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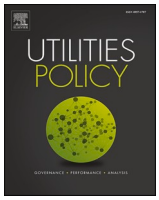

Full-length article

The impact of the cost-of-living crisis on water poverty in Scotland: A lived-experience analysis

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ABSTRACT

During the ongoing 'cost-of-living (CoL) crisis', households have faced increased household expenses, including water bills, which will hinder efforts towards tackling water poverty. Using a quota-based online panel survey (n = 726), we aimed to quantify the impact of the CoL crisis on water poverty in Scotland. Using lived experience rather than the typical income-based approach, we found that age and household income were significant predictors of water poverty, with younger respondents being more likely to struggle, contrary to conventional wisdom. We argue for the involvement of people with lived experience, government financial support and better targeting of that support.

1. Introduction

Supply shortages caused by the Covid-19 pandemic (Francis-Devine et al., 2022) and increasing energy and food commodity prices due to the Russia-Ukraine conflict (Kuzemko et al., 2022) have resulted in a global rise in the cost of living (CoL). These events have led to the cost of essentials, such as groceries and household bills, rising faster than the average household income, a situation described as a 'CoL crisis' (Wilson and Westwater, 2022), pushing millions of people across the world into extreme poverty (Webster and Neal, 2022) In the UK, these factors have been exacerbated by Brexit (the withdrawal of the UK from the European Union), which has increased trade barriers and costs for businesses (Clarke et al., 2023; WM REDI/CITY REDI, 2023).

Most previous research and commentary have focused on energy costs (Middlemiss et al., 2022; Farghali et al., 2023) and health implications of the CoL crisis, identifying a range of adverse public health impacts (Singh & Uthayakumar-Cumarasamay, 2022; Broadbent et al., 2023; Munro et al., 2023). Although recommendations have been made to mitigate these issues, they mainly relate to energy policy (Middlemiss et al., 2022; Guan et al., 2023) or practical advice for healthcare professionals (Singh & Uthayakumar-Cumarasamay, 2022; Munro et al., 2023). However, the ongoing CoL crisis has affected households across the world (WM REDI/CITY REDI, 2023), and in the UK, many previously secure households have been pushed into poverty, and those who were already struggling financially have faced further hardship (Lokshin et al., 2023). Nearly all household expenses have increased (Institute for Government, 2023), including water prices (Scottish Water, 2023a). In previous economic crises, household budgets have been constrained, and many households have been at higher risk of experiencing water poverty (Martins et al., 2019; Yoon et al., 2021). If the CoL crisis also increases the risk of experiencing water poverty, achieving zero by 2030, a goal set by the UK Water Industry Research body (UKWIR) (UKWIR, 2023) may be jeopardised.

Many definitions of water poverty have been proposed (Sullivan, 2002, 2003; Feitelson and Chenoweth, 2002; NEA, 2019; UKWIR, 2020), but they all describe a situation where households face hardship in accessing safe drinking water. Households may struggle to access available water (Sullivan, 2002) or afford access (Feitelson and Chenoweth, 2002; NEA, 2019; UKWIR, 2020). The former is generally applied to contexts in the global South (Ahmed and Kranthi, 2018; Shalamzari and Zhang, 2018; Kallio et al., 2018) and the latter in the global North (Sylvester et al., 2023; Yoon et al., 2021). Since the UK is in the global North, we consider the affordability dimension of water poverty in this study. Water unaffordability in this context rarely leads to households being unable to access safe water but may lead to self-restriction, debt accumulation (NEA, 2019) or other hardship from

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managing trade-offs between other inescapable living costs (UKWIR, 2020).

Water affordability is explicitly included in SDG 6, target 1, which aims to achieve universal and equitable access to safe and affordable drinking water by 203 (UN, 2015). However, there is no agreed definition of affordability nor an agreed metric for monitoring progress towards this target (Fagundes et al., 2023). Nevertheless, there has been considerable research on water affordability in the global North since SDG 6.1 was set (see, for example, Pierce et al. (2021)), but affordability remains a contested concept. A ratio-based approach, such as an income threshold, is a common metric for defining affordability. This approach is currently used across the global North, including in Portugal (Martins et al., 2019), the USA (Sarango et al., 2023), the UK (NEA, 2019; UKWIR, 2020) and Australia (Wasimi and Hassa, 2012), and has in the past been used in analyses by the World Bank (Kamata et al., 2010). The World Bank has recently described income thresholds for defining affordability as arbitrary and not theoretically robust (Andrés et al., 2021). Furthermore, an income threshold neglects the lived experiences of people who struggle to access (including to afford) safe drinking water (Anderson et al., 2023).

In recognition of the challenges associated with the income threshold and the neglect of lived experience, here we focus on the experiences of those struggling to afford their water bills and consider the utility of this approach compared to the income threshold.

2. The Scottish context

The water industry in Scotland differs from the rest of the UK and many countries across the world because of the way water is priced and billed. The public water supply in Scotland, which serves 97 % of the population (DWQR, 2025), is delivered by Scottish Water, a publicly owned company (Scottish Water, 2025a). Most households do not have a water meter and thus do not pay for water based on volumetric use.[1] Household water charges are based on the council tax band (municipal tax based on property values) and are collected alongside the municipal tax in a combined bill. Although this approach to charging means that water charges are steady month-to-month, the combined bill makes it more difficult for households to know how much they are paying separately for water and their municipal tax and may complicate the perception of how they are affected by each bill.

Despite the different approaches to water payment and billing, water affordability in Scotland, as in the rest of the UK, is defined using an income threshold (Eiser et al., 2024). This definition of affordable water is adopted for water poverty more generally, and a household is considered to experience water poverty if they spend more than 3 % of their household income (after housing costs) on their water and sewerage bill (NEA, 2019; UKWIR, 2020). Therefore, costs associated with water above this threshold are deemed unaffordable, though the water is not necessarily unobtainable.

In many countries that use the income threshold approach, interventions support households that cannot afford their water bills. These include social tariffs, which apply a discount to water bills for eligible households (Andrés et al., 2021), tiered or income-based water pricing (Sarango et al., 2023), debt forgiveness (Swain et al., 2023) and support to adopt water efficient practices (Lu et al., 2019). In Scotland, except for debt forgiveness, all of these interventions have been implemented or are available, and the way water supply and payment are administered in Scotland is arguably protective of consumers and their right to safe drinking water. For example, households cannot be disconnected from their water supply for non-payment (Water Industry (Scotland) Act, 1980), and as metering is uncommon, households face a flat water charge, which ensures households who need more water for reasons including household occupancy, medical need or religious purposes (in a domestic setting) are not adversely affected by their circumstances (Anderson et al., 2023). Furthermore, water pricing is designed to account for variable household affordability based on property values, a proxy for affordability (Walker, 2015). A social tariff is also available in Scotland, where eligible households can receive up to 35 % off their water bill via the Water Charges Reduction Scheme (CAS, 2021). Finally, households can be supported to save water-associated energy costs (Scottish Water, 2025c).

Despite the comprehensive range of support for Scottish households, water unaffordability persists, with 12 % of households found to spend more than 3 % of household income on water bills (Fraser of Allander Institute, 2019) and thus meet the criteria for water poverty. Furthermore, collecting the water and council tax bills in one payment can conceal the individual impact of these bills for both householders and policymakers. This practice does not mean that households are not affected by or impoverished by their water bill but that the attributable impact is less visible. This extensive range of support is inadequate to overcome water poverty, and the problem is at risk of being overlooked, highlighting the need for further research on water poverty in this context, particularly in a CoL crisis.

In addition to considering the merit of a lived-experience approach to evaluating water poverty, given the ongoing CoL crisis, we will also investigate how water poverty in Scotland has been impacted. Our specific objectives were to understand (i) how water poverty has been experienced during the CoL crisis, (ii) who has been most affected, (iii) how effective existing water affordability interventions have been, and (iv) how water poverty might be reduced in the future. The analysis will be valuable for researchers and policymakers in Scotland and further afield to understand what policy interventions may be required to make water affordable.

3. Methods

3.1. Survey development and administration

An online panel survey was designed to collect responses relating to experiences of the CoL crisis and how it has impacted (or is expected to impact) payment for household water services in Scotland. Participants were recruited using Qualtrics, an online survey platform (https://www.qualtrics.com/uk/). Qualtrics recruits survey respondents from various participant pools, where people have agreed to be solicited for research. There is little transparency around the conditions and compensation respondents receive, which may vary from pool to pool. Using an online panel means that the survey population is, to an extent, self-selecting and may affect how representative the population is. However, Qualtrics uses a quota-based sampling approach to create a survey population representative based on key characteristics, including gender, age, and ethnicity. In this case, the aim was to gather responses from 700 respondents. These respondents broadly represented the Scottish population regarding gender, age, and ethnicity (Table 1 - Scottish population column). Respondents were screened to ensure they met the survey requirements (i.e., 18 or over, residing in Scotland). Surveys were completed between February 22, 2023 and March 9, 2023, coinciding with the CoL crisis, which is considered to have begun at the end of 2021 (Institute for Government, 2023) and is ongoing at the time of writing.

Guidelines on designing surveys from Lietz (2010), McGuirk and O'Neill (2016) and Vannette and Krosnick (2018) were used to develop the survey instrument. It was pre-tested with 50 respondents using the Qualtrics platform. All pre-testing respondents met the survey requirements, and the pre-testing helped refine the survey questions, format and order. Changes were minor, so the pre-tested respondents were included in the final survey dataset. This research was approved by the University of Stirling's General University Ethics Panel (2022 10662

[1] Approximately 300 households in Scotland have a water meter, compared to 2.5 million without a meter (Fraser of Allander Institute, 2016). Households that wish to be metered must apply for and meet the costs of installation themselves (Scottish Water, 2025b).

Table 1
Survey demographics compared to census data.

		Scottish population %	Survey population %	Survey *n*
Gender	Male	49.0	49.2	357
	Female	51.0	50.4	366
	Other		0.3	2
Age	18–24	11.7	11.6	84
	25–34	18.9	19.0	138
	35–44	16.9	17.9	130
	45–54	19.2	20.1	146
	55–64	33.2[a]	15.7	114
	65–74		12.5	91
	75 and over		3.2	23
Ethnicity	Asian	2.6	3	22
	Black	0.7	3	22
	Mixed	0.3	1.8	13
	Other	0.4	0.3	2
	White	96	91.6	665

[a] *Respondents of 55+ are aggregated for targeting by Qualtrics during recruitment, hence the single figure for 55–64, 65–74 and 75 and over. However, these were disaggregated into the above age bands for analysis.*

8673).

3.2. Survey content and structure

The survey was structured in three parts. Respondents were asked about (i) their household characteristics, (ii) their experiences of the CoL crisis using a 5-point Likert scale and associated household financial decisions using ranking questions and (iii) socio-demographic data (see survey in supplementary data). These questions were asked, in part, to identify any relationships between the households that struggle to afford their bills (particularly their water bills) and household demographic characteristics. It was essential to understand who might need further support and highlight gaps in existing support provisions.

3.3. Demographic characteristics

The demographic characteristics collected as part of this survey are shown in Table 1. Ethnicity and age were particularly important as these factors have been identified as relevant to understanding who may be more susceptible to water poverty (Anderson et al., 2023). These showed that the survey population broadly represented the Scottish population for these variables. The distribution of the survey population across the income response bands is shown in Table 2. The Scottish median income is £26,572 (Fraser of Allander Institute, 2023), and the median income of the survey population was £30,000–39,999.

3.4. Statistical analysis

All statistical analyses were conducted in RStudio (2024.04.2 + 764 "Chocolate Cosmos" Release). Descriptive statistics were used to assess the efficacy of the social tariff. An ordinal logistic regression model (OLRM) using the CAR package (Fox and Weisberg, 2019) was used to test the predictive capability of several variables (Table 2) on the extent to which a household reported struggling to afford their water bill. This analysis aimed to understand who might be more likely to struggle and, consequently, to support the design of targeted policy interventions. A combined model was run, which included all independent variables of interest. We do not have a hypothesised causal path for model variables. Partial regression coefficients estimate the conditional total effects of independent variables (Morrissey and Ruxton, 2018) on the struggle to afford water, i.e., the effect of an independent variable on the struggle to afford water when all other variables are held constant. Our goal is not to make causal inferences but to identify factors associated with how much a household will struggle to afford their water bill. We ran a Brant test using the 'brant' library in R (Schlegel and Steenbergen, 2020) to check the proportional odds assumption, which showed that the assumption holds.

Table 2
Distribution of survey population across income categories.

		Survey *n*
Household Income	<£15,000	101
	£15,000-£19,999	72
	£20,000-£29,999	156
	£30,000-£39,999	127
	£40,000-£49,999	58
	£50,000-£59,999	51
	£60,000-£69,999	40
	£70,000-£79,999	36
	£80,000-£89,999	13
	£90,000-£99,999	13
	More than £100,000	18
	Prefer not to say	41

The age of the respondent was included in the model because poverty in old age is recognised as a global challenge (Ebbinghaus et al., 2019; Jeon et al., 2017; Alcántara and Vogel, 2023), and other literature on the CoL crisis has discussed the impacts specifically on older people (Khan, 2022). In Scotland, financial support was available for older people (UK Government, 2023), which could be paid in addition to other (not age-related) cost-of-living support payments (Kennedy et al., 2024). We hypothesised that older people would report struggling to afford their water bill more than younger respondents. Although water demand may be affected by age (Schleich and Hillenbrand, 2009), as water is not metered for the vast majority in Scotland, this is not relevant here, but it may be elsewhere.

The council tax band was included in the model, as water charging is based on the property tax band. The council tax band is used as a proxy for affordability (Walker, 2015), and the water charges increase as the council tax band increases (usually associated with increasing property values). Assuming this approach to setting water charges is effective, we hypothesised that there would be no difference in the extent to which households struggled among council tax bands.

Household locality and ethnicity were included because previous research showed that people living in rural areas or those from a minority ethnic group were more likely to experience water poverty (Anderson et al., 2023). We hypothesised that rural households and respondents who were from a minority ethnic group would be more likely to report struggling to afford their water bill than urban residents or those who are not from a minority ethnic group.

Household income was included as it was expected to be the most significant predictor of affordability. We hypothesised that as household income increased, the extent to which a household struggled to afford their water bill would decrease.

The OLRM indicated the direction of the relationship between the independent and dependent variables. An ANOVA (which uses a likelihood ratio test per Fox and Weisberg (2019)) was then performed on the model to determine the significance of the predictive capability of the independent variables (Table 3).

3.5. Operationalisation of water poverty

To explore the merit of a lived experience-based approach to evaluating water poverty, we focused on the experience of 'struggling' rather than other approaches, which may seem more intuitive. We did not analyse the experience of water poverty based on self-identified experience, as previous research has shown little recognition of the term 'water poverty' in Scotland, even among water professionals (Anderson et al., 2023). Furthermore, the term 'poverty' can carry a stigma, affecting whether respondents identify with this term (Inglis et al., 2023). We opted to use the term 'struggle' as this was the phrase commonly used by participants in the Anderson et al. (2023) research

Table 3
Descriptions of variables included in the model.

Variable	Description
AGE (IV)	Age categories ranging from 18 to 75+ (7 categories) (Ordinal)
HOUSEHOLD LOCALITY (IV)	Self-reported locality of household (0 = Urban, 1 = Rural, 2 = Remote) (Categorical)
COUNCIL TAX BAND (IV)	Council tax band of property (0 = A- 7 = H) (Categorical)
ETHNICITY (IV)	Self-reported ethnicity (0 = Asian, 1 = Black, 2 = Mixed, 3 = Other, 4 = White) (Categorical)
HOUSEHOLD INCOME (IV)	Household income ranging from £0->£100K (Ordinal)
STRUGGLE AFFORD WAT (DV)	"Over the past year, I've struggled to afford my water bill." (0 = Disagree – 2 = Agree)[a] (Categorical)

IV – Independent Variable.
DV – Dependent Variable.
[a] The categories 'strongly agree' and 'agree' and 'strongly disagree' and 'disagree' were aggregated into two categories for the model, leaving three DV categories in the model: 'agree', 'disagree' and 'neither agree nor disagree'.

and is implicitly experiential. Respondents were also asked whether they had heard the term water poverty and were required to select whether they thought they were affected (see Supplementary Material for the survey and Table 5 for results), but this was not used for interpreting the incidence of water poverty.

4. Results

4.1. Demographics of the survey population

In total, 726 survey responses were received and taken forward for analysis from the online panel. On average, respondents took 8 min and 19 s to complete the survey. Responses were automatically removed if the respondent took less than half the median time to complete (based on the pre-testing phase), assuming that very short response times would be associated with poor data quality (Meade and Craig, 2012). The survey population broadly represented the Scottish population, as reported in the 2011 census for gender, age, and ethnicity (Table 1). The median household income range was also consistent with Scottish household income (Fraser of Allander Institute, 2023).

Most respondents (83 %) had worried about the CoL crisis (Fig. 1a), and a large proportion had struggled to afford some of their bills over the last year (46 %) (Fig. 1b). Respondents were less likely to report specifically struggling with their water or council tax bills (Fig. 1c and d). The most frequent response to the questions about struggling to afford water and council tax bills was 'disagree'.

4.2. Financial decisions during the CoL crisis

Respondents were asked to rank a series of commodities (e.g., water, somewhere to live, broadband, transport) in terms of (a) which were the most important commodities in their lives and (b) if they needed to reduce spending, which they would reduce spending on first (Table 4). The top three priorities for respondents were somewhere to live, water and food, and these were also the three expenses respondents said they would be least likely to cut back on. This finding demonstrates consistency in decision-making and suggests that even when budgets are constrained, water costs are more protected than other expenses (e.g., mobile phone, transport, broadband) from non-payment. Further, it suggests that additional financial pressures experienced by households because of the increased CoL will first place greater pressure on other non-water aspects of household finances.

Table 4
Respondent rankings of (a) the importance of household commodities and (b) the expenses they would look to reduce first if they had to reduce their spending.

Ranking	(a) Which of the following commodities do you regard as most important in your life?	(b) If you had to reduce your spending, which expense would you look to reduce first?
1st	Somewhere to live	Mobile Phone
2nd	Food	Transport
3rd	Water	Broadband
4th	Energy	Energy
5th	Transport	Water (Council Tax)
6th	Mobile phone	Food
7th	Broadband	Mortgage/Rent

Table 5
Breakdown of respondents who had (a) heard of the term 'water poverty', (b) struggled to pay their water bill over the last year, and (c) heard of water discounts in Scotland (including percentage breakdown of (i) those who reported that they had struggled (n = 129) and (ii) those who reported that they had not struggled (n = 394).

(a) Have you heard of the term 'water poverty'?	
No, but I don't think it affects me	26 %
No, but I think it might affect me	3 %
No, I don't know what it means	24 %
Yes, and I think it affects me	5 %
Yes, but I don't think it affects me	42 %
(b) Over the last year, I've struggled to pay for my water bill	
Strongly agree	7 %
Agree	11 %
Neither agree nor disagree	28 %
Disagree	33 %
Strongly disagree	21 %
(c) Are you aware of the discounts available?	
No	62 %
i. *Of those who struggled*	*39 %*
ii. *Of those who did not struggle*	*67 %*
Yes, but I don't receive a discount	28 %
i. *Of those who struggled*	*34 %*
ii. *Of those who did not struggle*	*26 %*
Yes, and I receive a discount	10 %
i. *Of those who struggled*	*27 %*
ii. *Of those who did not struggle*	*7 %*

4.3. Who is affected by water poverty?

When participants were asked whether they had heard of the term 'water poverty', almost half (47 %) reported that they had, but relatively few respondents (8 %, $n = 60$) thought that they were affected by water poverty (Table 5a). While some respondents (18 %, n = 129) reported that they had struggled to afford their water bill during the past year, just over half (54 %, n = 394) reported that they had not (the remainder neither agreed nor disagreed) (Table 5b). Of those who reported struggling to pay their water bill over the last year, 39 % ($n = 50$) were unaware of the discounts available in Scotland (i.e., the Water Charges Reduction Scheme). Just over a quarter (27 %, n = 35) of those who struggled reported that they received a discount, with fewer of those who reported that they did not struggle to receive one (7 %, n = 26) (Table 5c).

We used a cumulative odds ordinal logistic regression to determine whether there was an association between age, household locality, council tax band, ethnicity or household income and the extent to which respondents had struggled to afford their water bills over the last year. The 'strongly agree' and 'agree' categories and the 'strongly disagree' and 'disagree' categories were aggregated into two categories 'agree' and 'disagree' for the analysis. The ANOVA showed that age and household income were the only significant predictors of how much a household struggled to afford their water bill (Table 6). The extent to which a household reported struggling to afford their water bill decreased with household income. Households were more likely to report struggling with an income of up to £40,000 (Fig. 2) than households earning more than £40,000.

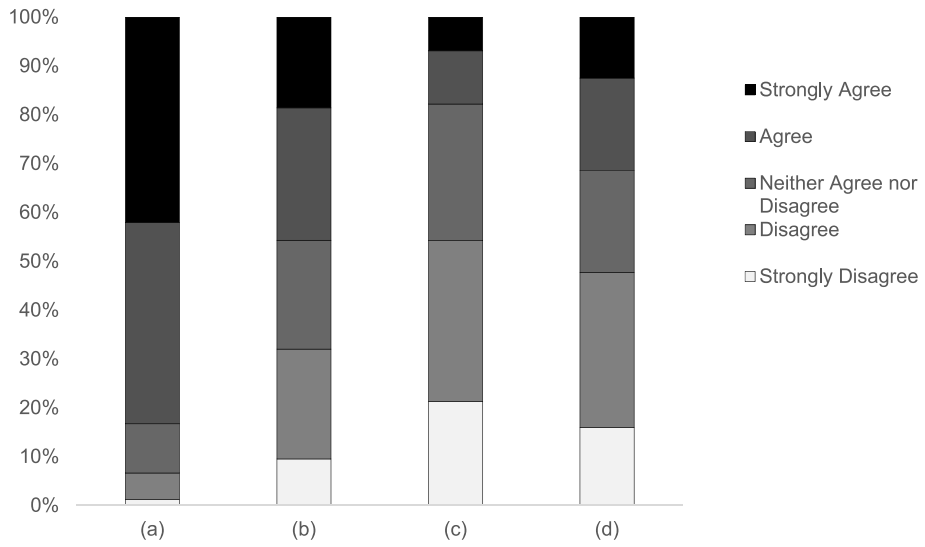

Fig. 1. The extent to which respondents (L–R): (a) worried about the Cost of Living crisis, (b) struggled to afford some of their household bills, (c) struggled to afford their water bill and (d) struggled to afford their council tax bill (n = 726).

Table 6
ANOVA of ordinal logistic regression model to determine the significance of the variables included in the model.

Variables	Lr Chisq	Df	Pr(>Chisq)
Age	28.8817	1	7.694e-08***
Household Locality	0.6646	2	0.7173
Council Tax band	7.3947	7	0.389
Ethnicity	4.1267	4	0.3891
Household Income	16.2049	1	5.685e-05***

*** denotes a p-value of <0.001.

4.4. Support for those affected by water poverty

Respondents were asked if they were aware of the discounts (social tariff) available to eligible households struggling to afford their water bill; some (38 %) reported that they were aware of these discounts, while the majority (62 %) were unaware. As outlined above, of those who struggled to pay their water bill over the last year, many (39 %) were unaware of the discounts. When asked about water company priorities (from a list in the survey, see Supplementary Material), 34 % said their priority should be "supporting customers to afford their water bills".

To evaluate the sufficiency of the water charge reduction (social tariff), we analysed data on respondents eligible for support based on their response that they are single-occupant households (Scottish Government, 2024a). We found that 19 % of respondents lived in single-occupant households. Of this 19 %, 10 % reported struggling to afford their water bill, and 61 % said they did not struggle, while the remainder (23 %) neither agreed nor disagreed. When respondents were asked if they were aware of discounts, most said that they were not aware of discounts (64 %); some said that they were aware of discounts but did not receive one (20 %), and some said that they were aware of discounts and did receive one (16 %).

4.5. Awareness of water payment in scotland

To understand how responses to the survey questions discussed above might be affected by an understanding of water payments in Scotland, which has previously been shown to be poor (Walker, 2015), we asked two questions: 'Are you aware of how much you pay for your water bill?' and 'How do you pay your water bill?' (Table 7). We found that awareness of water payment and the payment process was low. More than 20 % of respondents reported that they thought water was free in Scotland; many said they did not know how much they paid (60 %), and relatively few (17 %) said they knew how much they paid. Knowledge about how water bills are paid was better; most (75 %) reported paying their bill alongside their council tax. However, some (9 %) said they did not know how water bills are paid, and 6 % said they paid Scottish Water directly. The remaining 9 % said that they did not pay a water bill. Of those who responded 'Yes', 28 % (n = 33) reported that they struggled to pay their water bill; of those who responded that they thought the water was free in Scotland or that they were not aware, 16 % (n = 94) reported struggling to afford their water bill.

5. Discussion

To date, there has been a lack of research on the impact of the UK's CoL crisis on water poverty. The survey results presented here provide an overview of how people in Scotland have experienced the CoL crisis and the impact on their ability to pay their water bills. Research commissioned by Citizens Advice Scotland (CAS) in 2018 estimated that the number of households in water poverty would decline by 2027 (Fraser of Allander Institute, 2019). However, since the start of the CoL crisis, water charges and housing costs have increased more than projected, and median household income has declined (Scottish Water, 2021, 2022, 2023a; Scottish Government, 2023a; ONS, 2023). Thus, the CoL crisis has inevitably hampered progress towards reducing the incidence of water poverty, which has implications for achieving universal access to safe and affordable drinking water (UN, 2015) and zero water poverty (UKWIR, 2023).

5.1. Definition of water poverty

We took a lived-experience-centred approach, focusing on struggle, with the view that an income threshold is set at an arbitrary level (Andrés et al., 2021; Walker, 2009) and is not related to the point at which households become eligible for a social tariff, or to the price they pay for water. To capture the lived experience, we operationalised water poverty as occurring when a household self-reported that they struggled to afford their water bill over the last year instead of using an income threshold (NEA, 2019; UKWIR, 2020; Sylvester et al., 2023; Yoon et al., 2021).

Operationalising water poverty as 'struggling to afford their water bill' was relatively straightforward compared to calculating the proportion of income spent on water bills, as would be necessary using the income threshold approach. Furthermore, using lived experience to

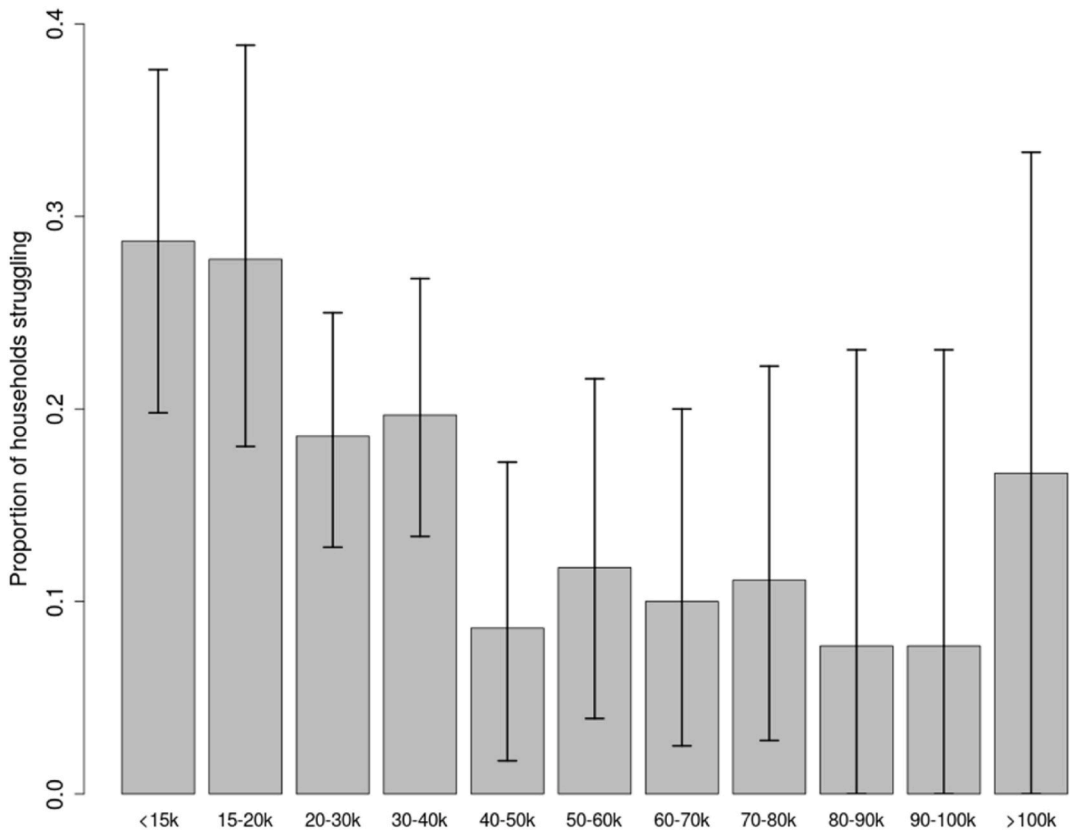

Fig. 2. Proportion of households reporting that they had struggled to afford their water bill over the last year by household income with 95 % bootstrapped confidence intervals (low sample size for households earning >£100k accounts for large error bar) demonstrating that households earning up to £40,000 were more likely to struggle than those earning more than £40,000.

Table 7
Responses to questions about water payment in Scotland.

Are you aware of how much you pay for your household water?	
I thought the water was free in Scotland	21 %
I'm not aware, and I don't know how to find out	19 %
I'm not aware, but I know how to find out	43 %
I'm on a private supply (e.g., from a well or spring), so don't pay a water bill	1 %
Yes	17 %
How do you pay your water bill?	
Alongside council tax	76 %
Directly to Scottish Water	6 %
I don't know	9 %
I don't pay a water bill	9 %

design interventions can lead to better outcomes more responsive to consumer needs (Reeves et al., 2020). In this case, it also demonstrates that water poverty is about more than water affordability (Sullivan, 2002, 2003; Feitelson and Chenoweth, 2002; Anderson et al., 2023) and could also describe a struggle to access water, not only the inability to afford it, as was considered here.

Furthermore, our analysis raises questions about the suitability of the income threshold approach. Using our definition, households earning up to £40,000 per year (well above the Scottish median of £26,572 (Fraser of Allander Institute, 2023)) are more likely to have reported that they struggled to afford their water bill over the last year compared to those earning more than £40,000. However, even using the 3 % income threshold, based on average private rent housing costs (HomeLet, 2023) and average water costs (Scottish Water, 2023b), households earning the median income in Scotland would spend more than 3 % of their income (after housing costs) on their water bill.[2] For households earning £30,000 - £39,999, 2.7 % and 1.7 % of household income would be spent on their water bill over the last year.[3] Thus, they would not be considered to experience water poverty. However, our analysis showed that respondents with a household income in this range were still more likely to struggle to afford their water bill than those earning £40,000 and above. This finding demonstrates first that using either the income-threshold or the lived-experience-centred approach, during a CoL crisis year, the median household in Scotland would experience water poverty; second, there may be people who experience 'struggle' to afford their water bill but who are not necessarily captured by the income-threshold approach because their income is 'too high'. Thus, water poverty continues to be a pressing concern in Scotland, and the income-threshold approach may not be adequate for accurately identifying those who face hardship in accessing and affording their water.

[2] With average (private rent) housing costs in Scotland (HomeLet, 2023): £940/month, £11,280/annum; average household income (Fraser of Allander Institute, 2023): £26,572; and average water costs for 2023/24 (Scottish Water, 2023b): £502.29/annum, households with a median income would spend 3.3 % of their household income (after housing costs) on their water bill.

[3] Households earning £30,000 per annum would spend 2.7 % and households earning £40,000 would spend 1.7 % of their household income (after housing costs) on their water bill.

5.2. CoL crisis

Most respondents reported that they had either worried about or had already been affected by the CoL crisis, broadly in line with previous research in the UK (ONS, 2022). However, although nearly half of respondents reported that they have struggled with some of their bills over the last year, only 31 % and 18 % reported struggling specifically with their council tax (municipal tax based on property values) and their water bill, respectively. This finding is particularly notable since council tax and water charges are collected in the same payment and highlights that poor awareness of water charging in Scotland, as reported elsewhere (CAS, 2018; Walker, 2015), persists.

Water bills are also increasing as water providers face higher energy costs for treating and supplying water (KPMG, 2023). However, we found that water was one of the most highly prioritised expenses among respondents, which is consistent with the analysis that was made following the 2008 financial crisis in Portugal (Frade and Coelho, 2015). Our finding that water is among the last expenses that households would choose to reduce suggests that water bills are relatively protected from non-payment and may reflect that households can control their energy bills and food costs more easily and/or that they link these expenses more explicitly with the CoL crisis. However, if households have to make sacrifices by reducing other expenses so that they can afford their water bill, the payment of their water bill cannot be relied on as evidence that the household is not struggling. The financial pressure may be shifted to other household expenses, and the household may face hardship regardless of which bill they choose to pay.

For example, trade-offs households make to manage their bills and prioritise spending when payment becomes more critical, between fuel and food during sudden cold weather (Beatty et al., 2014), highlight the need to consider overall household bills. By considering the affordability of household bills together ('joint affordability'), it may be possible to address common challenges experienced by consumers for different bills and to design interventions to respond to these (Martins et al., 2019). This approach also speaks to the issue previously described as 'the fragmentation of poverty', which questions the benefit of tackling discrete 'types' of poverty (e.g., fuel poverty, food poverty, period poverty) rather than the broader societal and systemic causes of poverty (Crossley et al., 2019). Our analysis suggests this is particularly relevant in Scotland, where trade-offs between different bills may be masking the actual impact of water bills on households.

5.3. Drivers of water poverty

Despite older people reportedly being more affected by the CoL crisis than other age groups (Pensions Policy Institute, 2022; UK Government, 2023; Kennedy et al., 2024), we found that older respondents were less likely to struggle to afford their water bills. Thus, we reject our hypothesis that as age increases, the extent to which a respondent is likely to struggle will also increase. No age group above 55 (55–64, 65–74 and 75 and over) were more likely to struggle to afford their water bill than younger respondents. Those most likely to struggle were those aged 18–25, and respondents in each subsequent age band were less likely to struggle. It is unlikely that age affects the extent to which a household will struggle, but the struggle is a consequence of the economic circumstances at different life stages (Kratz and Brüderl). These results may also have been affected by this survey being issued online, and perhaps the older people who completed it experienced different financial circumstances than is typical for their age group. Nevertheless, this was a surprising result and warrants further research.

Household income was the only other variable we analysed, significantly affecting the likelihood of a household reporting that they had struggled to afford their water bill over the last year. This finding was expected and supported our hypothesis that the extent to which a respondent struggled decreased as income increased. However, households that earned up to £40,000 were more likely to struggle to afford their water bill, which occurred at a higher income than anticipated, given that the median household income in Scotland is £26,572 (Fraser of Allander Institute, 2023). This finding suggests that struggling with water bills may be more prevalent than previous research on water affordability has suggested (Fraser of Allander Institute, 2019).

5.4. Support with water charges

Currently, support in Scotland is available through a social tariff (Water Charges Reduction Scheme), which gives eligible households up to 35 % off their water bill. Eligibility for the tariff is tied to eligibility for council tax reduction (Scottish Government, 2024a). From analysing a subset of those eligible (single-occupant households), we found that 10 % of households eligible for the social tariff struggled to afford their water bill. This finding could be interpreted as evidence that the social tariff is set at a level that relieves the burden on these households. However, we found that of those eligible, many were unaware of any discount (64 %), and some were aware but did not receive one (20 %). More of those who reported struggling received a discount (27 %) than those who reported that they had not struggled (7 %), which suggests that the eligibility criteria are somewhat effective at distinguishing who needs support. However, almost three-quarters (73 %) of those who reported struggling did not receive a discount, and more than half of our analysed subset of eligible respondents (64 %) were unaware of the discount, which may be further evidence of low awareness of water charging processes in Scotland, and/or suggests that communication about the social tariff and targeting does not necessarily reach enough of those entitled. Regardless, as we found that 18 % of all respondents reported struggling, the existing social tariff level and/or targeting is still insufficient to alleviate Scotland's water poverty.

Water charging is also tied to the council tax band in Scotland. Households living in higher-value properties are assumed to have higher incomes and water charges (Walker, 2015). We found that the council tax band did not significantly predict water poverty. This finding suggests that, as with social tariffs, this approach to setting prices effectively supports households in making their water bill affordable. However, recent government research has reported challenges of using this tax as a proxy for the affordability of household services. This result is due to the disproportionate burden placed on households in lower-value properties, with the tax described as 'regressive' (where lower-income households are disproportionately affected by the tax as they pay a greater proportion of their income than higher-income households) relative to property value (Scottish Government, 2023c). Further research would be required to understand the benefit of this approach to setting prices and making water affordable.

Tiered or income-based water pricing and social tariffs are common considerations and recommendations in other water affordability studies (Beecher, 2020; Martins et al., 2019; Leflaive and Hjort, 2020). Income-based water pricing and social tariffs are built into water charging processes in Scotland. Despite this, as our research has shown, water poverty is still challenging in Scotland, particularly during a CoL crisis. Therefore, further research and the careful design of these and additional interventions are required to support households in paying their water bills.

5.5. Recommendations

We found that asking people directly about their water bills provided some insight into respondents' lived experiences of managing water bills during the CoL crisis. As water bills are not linked to the income threshold used for defining water poverty, the impact on households found in this analysis is likely to more accurately reflect householders' actual experiences (Reeves et al., 2020). Although we offer some recommendations below, first and foremost, we recommend that people with lived experience of water poverty, defined either using the income threshold or the self-reported struggle approach, are involved in

designing and implementing all future interventions for improving water affordability. This approach has become a cornerstone of social policy design in Scotland in recent years through the Scottish Government's Experience Panels project, which designed the new social security system following devolution of social security powers (Scottish Government, 2024b), the Experts by Experience Panel run by the Poverty & Inequality Commission (Poverty and Inequality Commission, 2023) and the Minimum Income Guarantee Expert Group to provide people living in Scotland with financial security for a minimum standard of living (Scottish Government, 2023b).

Secondly, we propose that investigations into water poverty take a lived-experience approach to identifying water poverty, which has recently gained traction in the fuel poverty literature. Although an income threshold is still used for defining fuel poverty, the definition requires that the remaining income is insufficient to maintain an acceptable standard of living (Scottish Government, 2021); consequently, a household will only experience fuel poverty if their fuel bill causes them to struggle. This approach uses both an income threshold and a residual income approach (Gawel et al., 2011). We recommend exploring additional conditions, such as those used for fuel poverty. For example, for fuel poverty, the remaining income after fuel costs and any benefits income for disability or caring needs and childcare costs has been deducted must be at least 90 % of the UK Minimum Income Standard to be considered acceptable. A similar combined income threshold and residual income approach may be appropriate to address the risk that some households are overlooked for support because they manage to pay their water bill, but their financial insecurity is shifted onto other bills.

Although for this research, we asked households to self-report the extent to which they struggled, struggling is a subjective experience, and if it was used alone for designing or targeting support, there is a risk that two households with the same disposable income (after all bills were paid) could still consider themselves to have different levels of struggle. On the other hand, some households may reject the term 'struggle' as financial struggles may be associated with stigma (Inglis et al., 2023). One water company in the UK uses self-reporting affordability perception to measure water poverty, but using this in a policy-design context may be more challenging, as it is difficult to standardise this measure (UKWIR, 2020). Nevertheless, we recommend that mechanisms for targeting struggling households and the design of support involve people with lived experience (which could include those who self-report that they struggle or those whose spending on water bills breaches the income threshold).

Thirdly, we propose that generic utility support be considered in addition to social tariff and income-based pricing. In Germany, for example, households who find their water bill unaffordable can apply for social funds, which are part of the social welfare system and are intended to be spent on essentials, including utilities (Hanesch, 2020). Our analysis also revealed that most respondents did not consider water companies supporting customers to afford their water bills as a top priority, which raises the question of whether this support could be funded differently. As in Germany, Scottish households also have access to social welfare, but only the Winter Heating Payment (and the Child Winter Heating Payment) is expressly intended to contribute to utilities. This one-off lump sum is available to people who receive certain social security benefits (Scottish Government, 2024c). This approach to targeting support for water bills is already used for the social tariff and would, therefore, seem feasible for further specific social security support. While well-publicised government budgetary constraints make it seem unlikely that additional and broader utility support would be offered currently, if further discounts to water charges by the water supplier in Scotland are incompatible with a financially efficient water service, direct government financial support may be a necessary next step to alleviate hardship for struggling households.

Finally, and in recognition of the inevitability of future financial shocks for households in Scotland and further afield, this research has demonstrated that those presumed to need financial support are not necessarily those who struggle most. We found that young people were more likely to struggle with their water bills than older people, yet in the circumstances of the CoL crisis, when water bills had increased, additional financial support was available for older people. Depending on the nature of future financial crises, different groups may be more likely to struggle, but pressures on these groups must be understood so that future support can be designed to reach those who need it most.

This research has shown that recommendations for alleviating water poverty noted elsewhere – namely social tariffs, tiered or income-based pricing and support to adopt water efficient practices (for saving money on energy bills) (Andrés et al., 2021; Sarango et al., 2023; Lu et al., 2019) – have not been sufficient to make water universally affordable in Scotland. We do not suggest that the above recommendations replace these interventions but that they must be carefully designed to improve their efficacy. Several of our recommendations highlight additional steps that may be necessary to tailor the support offered through these interventions to target those who need it most.

5.6. *Considerations for using a lived-experience approach for future research on water poverty*

As noted, incorporating lived experience into policy design is challenging. In part because of the stigma that is associated with poverty, which may lead some households to reject the label of 'struggling' and also because of the difficulty in standardising a perception-based concept. However, this may be further complicated in places where water is not metered and/or where water bills are less visible. In these contexts and circumstances, attributing the impact of the water bill directly and identifying opportunities and interventions to alleviate water poverty (and poverty more widely) is a significant policy challenge.

As we have reported, only 17 % of respondents reported knowing how much they paid for their water bill. This lack of knowledge would seem to preclude households' ability to report how much they struggle. Yet 72 % of households reported 'agree' or 'disagree' with the experience of struggle, even though respondents had the option to report that they 'neither agreed nor disagreed'. This finding suggests that even when a household does not know how much they pay for a service, they can still perceive the bill's impact.

The results of the analysis highlight the value of taking a lived-experience approach, as it implicitly accounts for nuances in peoples' experiences and the unspoken, and perhaps unknown, factors that contribute to their 'struggle' (e.g., not knowing how much they pay or how to reduce their bill). However, the challenge of attributing the experience of struggle to a specific bill, especially quantifying the impact, remains. This problem complicates the design of policy interventions as it is unclear at what level the bill would no longer lead households to consider that they had struggled. For this reason, we recommend that further research be undertaken with those who have lived through experiences of water poverty to explore the unspoken and unclear interactions between knowledge, awareness, and perception.

Further research should also consider other factors which may affect the experience of water poverty. The model we presented here identified the demographic factors that significantly predicted how much a household struggled to afford their water bill. However, to gain further insight into alleviating water poverty and to understand how households make decisions over which bills to pay and prioritise, it would be helpful to collect data on actual actions taken in terms of prioritising their bills, as well as detail on what mitigation measures they have taken (across their household expenses), and where possible, the impact of those decisions. More data on households that experience water poverty (identified either by self-reporting or using the income threshold) would be especially valuable. This information would provide more details on how water poverty is experienced and effective actions (which would support the design of interventions to mirror these) and reveal the trade-

offs households make between household bills and expenses. Understanding these trade-offs is especially important, as analysing the decisions discretely may lead to the impediments to poverty alleviation remaining invisible.

6. Conclusion

The CoL crisis has compounded efforts to improve water affordability and reduce water poverty in Scotland. Using a lived-experience-centred approach to identify households experiencing water poverty, this study has shown that younger people were more likely to report struggling to afford their water bill than older people. Households with an annual income of up to £40,000, higher than the national median, also struggled with water bills. We found that having income-based pricing and social tariffs available in Scotland was insufficient to overcome water poverty. We have offered several recommendations for further research, which include involving people with lived experience in the design and implementation of further interventions; the re-evaluation of the water poverty definition; exploration of alternative financial support, potentially via the social security system; as well as learning from the CoL crisis to better understand who needs support in periods of financial crisis so that households are better prepared and supported in future. Even in high-income countries like Scotland, further steps, such as those suggested here, are necessary to achieve universal access to safe and *affordable* water (UN, 2015) and zero water poverty (UKWIR, 2023) by 2030.

CRediT authorship contribution statement

Heather K. Anderson: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **A. Bradley Duthie:** Writing – review & editing, Methodology, Investigation, Formal analysis, Data curation. **Craig W. McDougall:** Writing – review & editing, Methodology. **Richard S. Quilliam:** Writing – review & editing, Supervision, Funding acquisition, Conceptualization. **Heather Price:** Writing – review & editing, Supervision, Project administration, Funding acquisition, Conceptualization.

Statements and declarations

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jup.2025.101983.

Data availability

Data will be made available on request.

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