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Demographic Impacts for Insurers of the Cost-of-Living Crisis

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Credits and disclaimers

The authors would like to thank the following people for their contribution to this work

- Scott Hamilton
- Jeslyn Chew

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Background and project aims

Why model the effects of high inflation on insurers' demographic experience?

- “... making no changes to the package currently on offer will leave many households, rich and poor, seeing very significant declines in their real incomes.”

Johnson P, Joyce R, Levell P, Waters T. “The long squeeze: rising inflation and the current government support package”. Institute for Fiscal Studies. [Online] 15 Aug 2022 (cited 1 Sept 2022). Available from: <https://ifs.org.uk/articles/long-squeeze-rising-inflation-and-current-government-support-package>

- Even with government support with energy costs over a six-month period:
 - Energy prices are higher than was previously the case
 - Other household costs are rising quickly
 - **Household budgets are still likely to be squeezed**

What did we set out to investigate?

- How household budgets would change moving from winter 2021/22 to winter 2022/23 prices
- How mortality and lapse rates, as well as new business sales might respond



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Household profiles (1-3)

1. Young low-income family

2 adults, 2 young children

- Living in rented accommodation (high-rise flat)
- One adult working, the other taking care of the children
- 2021 Net income: £23.7k
- Adjusted income percentile^[1]: 13th

2. Young professionals

2 adults, 1 young child

- Mortgage payers ('60s/'70s semi-detached house)
- Both adults working, paying for childcare
- 2021 Net income: £48.8k
- Adjusted income percentile^[1]: 66th

3. Graduate flat-sharers

3 adults (focus on one only)

- Living in rented accommodation splitting bills (flat-share)
- Working
- 2021 Net income: £20.7k
- Adjusted income percentile^[1]: 89th
(*although difficult to compare due to household composition*)

References

[1] Institute for Fiscal Studies (2022) "Your household's income: where do you fit in?" [Online]
Available from: https://ifs.org.uk/tools_and_resources/where_do_you_fit_in



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Household profiles (4-6)

4. Well-off retired couple

2 adults

- Outright home owners (modern detached house)
- Retired, living on combination of occupational and state pensions
- 2021 Net income: £37.3k
- Adjusted income percentile^[1]: 66th

5. Low-income retired couple

2 adults

- Living in rented accommodation (Victorian terraced house)
- Retired, living on combination of state pension and pension credit
- 2021 Net income: £23.7k
- Adjusted income percentile^[1]: 32nd

6. Single low-income widow(er)

1 adult

- Living in rented accommodation (Victorian terraced house)
- Retired, living on combination of state pension and pension credit
- 2021 Net income: £16.8k
- Adjusted income percentile^[1]: 34th

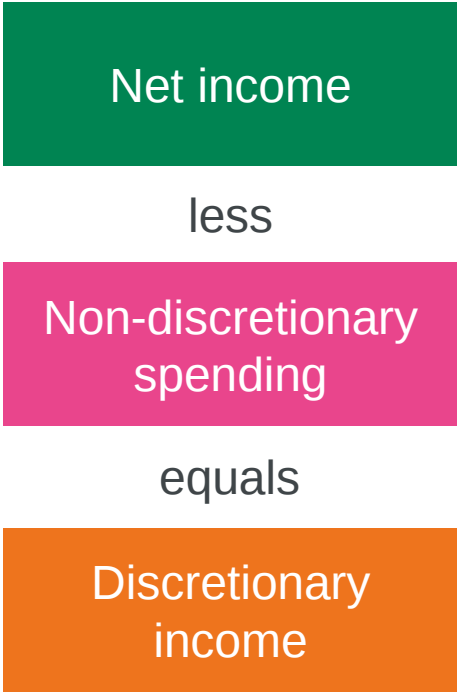
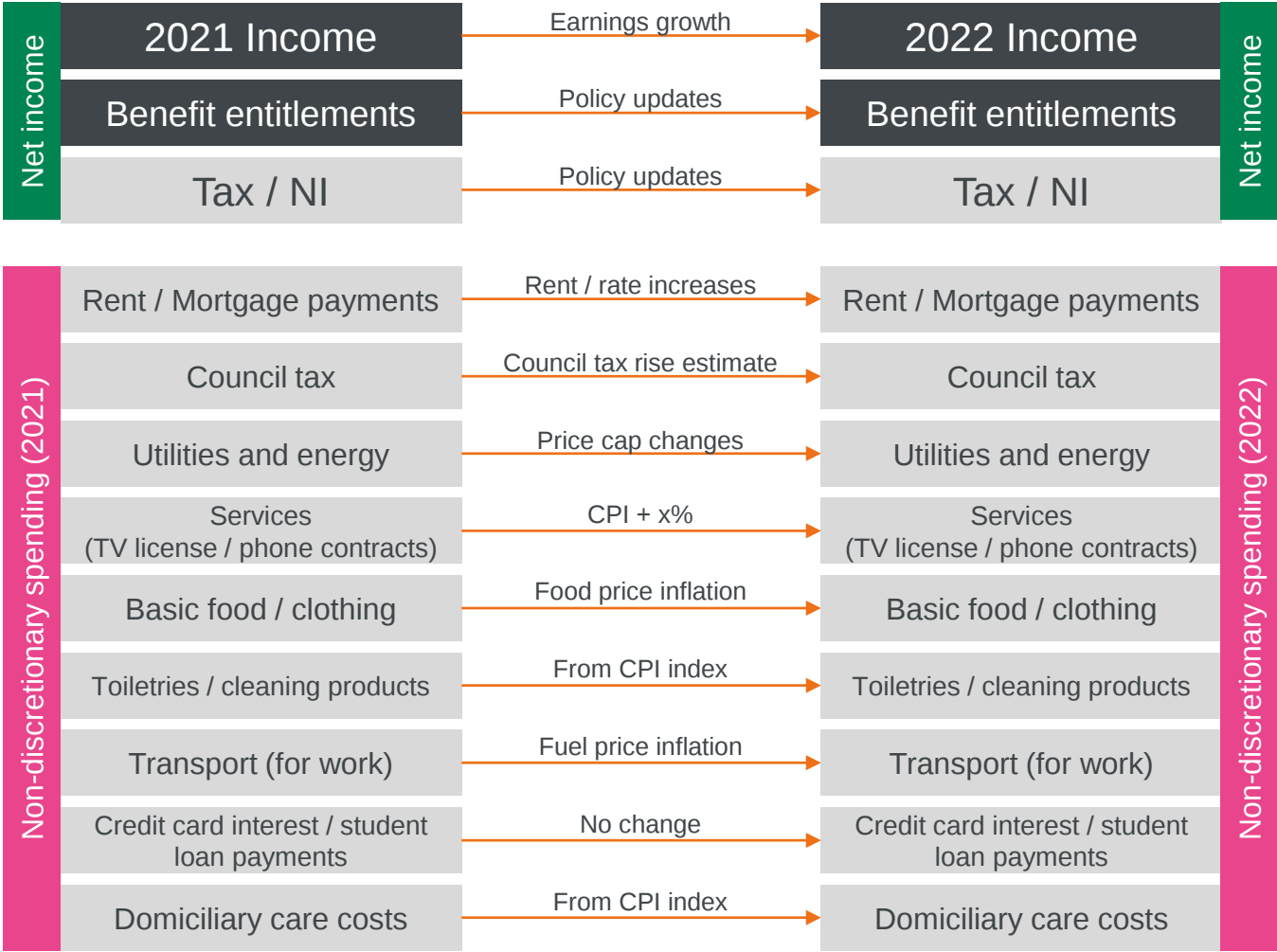
References

[1] Institute for Fiscal Studies (2022) “Your household’s income: where do you fit in?” [Online]
Available from: https://ifs.org.uk/tools_and_resources/where_do_you_fit_in



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Methodology (overview)



Methodology (energy costs)

- Heat-loss calculations for a typical dwelling (by type of dwelling)

Key parameter estimates have been taken from The Open University's online materials concerning heat-loss. In particular, see:

www.open.edu/openlearn/nature-environment/energy-buildings/content-section-2.2.3

www.open.edu/openlearn/nature-environment/energy-buildings/content-section-2.4.1

See also: www.thegreenage.co.uk/getting-to-grips-with-u-values/

House sizes sense-checked against: www.guora.com/What-are-the-average-dimensions-length-width-height-of-an-average-UK-house-not-square-feet-m

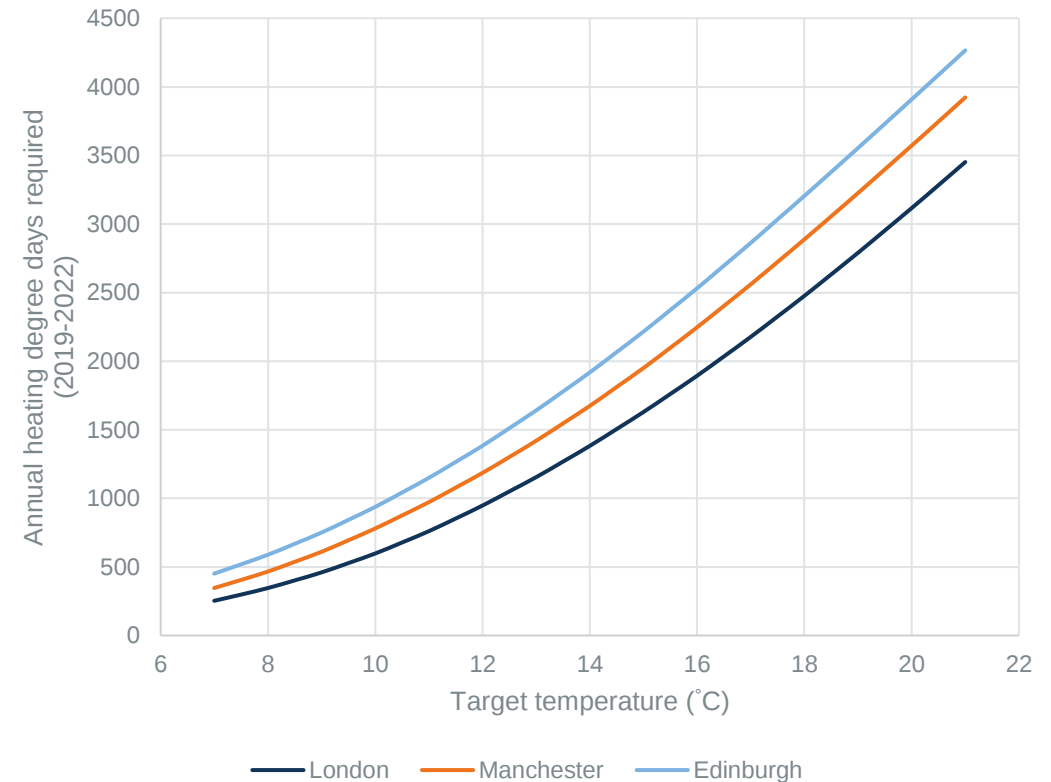
Household energy usage for heating based on heating degree days:

www.greenbuildingforum.co.uk/newforum/comments.php?DiscussionID=9717

Heating degree days data and information on the calculation (allowing for electricals / body heat): www.degreedays.net/#

- Heating energy requirement (kWh)

$$= \text{Daily heat loss} \times \frac{\text{Heating degree days}}{1,000}$$

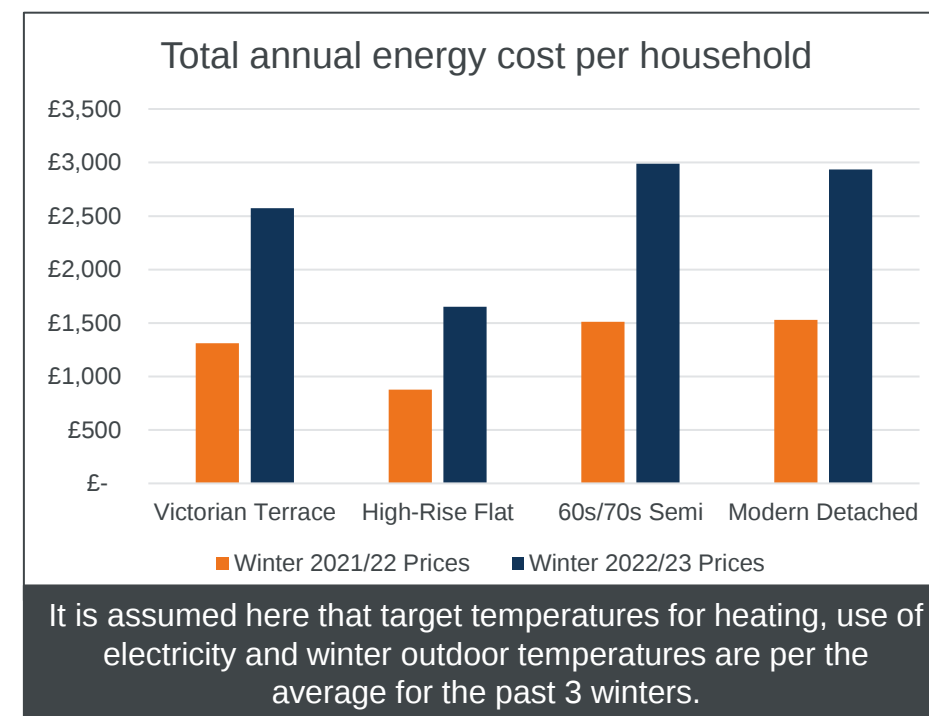


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Methodology (energy costs)

Prices per unit and consistency with projected price caps

Item	October 2021	Winter 2022/23
Electricity p/kWh (standing charge, p/day)	21 (25)	34 (46)
Gas p/kWh (standing charge, p/day)	4 (26)	10 (28)
Total cost ^[1]	£1,277	£2,500



[1] The price cap for October 2022 was announced by Ofgem on 26 August:

<https://www.ofgem.gov.uk/publications/ofgem-updates-price-cap-level-and-tightens-rules-suppliers>.



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Results

Discretionary Income (£'000s)	Young family	Young professionals	Flat-sharing graduates	Well-off retired couple	Low-income retired couple	Single low-income widow(er)
Winter 2021/22 prices	-0.6	5.7	9.5	23.7	5.0	-0.8
Winter 2022/23 prices	-0.8	5.1	10.0	22.2	4.5	-1.2
Change in discretionary income	-0.2	-0.6	+0.5	-1.5	-0.4	-0.4
(% change, +ve in 2021/22 only)		-11%	+5%	-7%	-9%	

- The change in discretionary income is not the full story for those with positive discretionary income in 2022/23.
- Discretionary **spending power** will have fallen further due to inflation in the price of lifestyle-related goods and services which would be purchased out of such discretionary income.
- Details of the spending breakdown for 2021/22 and 2022/23 are provided in an appendix to this deck.



Why might we expect a mortality shock?

- Low temperatures induce narrowing of the blood vessels, placing stress on the circulatory system and increasing the risk of **cardiovascular conditions**.^[1] Cold air also inflames lungs and inhibits circulation which increases the risk of **respiratory conditions**.^[1]
- A 1°C decrease in indoor temperature is associated with increases of 0.48mmHg and 0.45mmHg in systolic and diastolic blood pressure respectively.^[2] Several studies investigate the impact of blood pressure increase on cardiovascular mortality. They imply that a 1°C decrease in indoor temperature increases cardiovascular mortality by **1-3%**.^{[3] [4] [5]}
- A 1°C decrease in outdoor temperature is associated with an increase in respiratory disease mortality of **2.9%**.^[6] However, we would expect the impact of colder indoor temperatures to be greater than that of colder outdoor temperatures (our base scenario assumes a multiplier of 120% here).
- We weight these increased risks according to the proportion of cardiovascular- and respiratory-related deaths ordinarily seen in the winter (versus non-winter) months to obtain an overall relative risk.

References

[1] World Health Organization. "WHO Housing and Health Guidelines". [Online] 2018 [Cited 02 September 2022].

Available from: https://www.ncbi.nlm.nih.gov/books/NBK535293/pdf/Bookshelf_NBK535293.pdf.

[2] Zhao, H. et al., " 'My blood pressure is low today, do you have the heating on?' The association between indoor temperature and blood pressure". Journal of Hypertension [Online] 2019 [Cited 04 September 2022]; 37(3):504-512. Available from: <https://pubmed.ncbi.nlm.nih.gov/30134311/>.

[3] U.S. Department of Health and Human Services. "Prevention, Detection, Evaluation, and Treatment of High Blood Pressure". [Online] 2004 [Cited 04 September 2022]; Available from: https://www.ncbi.nlm.nih.gov/books/NBK9630/pdf/Bookshelf_NBK9630.pdf.

[4] Ward, A.M. et al. "Home measurements of blood pressure and cardiovascular disease: a systematic review and meta-analysis of prospective studies". Journal of Hypertension [Online] 2012 [Cited 04 September 2022]; 30 (3):449-456. Available from: <https://pubmed.ncbi.nlm.nih.gov/22241136/>.

[5] van den Hoogen, P.C.W. et al. "The Relation between Blood Pressure and Mortality due to Coronary Heart Disease among Men in Different Parts of the World". The New England Journal of Medicine [Online] 2000 [Cited 04 September 2022]; 342:1-8. Available from: <https://www.nejm.org/doi/full/10.1056/NEJM200001063420101>.

[6] Bunker, A. et al. "Effects of Air Temperature on Climate-Sensitive Mortality and Morbidity Outcomes in the Elderly; a Systematic Review and Meta-analysis of Epidemiological Evidence". Lancet [Online] 2016 [Cited 04 September 2022]; 6:258-268. Available from: [https://www.thelancet.com/article/S2352-3964\(16\)30073-1/fulltext](https://www.thelancet.com/article/S2352-3964(16)30073-1/fulltext).



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Decomposing mortality rates by cause

- To allow for the fact that certain causes of death are affected by ambient temperature to a different extent, three cause-of-death groups were chosen [for simplicity]:
 - **Circulatory** system disease deaths: ICD-10 codes I21-I22, I24, I250, I20, I25.1-I25.9 (ischaemic heart disease) and I60-I69 (cerebrovascular diseases)
 - **Respiratory** disease deaths: ICD-10 codes J09-J18 (influenza and pneumonia), J40-J47 (chronic lower respiratory diseases) and J20-J22 (bronchitis, acute bronchitis and other acute lower respiratory infection).
 - **Other** deaths
- Using ONS cause-of-death data^[1] and ONS mid-year population estimates^[2] for 2016-2018, approximate forces of mortality for each cause-of-death group and each band by age/sex were calculated.
- The use of forces of mortality rather than probabilities of death allows one to respect competition between causes-of-death, so we reduce the risk of overstating the impact of a stress to individual causes of death.

References

[1] Office for National Statistics, “21st Century Mortality dataset, England & Wales 2001-2018, licensed under the Open Government Licence

[2] Office for National Statistics, “Population estimates for the UK and constituent countries by sex and age; historical time series”. [Cited 04 September 2022]; Available from:

<https://www.ons.gov.uk/file?uri=/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/populationestimatesforukenglandandwalesscotlandandnorthernireland/mid2001tomid2019detailedtimeseries/ukpopulationestimates18382019.xlsx>

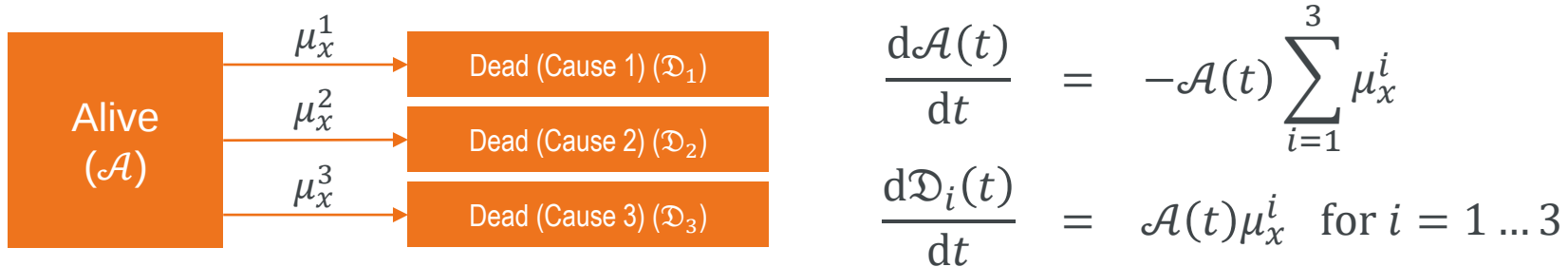


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Decomposing mortality rates by cause (formal version)

Let μ_x^1 to μ_x^3 be the forces of mortality for the three cause-of-death groups above, $E_{x,t}$ be an initial population estimate and $D_{x,t}^1$ to $D_{x,t}^3$ be the numbers of deaths observed due to the corresponding causes, in each case within the group by age and sex denoted x and in year t .

We can represent the continuous transitions from alive to dead (by cause) using a simple Markov model, the equations governing which are shown alongside the state space (with forces of transition labelled) below.



Solving these using the initial conditions $\mathcal{A}(0) = \sum_{t=1}^3 E_{x,t}$ and $\mathcal{D}_i(0) = 0$ for $i = 1 \dots 3$, and defining $E_x = \sum_{t=1}^3 E_{x,t}$ and $\mu_x = \sum_{i=1}^3 \mu_x^i$ we obtain solutions:

$$\mathcal{A}(t) = E_x e^{-t\mu_x} \quad \text{and} \quad \mathcal{D}_i(t) = E_x \frac{\mu_x^i}{\mu_x} (1 - e^{-t\mu_x}) \quad \text{for } i = 1 \dots 3$$

Setting $t = 1$ is consistent with estimating the number of deaths (due to each cause) expected over one year, so one would expect that:

$$\mathcal{D}_i(1) = E_x \frac{\mu_x^i}{\mu_x} (1 - e^{-\mu_x}) = \sum_{t=1}^3 D_{x,t}^i \quad \text{for } i = 1 \dots 3$$

This system of equations was solved for the implied values of μ_x^i using Excel's Solver add-in, using mid-year populations as a proxy for the initial populations, which are not published.



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Changes in household ambient temperatures

How far might individuals need to adjust their thermostats down due to squeezed discretionary incomes?

- The remaining negative discretionary income is assumed to result in a reduction in the use of energy by the householder, specifically by targeting a lower temperature in their home. The cost savings are calculated based on the same heat-loss calculations and heating degree days data at different target temperatures.
- Electricals and residents contribute to the heat of a home (c. 3.5°C) and our base costs were therefore calculated using heating degree days at 15.5°C , representing a home temperature of 19°C .
- Based on this approximation, in order to offset the negative discretionary income predicted this winter, a single pensioner subsisting on state pension / pension credit benefits only might need to **reduce the ambient temperature of their home by 1.5°C (London) / 2.5°C (Manchester) / 3.5°C (Edinburgh)**.
- This temperature difference has been used to assess the impact on mortality for this group, for which suitable relative risks have been assumed based on the aforementioned research. **We use a reduction of 2.5°C for our base scenario.**

Allowance for food and clothing banks – charitable sector support

- Where a household has an apparent negative discretionary income after inflating costs to Winter 2022/23 levels, it may be possible (through the use of food or clothing banks) to offset the need to reduce household temperature.
- However, it is feasible that the cost-of-living crisis will see the running costs of – and levels of donations to – such charitable organisations suffer as well.



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Resulting changes in mortality

Estimated increase in probabilities of death over 1 year (assuming rational behaviour)

- Reducing ambient temperatures by 2.5°C may increase mortality for males (females) by 0.04% (0.02%) for ages 65-74, 0.11% (0.08%) for ages 75-84, and 0.33% (0.28%) for ages 85 and over. Based on the number of low-income, single pensioner households, we have estimated 1,100 extra deaths over winter 2022/23 (500 males, 600 females).

Sources of uncertainty

- Financial impact per household – energy usage and inflation of prices for other goods/service are not fixed.
- Changes in income are also uncertain.
- Uncertainty around relative risks of mortality (by cause-of-death) due to living at a colder ambient temperature
- Uncertain homeowner behaviours, gatherings (e.g. community centres / warm spaces) and future government interventions
- Uncertain additional impact if temperatures drop to the point where hypothermia becomes a significant risk.
- Other groups (pensioner couples / young families) may also be affected.



What if people do not behave ‘rationally’?

Pensioners will not be able to assess what ‘affordable’ heating means

- This may mean households simply turn off heating altogether, exposing residents to larger temperature reductions.
- If this occurs, we may see more significant mortality impacts.

Users of prepayment meters may not be taking up all of the support available ^[1]

- One payment company claims it has only received half of the credit it expected to in October
- Such grants (vouchers) expire 90 days after the point of issue
- If vouchers are not claimed, vulnerable individuals may be forced to go without heating to a greater extent, again increasing the risk of adverse health outcomes.
- Default application of vouchers to electricity; two of the “big six” firms only allow them to be applied to electricity.

References

[1] MoneyMagpie. “Many Energy Support Scheme Vouchers Not Being Redeemed”. [Online] 2022 [Cited 15 November 2022];

Available from: <https://www.moneymagpie.com/make-money/many-energy-support-scheme-vouchers-not-being-redeemed>

[2] Money Saving Expert. “Smart prepay energy user? Many suppliers will let you use Government payments on gas AND electricity, but two still aren't – here's what each firm is doing”. [Online] 2022 [Cited 15 November 2022]

Available from: <https://www.moneysavingexpert.com/news/2022/11/smart-prepay-bill-support-transfer-gas-electricity-update/>



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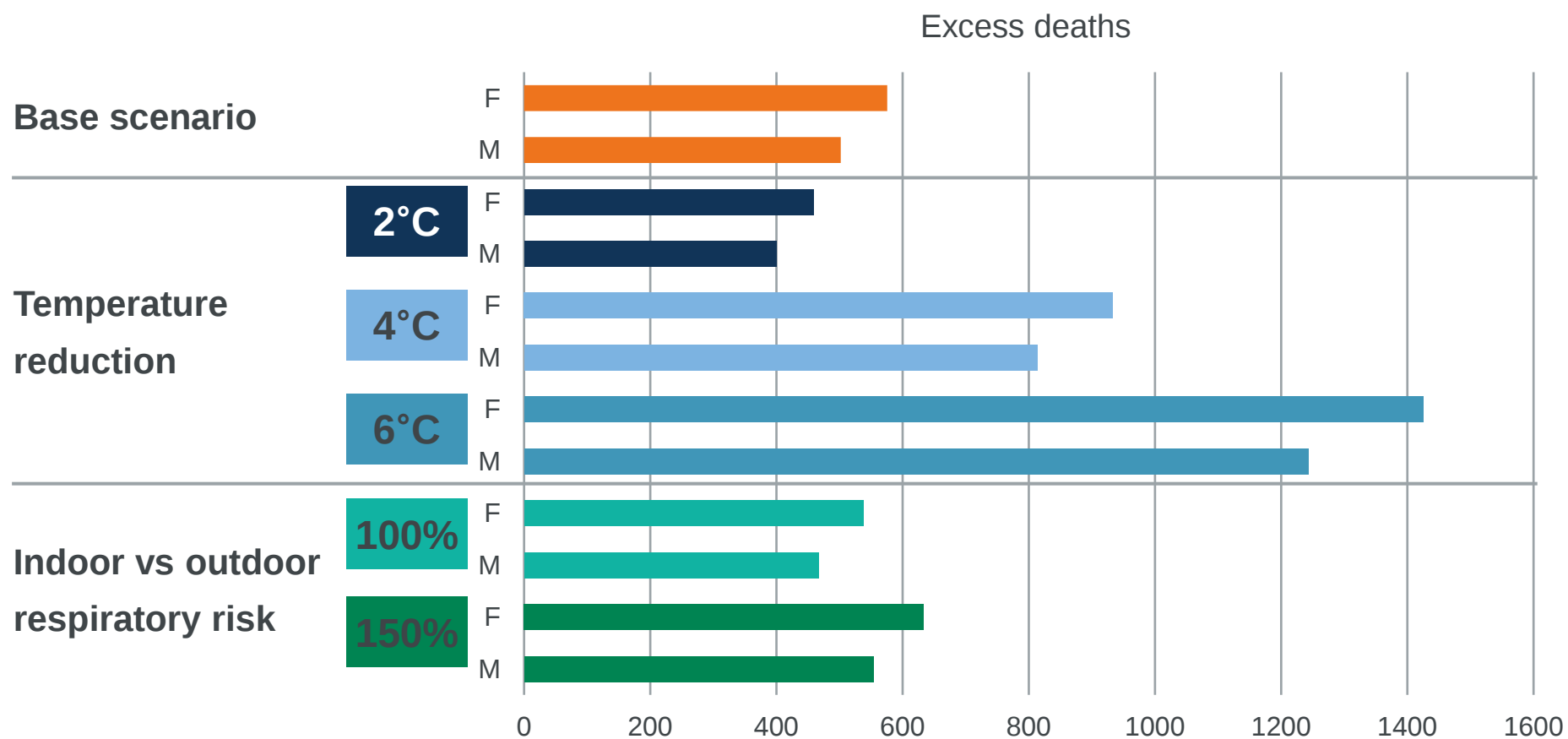
Impact on insurers and actuaries

Why should insurers care? After all, wouldn't deaths be amongst deprived (uninsured) groups?

- Annuity providers typically rely upon the CMI model to project mortality improvements. COVID-19 has meant that most firms are zero-weighting 2020-21 experience in their CMI model calibration. New experience will need to be used soon.
- Deaths in winter 2022/23 will affect the data which is used to calibrate the CMI model.
- Higher deaths in the lowest socioeconomic groups will push up total mortality, but improvements in annuitant mortality will likely be less badly affected by winter heating constraints.
- This would increase the basis risk between best-estimate projections using CMI_2022 and (more so) CMI_2023 and mortality improvements for a more affluent annuitant population.
- The IFoA notes, concerning its Royal Charter: “The IFoA’s policy and public affairs work seeks to inform and influence public policy, legislation and regulation to promote decisions and systems that serve the public interest.”
- Actuaries can inform and influence public policy by thinking through (in advance) the potential implications of those policies.



Sensitivity of excess deaths to temperature reduction



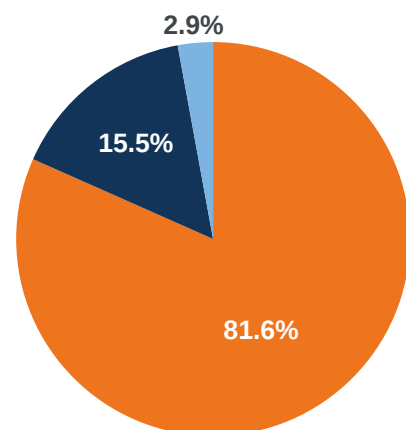
Assessing persistency impacts

Discretionary Income (£'000s)	Young professionals
Winter 2021/22 prices	5.7
Winter 2022/23 prices	5.1
Change in discretionary income	-0.6 (-11%)

A reduction in discretionary income could mean:

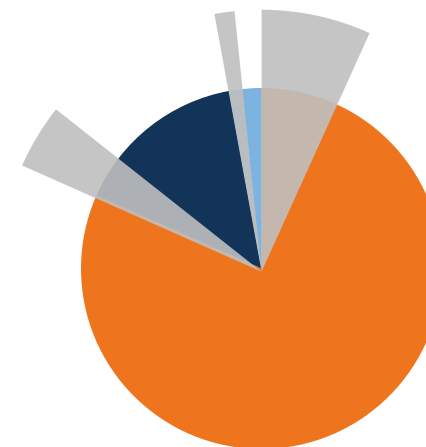
- A change in **lifestyle**
- A reduction in **capacity to save**
- A reduction in **ability to / willingness to buy financial products**

How might the young professionals' discretionary income have been spent during 2021/22?



■ Lifestyle ■ Insurance ■ Savings

How will they balance the decrease in discretionary spending across these three categories?



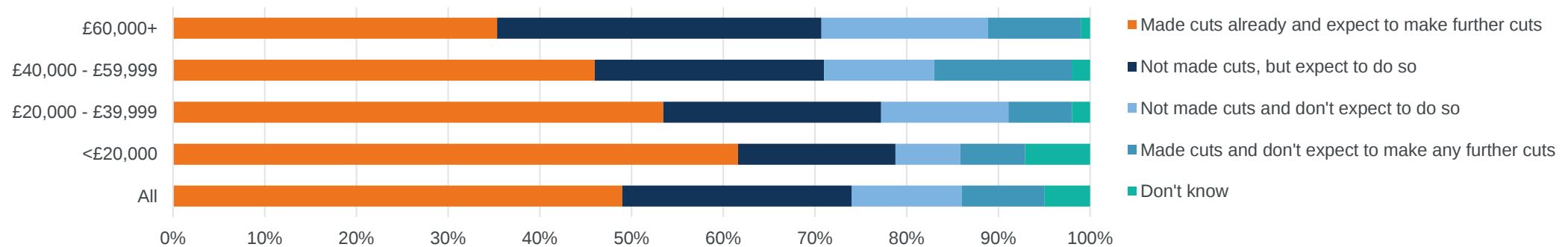
'Lifestyle' spending includes eating/drinking out, discretionary clothing, footwear and transport purchases, recreational or cultural goods/services, and holidays.



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Useful statistics (1)

- Consumers will have to determine how decrease in discretionary income is apportioned between lifestyle, insurance products, and saving.
- A YouGov poll^[1] conducted in August found that a greater proportion of poorer households have made (and expect to make further) cuts compared to more wealthy households.



- 2013 figures from the ABI show that the percentage of households holding insurance products increases with income decile. (e.g. Whole of Life: **10% of decile 1** households, **18% of decile 5** households and around **28% of decile 10** households).^[2]
- A 2015 German study found decreases in lapse rates for increased income – e.g. those with a net income of between €3k and €4k (~£2200 to £2900) per month were **36% less likely to lapse** than those earning up to €1500 (~£1100) per month [2015 prices].^{[3] [4]}

References

[1] YouGov (2022), "Cost of living crisis: one in four have had to cut essential spending". Available from: <https://yougov.co.uk/topics/consumer/articles-reports/2022/08/25/cost-living-crisis-one-four-have-had-cut-essential>

[2] ABI (2013), "Household spending on insurance tables". Available from: <https://www.abi.org.uk/globalassets/files/subject/public/stats/household-spending-on-insurance-tables.xlsx>.

[3] <https://www.exchangerates.org.uk/GBP-EUR-spot-exchange-rates-history-2015.html>

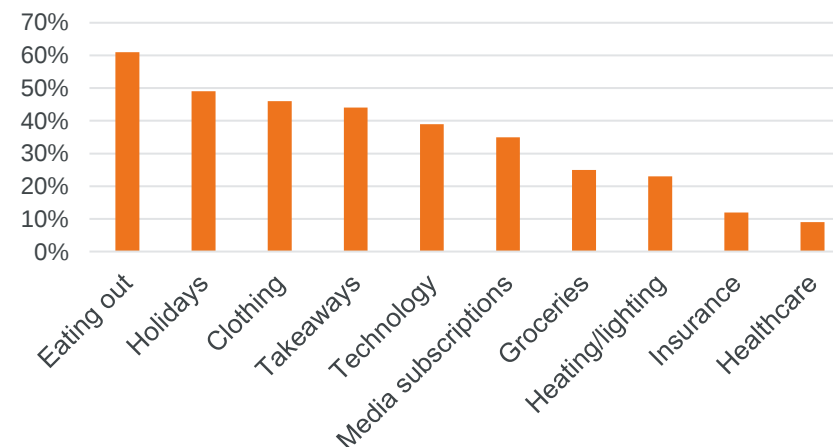
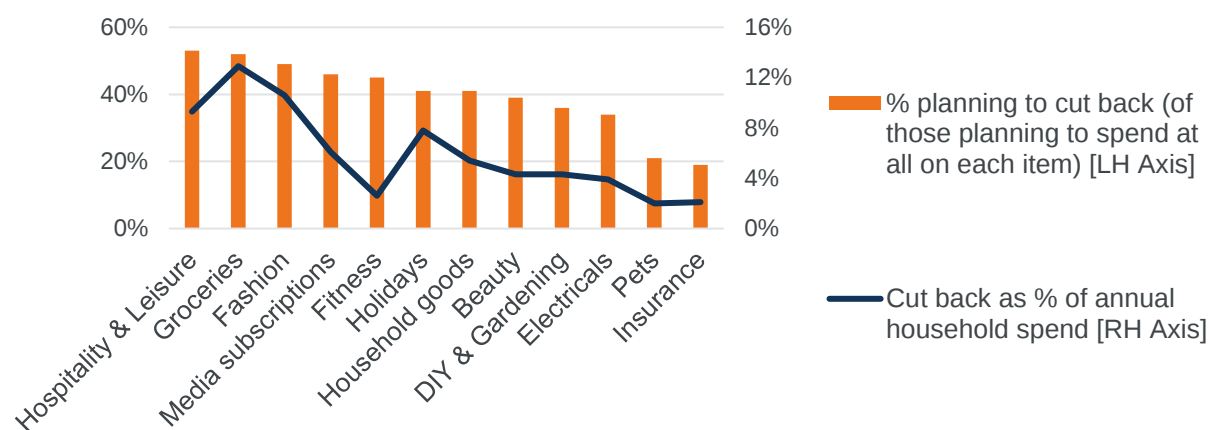
[4] Sirak, A.S. (2015), "Income and unemployment effects on life insurance lapse". Available from: https://www.wiwi.uni-frankfurt.de/fileadmin/user_upload/dateien_abteilungen/abt_fin/Dokumente/PDFs/Allgemeine_Dokumente/Inderst_Downloads/Neuere_Arbeiten_seit2015/SIRAK_-_Income_and_Unemployment_Effects_on_Life_Insurance_Lapse.pdf



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Useful statistics (2)

- An ABI report^[1] found that
 - 82% of customers agree that they would feel vulnerable without any insurance products (claimants are more likely than non-claimants to agree with this).
 - Proportions of consumers expressing a neutral view increases for the insurance products on which they are less likely to have made a claim (e.g. critical illness or life cover).
- In Summer 2022, Grant Thornton^[2] (left) and YouGov^[3] (right) found that a comparatively low proportion (versus other expenditure) of households planned to cut back on insurance.



References

[1] ABI, "The Price of Accuracy: Consumer Attitudes to Data and Insurance".

Available from: https://www.abi.org.uk/globalassets/files/publications/public/data/britain_thinks_consumer_data_insurance_report.pdf

[2] Grant Thornton (2022), "The Cut Back Economy: Assessing the impact of the cost-of-living crisis on the retail and consumer industry".

Available from: <https://view.ceros.com/grant-thornton/the-cut-back-economy/p/1>

[3] YouGov (2022), "Cost-of-living cutbacks: Where are the public tightening their belts?".

Available from: <https://business.yougov.com/content/43070-cost-living-cutbacks-where-are-public-tightening-t>



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Useful statistics (3)

- However, whilst the proportions relative to other areas of expenditure might be low, the intentions of 10-20% households to reduce spending on insurance represents a risk for providers.
- Indeed, research from the Chartered Insurance Institute has found that the cost of living crisis is **already leading to consumers changing their spending habits in relation to insurance**. One in five insurance professionals reported consumers **reducing the amount of cover** they purchase to reduce costs. A similar proportion stated that a growing number of policies are being allowed to **lapse**.^[1]
- When asked about expenditure, **47%** of insurance customers said it was at least somewhat likely that they would cut insurance spending. **10%** said that, if they were to cancel non-mandatory insurance, income protection would be one of the most likely to be cut.^[2]
- **23%** of people believe that the insurance industry has not done enough to help struggling customers (down from **26%** in 2021), whilst **26%** have a negative view of insurers.^[2]
- We may see falls in contributions to DC pension schemes as people seek to maximise their short-term income. We should not rule out the possibility of employees opting out of their employer-backed schemes.

References

[1] Cover magazine (2022), "Consumers reducing coverage and allowing policies to lapse: CII".

Available from: <https://www.covermagazine.co.uk/news/4051209/consumers-reducing-coverage-allowing-policies-lapse-cii>

[2] Guidewire (2022), "Are Insurers Moving with Changing Times and Tastes? The 2022 State of the UK Insurance Customer Attitudes Study".

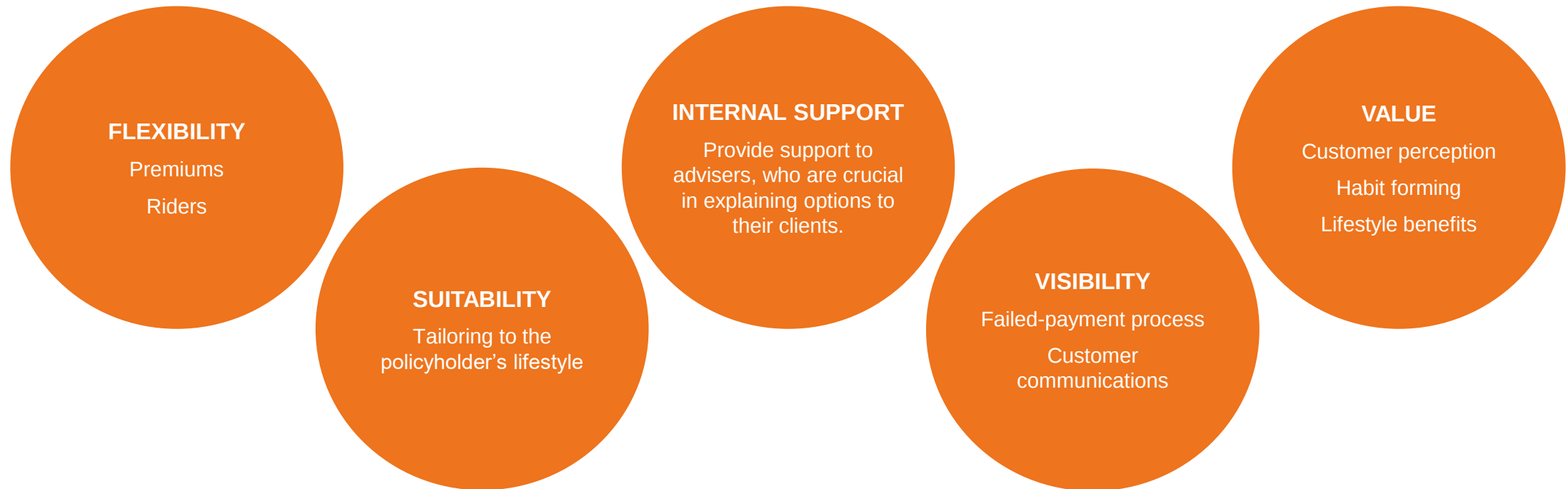
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What can insurers do to reduce the risk of lapse?

- The FCA has reminded firms of their “responsibility to treat affected customers fairly and consider what further support they can offer” in light of the cost of living crisis.^[1]



References

[1] Financial Times (2022), “Cost of living crisis could force consumers to cut back on insurance, FCA warns”. Available from: <https://www.ft.com/content/b4246b26-cef3-4522-8236-b00a633b62a2>



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Conclusions

- According to our modelling, the government support in relation to energy bills has mitigated a large portion of the immediate risk this winter – it significantly reduces the squeeze on discretionary income.
- However, households are still likely to see decreases in their discretionary income, and a mortality shock affecting vulnerable groups remains plausible, more so if allowing for irrational behaviour.
- The insurance industry is already experiencing lapses and, whilst there is evidence to suggest that insurance expenditure may be more protected than lifestyle spending, further lapses cannot be ruled out.
- Purchase and lapse rates may be sensitive to inflation and the level of support provided by the government. Even after the reduction in discretionary income for households is taken into account, the subsequent effects of inflation on affordability must be taken into account.
- Should there be a recession, there is a need to consider how long-term lapse rates might further increase in the event of greater unemployment.
- Providers can take action now to mitigate the risk of further lapses.



Questions

Comments

Expressions of individual views by members of the Institute and Faculty of Actuaries and its staff are encouraged.

The views expressed in this presentation are those of the presenter.



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Demographic Impacts for Insurers of the Cost-of-Living Crisis

Appendix A: Discretionary
income calculations

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Annual discretionary income at winter 2021/22 prices

Income / Expenditure (£'000s)	Young family	Young professionals	Flat-sharing graduates	Well-off retired couple	Low-income retired couple	Single low-income widow(er)
Gross income (including salary, pension and benefits)	26.4	63.1	25.0	40.3	23.7	16.8
Income net of tax / NI	23.7	51.2	20.7	37.3	23.7	16.8
Housing costs (rent / mortgage / repairs / buildings insurance for mortgagees)	10.2	13.9	5.6	2.2	9.0	6.0
Council tax, Water, Telecoms, TV	2.6	3.2	1.1	3.2	2.1	1.9
Energy bills	0.9	1.5	0.3	1.5	1.3	1.3
Consumables (food, clothing, toiletries, cleaning products, sanitary products)	8.4	6.9	2.1	3.6	3.4	1.8
Childcare or domiciliary care costs	0.0	13.7	0.0	0.8	1.0	6.4
Public transport or car costs	1.7	3.4	1.1	2.3	1.7	0.0
Student loan, credit card interest and other	0.4	0.5	0.0	0.0	0.2	0.1
Total unavoidable expenditure	24.2	45.5	11.2	13.6	18.8	17.6
Discretionary income (£'000s)	-0.6	5.7	9.5	23.7	5.0	-0.8



Annual discretionary income at winter 2022/23 prices

Income / Expenditure (£'000s)	Young family	Young professionals	Flat-sharing graduates	Well-off retired couple	Low-income retired couple	Single low-income widow(er)
Gross income (including salary, pension and benefits)	28.6	67.3	26.7	41.5	25.7	19.1
Income net of tax / NI	25.7	54.5	22.1	38.4	25.7	19.1
Housing costs (rent / mortgage / repairs / buildings insurance for mortgagees)	10.6	14.1	5.8	2.5	9.4	6.3
Council tax, Water, Telecoms, TV	2.7	3.3	1.1	3.3	2.1	2.0
Energy bills	1.7	3.0	0.6	2.9	2.6	2.6
Consumables (food, clothing, toiletries, cleaning products, sanitary products)	9.5	7.8	2.3	4.1	3.9	2.1
Childcare or domiciliary care costs	0.0	14.0	0.0	0.8	1.1	7.3
Public transport or car costs	1.8	3.8	1.2	2.6	1.9	0.0
Student loan, credit card interest and other	0.5	0.8	0.0	0.0	0.2	0.1
Total unavoidable expenditure	26.7	49.4	12.1	16.3	21.2	20.3
Discretionary income (£'000s)	-0.8	5.1	10.0	22.2	4.5	-1.2

These figures have not been updated for the effects of the Autumn Statement on taxes and the future government support for energy bills.



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