgeting and management of household energy use. Unfortunately, this feedback encouraged householders experiencing severe hardship to take extreme measures when restricting their energy use, particularly with regards to insufficient use of heating. Despite this and other disadvantages, prepayment meters were perceived positively and were preferred to standard post-payment billing, as was also found in the surveys.

To investigate whether prepayment metering is a useful proxy for identifying households in fuel poverty, we undertook an integrative analysis using survey data and informed by the qualitative interviews to estimate fuel poverty rates among prepayment meter users using several of the questions asked of survey participants as indicators. Here we compare three types of estimated measures of fuel poverty: actual expenditure, required expenditure, and composite measure. For ease of reference we describe the methods and results of each estimate calculation together in the following sections.

### 2.1. Actual expenditure fuel poverty among prepayment meter users

At one end of the spectrum, using the reported annual expenditure on electricity as a percentage of household income, it is possible to calculate the number of households using prepayment metering that experience *actual expenditure* fuel poverty. However, actual energy expenditure has been shown to be a poor indicator of fuel poverty due to the energy and other expenditure self-rationing behaviours typical among fuel poor households [1,2,16,30–32]. Therefore it is likely to underestimate the number of households in fuel poverty if a 10% actual spend threshold is used. Also contributing an underestimate is that only electricity spending is included

<sup>1</sup> The term “self-disconnection” refers to the service being shut off when a prepayment meter runs out of credit. While the term problematically implies the consumer has agency to make a choice to disconnect, the term is widely used and understood so we use it here.

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