Assessing the health benefits of Lifetime Homes

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Assessing the health benefits of Lifetime Homes

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Executive summary

This report uses existing data to provide an assessment of the health benefits associated with new homes built to current building regulations, and in particular built to the Lifetime Homes Standard. The English House Condition Survey and the Housing Health and Safety Rating Scheme are used in a novel way to assess these risks.

The data are presented in a spreadsheet-based model allowing the user to change a number of key parameters. These include:

- the health costs associated with the different levels of harm, relating either to direct NHS costs or to societal costs
- the type of building
- the number of bedrooms in the building
- the ability to consider the ageing population in the UK and how this might affect risk in the future.

In addition to these variables, a number of other factors are estimated to try and provide a cost model. These include the estimated savings factors associated with each hazard, when looking at new buildings. With further research, these factors could be refined to provide more accurate estimates.

The total cost of building-related hazards is calculated to be approximately £2.48bn per annum in direct health costs or £40bn as a potential cost to society.

Homes built to current building regulations offer significant health advantages over the average stock, and may provide direct NHS health cost savings per dwelling in excess of £4,000 during a 60-year expected lifespan. Building to the Lifetime Homes Standard could provide an extra £194 of savings over 60 years, or £700 if the potential adaptations to bathrooms and access to a bedroom/bathroom were made.

When considering the potential cost to society, the savings are likely to be much higher. Using the model, it is suggested that a home built to current building regulations could save £83,000 during a 60-year lifespan, compared to the average for the current stock. Building to the Lifetime Homes Standard could provide a further £1,600 in savings, or £8,600 if the potential adaptations were made.

1 Introduction

1.1 Overview

Communities and Local Government commissioned the Building Research Establishment (BRE) to assess the health benefits of the Lifetime Homes Standard. The Department launched *Lifetime Homes, Lifetime Neighbourhoods: a National Strategy for Housing in an Ageing Society* in 2008 and this project aimed to use existing data to provide an assessment of the health benefits associated with the standard.

1.2 The Lifetime Homes Standard

The Joseph Rowntree Foundation was responsible for the concept of the Lifetime Home in the early 1990s. Since then the concept has developed into a standard based on 16 design features that make a dwelling adaptable. The standard can adapt to the ageing of occupants and circumstances that lead to reduced mobility for occupants.

The 16 design features of the Lifetime Homes Standard are:

1. Car Parking Width
2. Access From Car Parking
3. Approach Gradients
4. Entrances
5. Communal Stairs & Lifts
6. Doorways & Hallways
7. Wheelchair Accessibility
8. Living Room
9. Entrance Level Bedspace
10. Entrance Level WC & Shower Drainage
11. Bathroom & WC Walls
12. Stair Lift/Through-Floor Lift
13. Tracking Hoist Route
14. Bathroom Layout
15. Window Specification
16. Controls, Fixtures & Fittings

1.3 The purpose of the study

The overall aim of this project is to provide a clear analysis of the personal and financial benefits of building to the Lifetime Homes Standard.

The specific objectives of this project are:

- To identify direct health benefits of living in Lifetime Homes.
- To identify whether there are indirect health benefits of building to the Lifetime Homes Standard.

- To provide a cost model for consideration which creates a value base, and long-term projections for the return on investment of building to the Lifetime Homes Standard.

- To provide a commentary on whether making new homes better suited to an ageing population can provide much broader societal benefit.

1.4 What is health?

This report will focus on housing and health, and for the purpose of this project direct health is associated with the reduction of injury caused by hazards in dwellings. Indirect health benefits are considered to be those that promote psychological wellbeing and activity for dwelling occupants.

1.5 Direct health benefits

The model is based on assumptions that the Housing Health and Safety Rating System (HHSRS), an indicator of the level of risk in dwellings, can be linked to the 16 Lifetime Homes criteria.

The HHSRS is a means of identifying defects in dwellings and of evaluating the potential effect of any defects on the health and safety of occupants, visitors, neighbours and passers-by. The system provides a means of rating the seriousness of any hazard, so that it is possible to differentiate between minor hazards and those where there is an imminent threat of major harm or even death. The emphasis is placed on the potential effect of any defects on the health and safety of occupants and visitors, particularly if they are vulnerable people. Table 1 shows all 29 hazards.

Table 1: The 29 hazards covered by HHSRS

Physiological Requirements	**Psychological Requirements**	**Protection Against Accidents**
Damp and mould growth etc	Crowding and space	Falls associated with baths etc
Excessive cold	Entry by intruders	Falling on level surfaces
Excessive heat	Lighting	Falling on stairs etc
Asbestos etc	Noise	Falling between levels
Biocides	**Protection Against Infection**	Electrical hazards
CO and fuel combustion productions	Domestic hygiene, pests and refuse	Fire
Lead	Food safety	Flames, hot surfaces etc
Radiation	Personal hygiene, sanitation and drainage	Collision and entrapment
Un-combusted fuel gas	Water supply	Explosions
Volatile organic compounds		Position and operability of amenities etc
		Structural collapse and falling elements

The current study accepts that the Lifetime Homes Standard is likely to have an impact on some of the HHSRS hazards and Table 2 indicates which criteria have a direct health impact by reducing the likelihood of injuries.

Table 2: The potential direct health benefits

Lifetime Homes criteria		Direct health benefits (reduction in accidents)						
		Access issue only	**Falls on stairs**	**Falls on the level**	**Falls associated with baths**	**Fear of crime**	**Personal hygiene, sanitation, drainage**	**Ergonomics**
1	Car Parking Width	✓						
2	Access From Car Parking		External steps	✓				
3	Approach Gradients		External steps	✓				
4	Entrances			✓		✓ (marginal)		
5	Communal Stairs & Lifts		(communal)					
6	Doorways & Hallways	✓						
7	Wheelchair Accessibility	✓						
8	Living Room		✓					
9	Entrance Level Bedspace		✓					
10	Entrance Level WC & Shower Drainage		✓				✓	
11	Bathroom & WC Walls			✓	✓			
12	Stair Lift/Through-Floor Lift		✓					
13	Tracking Hoist Route						✓	
14	Bathroom Layout	✓						
15	Window Specification	✓						
16	Controls, Fixtures & Fittings							✓

1.5.1 Indirect health benefits

The Lifetime Homes Standard increases accessibility and improves the potential for adaptations in dwellings for occupants that may be elderly; and therefore have restricted mobility, temporarily incapacitated or disabled. The indirect health benefits for occupants therefore focus on the promotion of psychological wellbeing and activity. Ensuring that occupants can maintain a good quality of life means that the dwelling itself must be functional for all occupants and that no additional stress and anxiety should be caused to any household member who is elderly, or who has become temporarily incapacitated or disabled.

Consider a dwelling built to the Lifetime Homes Standard; the dwelling alone offers occupants the potential to easily adapt it to meet their needs but it also helps to determine the potential occupants of that dwelling and therefore the community that will be formed in the area. Potentially, anyone from any part of society could choose to live in such a dwelling, whether the occupants are elderly, or a household member is disabled or if there are young children in the household. This could help to create stable and mixed communities and lead to greater social inclusion. The Audit Commission was keen for local authorities to 'tackle social isolation and support independent living' in the elderly population.[1] Some indirect health benefits of this could include a reduction in fear of crime as the vulnerable sectors of the community such as the elderly and disabled are more integrated into the community. Criteria three of the Lifetime Homes Standard refers to 'Approach Gradients', stating that the approach to all entrances should be level or gently sloping. This would reduce the problem of elderly and disabled people needing a ramped entrance to access their dwelling. Previous research has found that this group feels that ramps were 'highly visible and unwelcome indicators of vulnerability and disability'.[2] Removing the need for ramps and therefore making the vulnerable less visible may reduce the fear of crime in this group. A recent study noted clear links between the fear of crime and health in participants aged between 50 and 75; notably individuals with high fear of crime were twice as likely to suffer from depression.[3] The fear of crime may also restrict the level of participation in physical and social activities which can have a negative impact on health.

Many of the design criteria associated with Lifetime Homes seek to maximise the level of independence for occupants within the dwelling and the immediate external area. The health benefits of this will vary depending on the type of occupants. For the elderly, the ability to return home after hospitalisation would help to increase their level of independence and quality of life. Cobbold notes the difficulties faced by some that are discharged from hospital to dwellings that do not fit their needs.[4] A systematic review and meta-analysis noted the importance of complex interventions including community-based care after hospital discharge for this group, suggesting that some form of intervention can help elderly people to continue living at home as an alternative to admittance into a nursing home. Merely being at home was one factor that promoted independence but other studies reviewed focused on empowerment, autonomy, independent decision-making, and improved self-esteem and self-confidence as an outcome of intervention.

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[1] Audit Commission (2008) *Don't stop me now: Preparing for an ageing population.* London: Audit Commission.

[2] Joseph Rowntree Foundation, Housing Research 174 (April 1996*) Incorporating Lifetime Homes standards into modernisation programmes.* York: JRF.

[3] Stafford, M., Chandola, T. & Marmot, M.G. (2007) Association between fear of crime and mental health and physical functioning. *American Journal of Public Health,* 97(11), 2076-2081.

[4] Cobbold, C. (1997) *Cost-benefit analysis of Lifetime Homes.* York: JRF.

One of the studies also pointed to the importance of an individual being able to go out alone as an important marker of independence.[5] Living in a Lifetime Home that can be easily adapted might also aid the transition from hospital to home for elderly people and help to maintain their quality of life. Table 3 shows the potential indirect health benefits from the Lifetime Homes Standard.

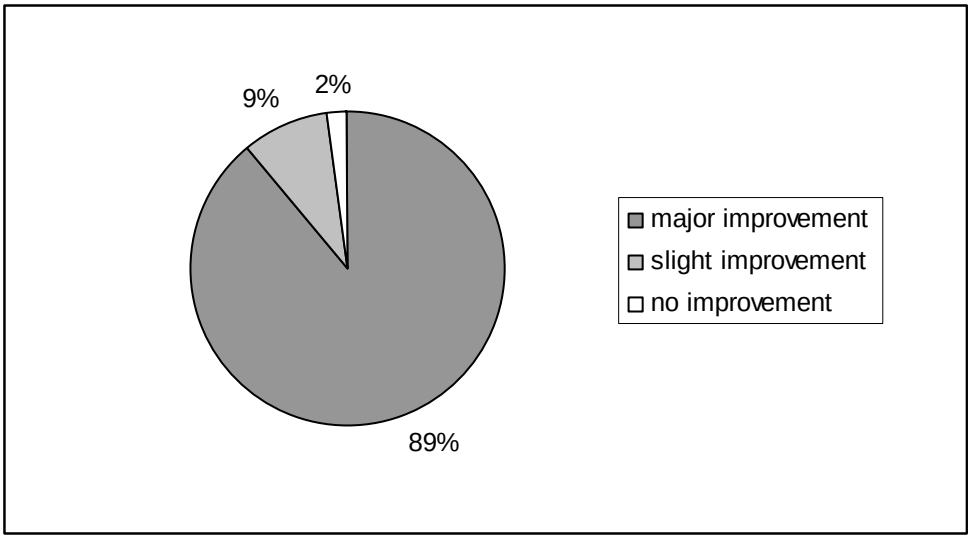
Table 3: The potential indirect health benefits

Lifetime Homes criteria		Indirect health benefits (Promotion of psychological wellbeing and activity)					
		Increase independence	**Reduce need for external assistance**	**Reduce stress-related illnesses**	**Reduce fear of crime**	**Improve psychological wellbeing**	**Create stable communities**
1	Car Parking Width	✓					✓
2	Access From Car Parking	✓					✓
3	Approach Gradients	✓			✓		✓
4	Entrances	✓			✓		✓
5	Communal Stairs & Lifts	✓	✓				✓
6	Doorways & Hallways	✓					✓
7	Wheelchair Accessibility	✓	✓	✓		✓	✓
8	Living Room						✓
9	Entrance Level Bedspace	✓	✓	✓			✓
10	Entrance Level WC & Shower Drainage		✓	✓		✓	✓
11	Bathroom & WC Walls						✓
12	Stair Lift/Through-Floor Lift	✓					✓
13	Tracking Hoist Route						✓
14	Bathroom Layout	✓					✓
15	Window Specification						✓
16	Controls, Fixtures & Fittings	✓					✓

[5] Beswick, A.D. et al. (2008) Complex interventions to improve physical function and maintain independent living in elderly people: a systematic review and meta-analysis. *Lancet*. March, 371(9614), 725–735.

People with disabilities would also benefit from Lifetime Homes that are adapted to meet their needs as they are likely to suffer from social exclusion; for example, if they do not have the means to bathe they are likely to withdraw from social interaction. In 2005, ODPM noted the importance of adaptations for this group in 'reducing the social and financial costs of depression'. Figure 1 shows that the majority of people who had adaptations to their home reported an improved quality of life.[6]

Figure 1: Quality of life, ODPM, 2005



Ultimately, the indirect health benefits associated with the Lifetime Homes Standard focus on improving the quality of life of occupants. The Partial Regulatory Impact Assessment (PRIA) – Lifetime Homes[7] suggests that implementing the Lifetime Homes Standard would have the following impacts on health and costs attributed to health:

- reduce, or delay the need for people to move to residential care
- reduce the demand for temporary residential care
- ensure that people are discharged from hospital into suitable accommodation instead of remaining in hospital in much needed acute hospital beds because their accommodation is unsuitable
- reduce the need for home care for disabled people.

[6] Office of the Deputy Prime Minister (2005) *Reviewing the Disabled Facilities Grant Programme*. London: ODPM.

[7] Communities and Local Government (2007) *The future of the Code for Sustainable Homes – Making a rating mandatory*. London: Communities and Local Government.

2 Description of the project

The project has been conducted in three stages.

Initial consideration of the Lifetime Homes Standard was made to determine the potential direct and indirect health benefits associated with its design criteria. Emphasis on the direct costs was placed on established hazards detailed in the HHSRS. While the model cannot address the indirect health benefits, an in-depth consideration of these benefits has been included through a literature review.

On the back of Table 2 an Excel spreadsheet model was created, allowing homes to be compared for their potential benefit when compared to average existing housing in England. This model considers the option to change severity pricing, dwelling type, number of bedrooms, risk contribution of hazards and the proportion of older occupants in the population.

This report constitutes the final part of the project, providing a summary of the direct and indirect health benefits assessed by the model and an overview of the broad societal benefits of Lifetime Homes, as well as describing in some detail how the model works and what assumptions need to be made.

3 The model

3.1 Assumptions in the model

3.1.1 Housing occupants

The first English House Condition Survey (EHCS) was carried out in 1967 to inform the government about the current condition of the housing stock and to benchmark its housing renewal policies. The survey was repeated in 1971 and every five years after that until 2001. Since 2001, the EHCS has consisted of four main component surveys:

1. Physical inspection of the dwelling by a trained surveyor.

2. Interview with the household.

3. Assessment of market value by a trained valuer based on details and photographs.

4. Interview with the landlord where homes are privately rented.

These are used to form a complete picture of the sampled dwelling and its occupants. The sample is a stratified random sample of all dwellings in England. In 2001 the core sample (where we had complete physical and interview surveys) was around 17,000. From 2002, the survey has consistently achieved just over 8,000 core responses per year.

The EHCS data for 2005-2007 were used to determine the breakdown of different households by the type of people living in them, as in Table 4.

Table 4: Household type profile for English housing stock

Profile of all dwellings							
Household type	Household includes anyone with long-term illness or disability = mobility problem						**Assumed years in Lifetime Home**
	Yes		**No**		**Total**		
	Number	**%**	**Number**	**%**	**Number**	**%**	
Couple with no child(ren) oldest person in household over sixty	925,969	4.3	2,756,729	12.9	3,682,698	17.2	10
Couple with no child(ren) oldest person in household under sixty	321,773	1.5	2,521,514	11.8	2,843,287	13.3	8
Couple with child(ren)	472,205	2.2	5,813,867	27.2	6,286,072	29.4	18
Lone parent with child(ren)	222,402	1.0	1,860,012	8.7	2,082,414	9.7	6
Two or more families	45,289	0.2	236,522	1.1	281,811	1.3	1
Lone person sharing with other lone persons	63,522	0.3	561,076	2.6	624,598	2.9	2
Single occupier over sixty	1,092,999	5.1	2,073,662	9.7	3,166,661	14.8	9
Single occupier under sixty	338,740	1.6	2,073,796	9.7	2,412,536	11.3	7
Total	3,482,899	16.3	17,897,178	83.7	21,380,077	100.0	60

Nearly 30 per cent of housing is occupied by couples with children, and another 30 per cent by couples without children. Singles occupy another 25 per cent of homes. We can also determine what proportion, either singles or couples, have an occupant that is over 60, which is about 32 per cent. These proportions can be used to estimate the number of years each particular household type will occupy an average house. However, it is unlikely that any particular house will ever be occupied by all of these different groups. Assuming that the average Lifetime Home will be occupied for 60 years, we can therefore estimate the number of years each household would live in this average house.

The EHCS data can also give us an estimate of the proportion of these homes that house someone with a form of long-term illness or disability, which we have equated to a mobility problem. About 16 per cent of households have an occupier that is in this category. It is assumed, for the model, that homes occupied by people with a mobility problem would require the home to be adapted.

Similar breakdowns are shown in Appendix A, for different housing types and for homes with different numbers of bedrooms.

3.1.2 Likelihood of harm

The HHSRS system allows each of the hazards, shown in Table 1, to be compared for relative risk. These are shown in Table 5.

Table 5: Average risk scores by HHSRS hazard

Hazard	Average risk score	Average likelihood of harm	Class 1	Class 2	Class 3	Class 4
1. Damp and mould growth	10.5	464	0.0%	1.0%	10.0%	89.0%
2. Excess cold	925.8	380	34.0%	6.0%	18.0%	42.0%
3. Excess heat	0.4	900,000	31.0%	8.0%	25.0%	36.0%
4. Asbestos (and MMF)	0.1	3,300,000	19.0%	1.0%	0.0%	80.0%
5. Biocides	0.0	513,333	0.0%	0.0%	9.1%	90.9%
6. Carbon monoxide and fuel combustion	1.3	1,250	0.0%	0.0%	2.0%	98.0%
7. Lead	0.1	58,400	0.0%	1.0%	9.0%	90.0%
8. Radiation	91.0	10,000	90.0%	10.0%	0.0%	0.0%
9. Uncombusted fuel gas	0.3	83,784	1.2%	2.3%	41.4%	55.1%
10. Volatile Organic Compounds	0.4	5,580	0.1%	0.1%	1.0%	98.8%
11. Crowding and Space	19.4	8,000	14.0%	7.0%	26.0%	53.0%
12. Entry by intruders	122.3	40	0.0%	1.0%	10.0%	89.0%
13. Lighting	0.1	50,825	0.1%	0.9%	9.0%	90.0%
14. Noise Protection	5.1	900	0.0%	1.0%	9.0%	90.0%
15. Domestic hygiene, pests and refuse	0.2	5,585	0.0%	0.1%	1.0%	98.9%
16. Food safety	1.9	4,960	0.0%	2.0%	22.0%	76.0%
17. Personal hygiene, sanitation and drainage	1.2	7,750	0.0%	2.0%	22.0%	76.0%
18. Water supply for domestic purpose	0.0	1,423,649	0.0%	1.0%	9.0%	90.0%
19. Falls associated with baths	6.6	4,026	1.9%	3.6%	10.3%	84.2%
20. Falling on level surfaces	182.1	135	0.2%	13.8%	27.3%	58.7%
21. Falling on Stairs etc.	134.3	245	1.9%	6.7%	21.7%	69.7%
22. Falling between levels	4.5	1,693	0.2%	1.8%	9.9%	88.1%
23. Electrical hazards	1.7	16,869	0.6%	8.2%	49.2%	42.0%
24. Fire	17.2	4,760	7.0%	2.6%	29.1%	61.3%
25. Flames, hot surfaces	40.9	182	0.0%	1.3%	17.8%	80.9%
26. Collision and entrapment	58.7	39	0.0%	0.1%	4.1%	95.9%
27. Explosions	0.7	156,528	11.2%	0.0%	5.4%	83.4%
28. Ergonomics (Position and operability of	0.6	12,925	0.0%	1.7%	16.9%	81.4%
29. Structural collapse and failing elements	0.6	11,170	0.3%	0.1%	8.2%	91.4%

The HHSRS scoring procedure uses a formula to generate a numerical risk score for each of the hazards. The higher the score, the greater the severity of the hazard. Potential hazards are assessed in relation to the most vulnerable class of person who might typically occupy or visit the dwelling; for example, for falls on stairs the vulnerable

group is the elderly (60+ years), for falls on the level it is also the elderly, and for falls between levels it is children under five years old.

The hazard score formula requires two values:

- the likelihood of the occurrence which could result in harm to a vulnerable person over the following 12 months (the likelihood is to be given as a ratio – e.g. 1 in 100, 1 in 500, etc)

- the likely health outcomes or harms which would result from the occurrence.

The guidance documents associated with HHSRS provide data on the average likelihood of harm and the severity of the injuries associated with that hazard. Take falls on stairs as an example. On average, the fall results in a 21.7 per cent chance of serious strain or sprain injuries, but there is also a 6.7 per cent chance of a more serious fracture and a 2 per cent chance of death. The remaining 69.6 per cent of injuries are likely to be something less serious. The average likelihood of an injury occurring is 1 in 245. The four classes of harms and associated weightings are listed in Table 6.

Table 6: Classes of harms and weightings used in the HHSRS

Class	Examples	Weightings
Class 1	Death, permanent paralysis below the neck, malignant lung tumour, regular severe pneumonia, permanent loss of consciousness, and 80% burn injuries.	10,000
Class 2	Chronic confusion, mild strokes, regular severe fever, loss of a hand or foot, serious fractures, very serious burns and loss of consciousness for days.	1,000
Class 3	Chronic severe stress, mild heart attack, regular and persistent dermatitis, malignant but treatable skin cancer, loss of a finger, fractured skull, severe concussion, serious puncture wounds to head or body, severe burns to hands, serious strain or sprain injuries and regular and severe migraine.	300
Class 4	Occasional severe discomfort, chronic or regular skin irritation, benign tumours, occasional mild pneumonia, a broken finger, sprained hip, slight concussion, moderate cuts to face or body, severe bruising to body, 10% burns and regular serious coughs or colds.	10

The risk score can be generated for each hazard as illustrated below:

Class of harm weighting			Likelihood 1 in		Spread of harm (%)		
1	10,000	÷	245	X	1.9	=	77.5
2	1,000	÷	245	X	6.7	=	27.3
3	300	÷	245	X	21.7	=	26.6
4	10	÷	245	X	69.7	=	2.8
					Hazard score	=	134.3

Four of the hazards: falls on stairs, falls on level surfaces, entry by intruders and excessive cold, have average risk scores over 100; radiation is also quite high at 91 but this is very area dependent. The rows with tan colouring in Table 5 are the hazards likely to be mitigated through Lifetime Homes designs, and the rows in yellow are where hazards are calculated or measured under the EHCS.

3.1.3 Associated costs

Since the severity of the likely outcomes is known, it is possible to assign a direct health cost to each of the class of harms. The cost depends on the type of treatment provided, and the care required once the person leaves hospital. There is a considerable amount of data provided by the NHS (NHS website) on the costs of a number of different procedures, including visits to a GP and to Accident and Emergency (A&E) (PSSRU, 2004), and the costs of dressings, prescriptions (British National Formulary (BNF) website) as well as hospital treatments. The type of injury or illness was refined to follow the information provided by the NHS, using BRE expert opinion, and expert medical advice.

It is recognised that the costs provided by the NHS will vary across the country because different Primary Care Trusts have different unit costs. Often these differences can be significant, for example, the difference between the upper or lower quartile unit costs and the mean can be greater than 50 per cent. For this reason, these costs should be taken as indicative, rather than exact. Another cause for caution in using these costs is that the source of some of the data is a few years old and may therefore not reflect current or future values. However, because the likely error in using data that is not up to date is less than the variation by area, these values are accepted at face value rather than adjusting for inflation. It is important to realise that some costs would be a one-off charge, such as a simple visit to A&E, but others would have long-term costs, such as any incident causing the person to become quadriplegic. These long-term costs are more likely to arise as a consequence of class 1 or 2 harms.

The range of costs for the outcomes associated with different hazards and class of severities is shown in Table 7. It is clear that there are wide ranges in the costs between different hazards for the same class of severity. Much of the difference for classes 1 and 2 is due to the high cost of care that some people require; using a weekly rate of £433 for residential and nursing care and intensive home care can easily add many thousands of pounds to the cost, depending on the duration of care required. Because the actual outcome chosen for each hazard/class of harm was typical, but somewhat arbitrary, there is a concern that another outcome which would have been equally valid for that hazard/class of harm combination would have a different cost. For this reason a single value for each class of harm is chosen that represents a reasonable value based on the data collected for all hazards. This value is not arrived at mathematically owing to the reasons outlined previously, but is a figure that is representative and easy to use.

Table 7: Estimate of costs to the NHS of typical outcomes for each hazard, and representative costs for each class of harm (£)

Hazard	Class 1	Class 2	Class 3	Class 4
Damp and mould growth	-	1,998	1,120	180
Excessive cold	19,851	22,295*	519	84
Radon (radiation)	13,247	13,247*	-	-
Falls on the level	59,246**	25,424*	745	67
Falls on stairs	59,246**	25,424*	745	67
Falls between levels	59,246**	6,464*	1,693	67
Fire	11,754*	7,878*	2,188	107
Hot surfaces	-	4,652	1,234	107
Collision and entrapment	-	3,439	1,536	67
Representative cost	**50,000**	**20,000**	**1,500**	**100**

*Costs after the first year are likely to occur, as a consequence of the initial illness/incident.
**Costs after the first year will occur.

Since these figures are likely to be only approximate, and only relate to one of many possible outcomes for each hazard/severity, we have chosen to adopt a robust approach by taking the same typical values for each severity across all hazards.

Alternative costs could be used. For example, the HM Treasury document, *Managing risks to the public: appraisal guidance*, recommends that the most appropriate willingness to pay values should be used as benchmarks. One well-established example is derived from the Department for Transport's Value of a statistical life (VOSL) data. Values for fatal, serious and slight injuries are given which could relate to class 1 through class 3 severities of harm, see Table 8.

Table 8: Average value of prevention per casualty by severity and element of cost

2002 data	(£) at June 2002 prices			
Injury severity	Loss output	Medical and ambulance	Human costs	TOTAL
Fatal	429,670	740	819,490	1,249,890
Serious	16,540	10,030	113,870	140,450
Slight	1,750	740	8,340	10,830
Average, all casualties	8,360	1,850	30,080	40,290

A value for class 4 harms can be estimated to be no more than 10 per cent of class 3 harms, and hence a value of £1,000 has been used.

Both of these two methods can be used to estimate the cost associated with these hazards for an average house in any one year. Using the direct cost methods based on research on the cost of poor housing, the average house will have an average direct cost to the NHS of £113 per year, £47 of which is associated with the hazards linked to the Lifetime Homes Standard, see Table 9. When using the Transport Research Laboratory-based values, the estimates increase to £1,812 per year for all hazards, and £424 for Lifetime Homes related hazards.

Table 9: Cost of harm for an average house by hazard

Hazard	Cost of harm on average	
	Poor housing cost estimates	TRL-based cost estimates
1. Damp and mould growth	£ 0.95	£ 7.09
2. Excessive cold	£ 48.72	£ 1,146.37
3. Excessive heat	£ 0.02	£ 0.45
4. Asbestos (and MMF)	£ 0.00	£ 0.07
5. Biocides	£ 0.00	£ 0.00
6. Carbon monoxide and fuel combustion products	£ 0.10	£ 0.94
7. Lead	£ 0.01	£ 0.05
8. Radiation	£ 4.70	£ 113.90
9. Uncombusted fuel gas	£ 0.02	£ 0.27
10. Volatile organic compounds	£ 0.03	£ 0.44
11. Crowding and space	£ 1.11	£ 23.49
12. Entry by intruders	£ 10.98	£ 82.25
13. Lighting	£ 0.01	£ 0.08
14. Noise protection	£ 0.47	£ 3.56
15. Domestic hygiene, pests and refuse	£ 0.02	£ 0.22
16. Food safety	£ 0.16	£ 1.16
17. Personal hygiene, sanitation and drainage	£ 0.10	£ 0.74
18. Water supply for domestic purpose	£ 0.00	£ 0.00
19. Falls associated with baths	£ 0.47	£ 7.62

20. Falling on level surfaces	£	24.65	£	186.20
21. Falling on stairs etc	£	10.96	£	146.93
22. Falling between levels	£	0.41	£	4.07
23. Electrical hazards	£	0.16	£	1.44
24. Fire	£	0.95	£	19.89
25. Flames, hot surfaces	£	3.34	£	24.23
26. Collision and entrapment	£	4.55	£	38.69
27. Explosions	£	0.04	£	0.90
28. Ergonomics (Position and operability of amenities)	£	0.05	£	0.38
29. Structural collapse and failing elements	£	0.03	£	0.50
Total	**£**	**113.02**	**£**	**1,811.95**
Total of hazards likely to be mitigated through LTH	**£**	**47.22**	**£**	**424.11**

3.1.4 New housing risk factors

Part of the purpose of building regulations is to provide a minimum standard of health and safety on hazards associated with buildings. Many of the hazards seen in the housing stock are dealt with well by the current guidance, but there will always be some risk of injury remaining. Estimates have therefore been made on how much of the risk can be considered to be controlled by following the current building regulation guidance. These estimates are given in Table 10.

There is no scientific basis for these estimates, but they could be refined through further research and analysis. However, they do provide a good assumption of the amount of savings that can be expected in a new dwelling compared to an average home. It is also clear that different types of home are likely to have different risks associated with them. Since we cannot obtain more accurate estimates at this time, the risk factors provided have been assumed to apply to all dwellings.

Table 10: Risk factors of new housing

Hazard	Risk factor for current regs	Risk factor for LTH	Risk factor for LTH converted
1. Damp and mould growth	0.95		
2. Excessive cold	0.99		
3. Excessive heat	- 5.00		
4. Asbestos (and MMF)	-		
5. Biocides	-		
6. Carbon monoxide and fuel combustion products	0.99		
7. Lead	0.99		
8. Radiation	0.95		
9. Uncombusted fuel gas	0.95		
10. Volatile organic compounds	1.00		
11. Crowding and space	1.00		
12. Entry by intruders	0.20	0.22	0.22
13. Lighting	-		
14. Noise protection	0.50		
15. Domestic hygiene, pests and refuse	0.50		
16. Food safety	-		
17. Personal hygiene, sanitation and drainage	0.10	0.15	0.30
18. Water supply for domestic purpose	-		

19. Falls associated with baths	0.05	0.05	0.80
20. Falling on level surfaces	0.20	0.30	0.30
21. Falling on stairs etc	0.10	0.15	0.90
22. Falling between levels	0.50		
23. Electrical hazards	0.95		
24. Fire	0.95		
25. Flames, hot surfaces	0.50		
26. Collision and entrapment	0.30		
27. Explosions	0.90		
28. Ergonomics (Position and operability of amenities)	0.40	0.45	0.45
29. Structural collapse and failing elements	0.60		
Cost of poor housing cost savings	£ 67.64		
LTH hazard cost to NHS per year	£ 8.28	£ 11.52	£ 20.11
LTH hazard cost to NHS over 60 years	£ 496.60	£ 691.04	£ 1,206.51
Percentage of average hazard cost saved	18%	24%	43%
TRL cost savings	£ 1,390.81		
LTH hazard cost to NHS per year	£ 68.99	£ 96.66	£ 212.67
LTH hazard cost to NHS over 60 years	£ 4,139.34	£5,799.38	£ 12,760.48
Percentage of average hazard cost saved	16%	23%	50%

For some hazards the reduction in risk is significant. For example, current guidance in Approved Document L should bring the SAP rating up to a much higher level than that found in the current housing stock. It is therefore very difficult to bring the temperature of these houses down below 16°C, the point at which prolonged exposure could lead to health risks. The factor for excessive cold has therefore been placed very high at 0.99. Since the majority of the cost (between 43 and 63 per cent, depending on the associated costs used) is related to excessive cold, this goes a long way to account for all possible direct health cost savings associated with new buildings.

The same reasoned estimate can be determined for each of the hazards likely to be mitigated within homes built to the Lifetime Homes Standard, shaded in tan. For each of these hazards, three estimates can be made: the risk factor for homes built to current building regulations, the risk factor associated with homes built to the Lifetime Homes Standard and the risk factors associated with Lifetime Homes Standard homes where the adaptations have all been implemented. The assumption is made that those people with mobility issues will require the adaptations to be made, whereas those without would not make these adaptations. These factors can easily be changed to account for more accurate risk analysis and guidance.

3.1.4.1 Falling on level surfaces

The majority of the risk associated with falls on level surfaces is related to the slip resistance of the walking surfaces. The remainder is related to trip hazards, changes in level and introduced hazards. Current building regulations do not require slip resistance

in dwellings. However, there is guidance to reduce the risk associated with trip hazards, and level access is expected for at least one entrance to the dwelling. It has been assumed that this would reduce the risk by 20 per cent. Homes built to the Lifetime Homes Standard increase this reduction since level access is required for all entrances, so this has increased the estimate to 30 per cent. There are no adaptations intended within the Lifetime Homes Standard that reduce the risk any further. Since the cost associated with falls on level surfaces is high, small changes to this risk factor will have a significant effect on the overall cost saving.

3.1.4.2 Falling on stairs etc

There is little difference between average stairs in dwellings and stair guidance in current building regulations. However, there is a reduction in the likelihood of steps leading up to the main entrance, and communal stairs are better. It is therefore assumed that the reduction in risk would be no more than 10 per cent. The Lifetime Homes Standard takes this a little further by removing steps from the entrance to the plot, or from the on-plot parking area. The main stairs are also intended to be fitted with a stair lift, encouraging wider and straighter flights and reducing the estimated risk by about 15 per cent. Where people have mobility problems, the main stairs in the house can be the hardest factor to overcome. The Lifetime Homes Standard goes a long way to anticipating this risk, and puts in place adaptation elements that when implemented make it hardly necessary to use the stairs. Consequently, the estimated reduction in risk has been increased to 90 per cent. The cost associated with falls on stairs is also high, and hence a small change in these risk factors will have a significant effect on the overall cost saving.

3.1.4.3 Entry by intruders

Current building regulation guidance does not directly tackle entry by intruders. The majority of the risk in this hazard is fear of crime. Because of its high likelihood (1 in 40), this makes a significant contribution to the direct health costs. Fear of crime is highly area-dependent, so many new developments will potentially generate a low level of fear, at least initially. Also, advice on designing out crime has been considered in many new developments. With this in mind, the risk has been reduced by 20 per cent. The risk for homes built to the Lifetime Homes Standard has been reduced further to 22 per cent to take into account the required external lighting. This hazard also contributes a large amount to the overall cost, so potentially could have a significant effect on the overall cost saving. However, it is unlikely that the risk reduction will be any greater than that proposed.

3.1.4.4 Other hazards

The other three hazards related to the Lifetime Homes Standard (ergonomics, falls associated with baths, and personal hygiene, sanitation and drainage) all contribute very little to the overall direct health cost associated with hazards. In total, the three contribute only about 0.5 per cent of the cost. For this reason the risk factors will have little effect on the final savings. Building regulation guidance recommends that switches and sockets are placed within an acceptable range, hence a risk factor of 40 per cent reduction has been applied. This has been increased to 45 per cent for homes built to the Lifetime Homes Standard to take account of the restriction being applied to all controls. Personal hygiene, sanitation and drainage has been given a 10 per cent reduction in risk for new dwellings. This is increased to 15 per cent for better access to entrance level toilets, increasing to 30 per cent to take account of the provision of an entrance level shower room.

Falls associated with baths are not covered by current building regulations, although modern bathrooms do tend to have bathroom furniture with fewer corners that could result in injury. The risk factor applied is therefore very small at 5 per cent, which has been carried over into homes built to the Lifetime Homes Standard. However, since handrails in bathrooms are expected within the adaptations, this is assumed to reduce the risk of falls associated with baths considerably. A risk reduction of 80 per cent is therefore applied.

3.1.5 Ageing population

The final assumption made in the model tries to take account of the fact that the population in the UK is getting older. Latest data from Communities and Local Government suggest that the number of households in the UK is expected to rise over the next 30 years, increasing by about 250,000 per year. Half of this increase is expected to be in households where the head of the household is over 65. Since we also know that this section of the population is more at risk of some hazards, it is worth trying to take account of this in the model. A factor has therefore been included which increases the proportion of over 60-year old households. This is applied to households made up of couples without children and single occupiers without children. The percentage increase is applied as a decrease to these household types that are younger than 60. The increase is applied as a cumulative percentage over 60 years (the expected life of a Lifetime Home) and the average increase is applied to these proportions to provide a revised proportion indicative of the ageing population. A maximum percentage restriction of 0.19 per cent per annum has been applied. Anything greater than that would mean the proportion of the single and couple households without children will become negative for some house types.

3.2 The cost of building to the Lifetime Homes Standard

The model provides a clear understanding of the direct health benefits associated with the Lifetime Homes Standard, but it does not include an assessment of the cost of building to the standard. There have been various studies providing a wide range of values associated with the costs of building to the Lifetime Homes Standard; these range from £90 - £1,615 per dwelling.

Sangster (1997), see Table 11, reported that the minimum cost of adapting a dwelling to the Lifetime Homes Standard at the design stage was £90. The maximum cost for a dwelling of at least three bedrooms would rise to just over £300. When two-bedroom dwellings were considered, the maximum costs were well over £1,000 as it was assumed that a downstairs toilet would not have been originally provided. CLG (2007) updated these costs and estimated that the total additional cost of incorporating the Lifetime Homes Standard was £547.[8]

[8] Communities and Local Government (2007) *The future of the Code for Sustainable Homes – Making a rating mandatory.* London: Communities and Local Government.

Table 11: Summary of the cost of the standard on dwelling types[9]

House type	Sector	Minimum costs (per dwelling)	Maximum costs (per dwelling)
4 bedroom, 6 person house	Social	£90	£302
	Private	£100	£295
3 bedroom, 5 person house	Social	£90	£302
	Private	£100	£295
2 bedroom, 4 person house	Social	£90	£1377*
	Private	£100	£1224*

* Maximum cost assumes that a downstairs toilet would not have been originally provided.

The Chartered Institute of Housing in Northern Ireland and the Joseph Rowntree Foundation conducted a comparative study into the cost of meeting Building Regulations and the Lifetime Home Standard. The additional cost of building Lifetime Homes ranged from £165 to £545 per dwelling, depending on the size, layout and specification of the property.[10]

Table 12 suggests that the cost of adapting standard house designs is approximately £1,500.

Table 12: The cost of the standard on dwelling types[11]

House type	Extra costs
2 bedroom, 4 person house	£1,615
3 bedroom, 5 person house	£1,435
4 bedroom, 6 person house	£1,570

It is because of this amount of variability in reported figures on the cost of building to the Lifetime Homes Standard that the direct health benefits model does not attempt to carry out a cost benefit analysis. Instead, the value of the benefit determined by the model can be used to determine the maximum cost of the adaptations that can be made before the adaptations are no longer cost-effective.

It should be noted that the cost benefit can be cumulative but this has not been taken into account, instead the total benefit over 60 years has been assumed to be a direct multiple of the first year's benefits. However, the 60-year benefit value is the one that should be used when assessing against the potential cost. The model also does not take into account any benefit generated by easier adaptations or through indirect health benefits.

[9] Sangster, K. (1997) *Costing Lifetime Homes*. York: Joseph Rowntree Foundation.
[10] Blythe, A., O'Brien, P. & McDaid, S. (2002) *Lifetime homes in Northern Ireland: evolution or revolution.* Belfast: Joseph Rowntree Foundation, Chartered Institute of Housing (NI).
[11] Ainsley Gommon Architects & Tweed QS (1999) *Lifetime Homes Desktop Study*. Cardiff: National Assembly for Wales.

4 Summary findings

By applying all of these assumptions to the data, a model for the direct health costs of Lifetime Homes can be estimated. The model of costs is provided in a spreadsheet as shown in Figure 2.

Figure 2: Example of direct health cost model spreadsheet

1 Using Cost of poor housing costs — Apply weighting for ageing population 3 no

2 By distribution across household type

	1 year	60 years	% saving
Average dwelling health costs whole stock	£ 47.22	£ 2,833.12	
Building Regs	£ 8.28	£ 496.60	18%
LTH	£ 11.52	£ 691.04	24%
LTH converted	£ 20.11	£ 1,206.51	43%
Total saving compared to average	£ 14.38	£ 862.95	30%

House type is 4 bungalow

bungalow

Household type	Does the household include anyone with long term illness or disability (= mobility problem) Yes	No	Total	Assumed years in Lifetime home	Mobility saving	Other Saving	1 Year Total	60 year Total	Percentage Saving from average
couple with no child(ren) oldest person in household over sixty	11.8%	25.3%	37.1%	22	£ 2.38	£ 2.91	£ 5.29	£ 317.53	11.2%
couple with no child(ren) oldest person in household under sixty	2.6%	7.5%	10.1%	6	£ 0.51	£ 0.87	£ 1.38	£ 82.93	2.9%
couple with child(ren)	2.0%	8.3%	10.2%	6	£ 0.40	£ 0.95	£ 1.35	£ 80.92	2.9%
lone parent with child(ren)	0.7%	2.9%	3.5%	2	£ 0.13	£ 0.33	£ 0.46	£ 27.82	1.0%
two or more families	0.1%	0.1%	0.2%	0	£ 0.02	£ 0.01	£ 0.04	£ 2.24	0.1%
lone person sharing with other lone persons	0.2%	0.8%	0.9%	1	£ 0.04	£ 0.09	£ 0.13	£ 7.53	0.3%
Single occupier over sixty	14.3%	17.7%	32.0%	19	£ 2.87	£ 2.04	£ 4.91	£ 294.90	10.4%
Single occupier under sixty	1.7%	4.1%	5.8%	4	£ 0.34	£ 0.48	£ 0.82	£ 49.08	1.7%
total	33.4%	66.6%	100.0%	60	£ 6.71	£ 7.68	£ 14.38	£ 862.95	30.5%

2 By distribution across household type

	1 year	60 years	% saving
Average	£ 47.22	£ 2,833.12	
Building Regs	£ 8.28	£ 496.60	18%
LTH	£ 11.52	£ 691.04	24%
LTH converted	£ 20.11	£ 1,206.51	43%
Total saving compared to average	£ 12.92	£ 775.01	27%

Number of bedrooms is 5 All

All

Household type	Does the household include anyone with long term illness or disability (= mobility problem) Yes	No	Total	Assumed years in Lifetime home	Mobility saving	Other Saving	1 Year Total	60 year Total	Percentage Saving from average
couple with no child(ren) oldest person in household over sixty	4.3%	12.9%	17.2%	10	£ 0.87	£ 1.49	£ 2.36	£ 141.36	5.0%
couple with no child(ren) oldest person in household under sixty	1.5%	11.8%	13.3%	8	£ 0.30	£ 1.36	£ 1.66	£ 99.66	3.5%
couple with child(ren)	2.2%	27.2%	29.4%	18	£ 0.44	£ 3.13	£ 3.58	£ 214.56	7.6%
lone parent with child(ren)	1.0%	8.7%	9.7%	6	£ 0.21	£ 1.00	£ 1.21	£ 72.67	2.6%
two or more families	0.2%	1.1%	1.3%	1	£ 0.04	£ 0.13	£ 0.17	£ 10.20	0.4%
lone person sharing with other lone persons	0.3%	2.6%	2.9%	2	£ 0.06	£ 0.30	£ 0.36	£ 21.72	0.8%
Single occupier over sixty	5.1%	9.7%	14.8%	9	£ 1.03	£ 1.12	£ 2.15	£ 128.70	4.5%
Single occupier under sixty	1.6%	9.7%	11.3%	7	£ 0.32	£ 1.12	£ 1.44	£ 86.14	3.0%
total	16.3%	83.7%	100.0%	60	£ 3.28	£ 9.64	£ 12.92	£ 775.01	27.4%

Cells shaded white are drop-down lists that can be changed to affect the outcome. By changing 1 it is possible to switch between the cost of poor housing severity costs and the TRL severity costs. Drop-down 2 changes the data so that each row is considered independently. That is to say, what would be the percentage saving if a bungalow only had couples with children for the full 60 years. The weighting for an ageing population can be applied at 3 and the percentage annual increase can be changed manually. Drop-down 4 allows the house type to be changed and 5 allows the number of bedrooms to be changed. These two are independent of each other so they are not looking at three-bedroom bungalows, but all three-bedroom bungalows and all bungalows.

Within each row the tan cells show the potential saving, taking into account the assumptions that have been made. In the above example, the maximum saving for Lifetime Homes when compared to average existing homes is £11.52 per annum or £691.04 over 60 years (24 per cent of the cost). By applying the adaptations expected by Lifetime Homes, this increases to £20.11, or £1,206.51 over 60 years (43 per cent of the cost). However, if we consider that adaptations are only made where required, i.e. homes where an occupant has mobility issues, then the total saving will be somewhere between these two values. For all housing, the estimated saving per dwelling is 27 per cent of the

costs. For bungalows this increases to 30 per cent. It is worth noting that the majority of the contribution for bungalows comes from occupants over 60, since they are more likely to live in bungalows.

Figure 3: Example of direct health cost model spreadsheet

Using TRL cost of life — Apply weighting for ageing population: no

By distribution across household type

	1 year	60 years	% saving
Average dwelling health costs whole stock	£ 424.11	£ 25,446.82	
House type is: Detached — Building Regs	£ 68.99	£ 4,139.34	16%
LTH	£ 96.66	£ 5,799.38	23%
LTH converted	£ 212.67	£ 12,760.48	50%
Total saving compared to average	£ 111.06	£ 6,663.80	26%

Detached

Household type	Does the household include anyone with long term illness or disability (= mobility problem) Yes	No	Total	Assumed years in Lifetime home	Mobility saving	Other Saving	1 Year Total	60 year Total	Percentage Saving from average
couple with no child(ren) oldest person in household over sixty	4.6%	19.8%	24.4%	15	£ 9.81	£ 19.10	£ 28.91	£ 1,734.77	6.8%
couple with no child(ren) oldest person in household under sixty	1.7%	13.1%	14.8%	9	£ 3.63	£ 12.70	£ 16.33	£ 979.93	3.9%
couple with child(ren)	2.5%	39.7%	42.2%	25	£ 5.38	£ 38.39	£ 43.77	£ 2,626.05	10.3%
lone parent with child(ren)	0.4%	3.7%	4.1%	2	£ 0.89	£ 3.60	£ 4.49	£ 269.54	1.1%
two or more families	0.2%	0.9%	1.1%	1	£ 0.37	£ 0.91	£ 1.28	£ 77.06	0.3%
lone person sharing with other lone persons	0.2%	0.9%	1.2%	1	£ 0.53	£ 0.89	£ 1.41	£ 84.89	0.3%
Single occupier over sixty	2.1%	5.8%	7.9%	5	£ 4.51	£ 5.63	£ 10.14	£ 608.39	2.4%
Single occupier under sixty	0.6%	3.5%	4.2%	2	£ 1.30	£ 3.42	£ 4.72	£ 283.16	1.1%
total	12.4%	87.6%	100.0%	60	£ 26.41	£ 84.65	£ 111.06	£ 6,663.80	26.2%

By household type

	1 year	60 years	% saving
Average	£ 424.11	£ 25,446.82	
Number of bedrooms is: Two bedroom — Building Regs	£ 68.99	£ 4,139.34	16%
LTH	£ 96.66	£ 5,799.38	23%
LTH converted	£ 212.67	£ 12,760.48	50%
Total saving compared to average	£ 115.93	£ 6,955.91	27%

Two bedroom

Household type	Does the household include anyone with long term illness or disability (= mobility problem) Yes	No	Total	Assumed years in Lifetime home	Mobility saving	Other Saving	1 Year Total	60 year Total	Percentage Saving from average
couple with no child(ren) oldest person in household over sixty	31.4%	68.6%	100.0%	60	£ 66.88	£ 66.26	£ 133.14	£ 7,988.54	31.4%
couple with no child(ren) oldest person in household under sixty	11.1%	88.9%	100.0%	60	£ 23.64	£ 85.91	£ 109.55	£ 6,573.27	25.8%
couple with child(ren)	8.8%	91.2%	100.0%	60	£ 18.75	£ 88.14	£ 106.88	£ 6,413.07	25.2%
lone parent with child(ren)	10.2%	89.8%	100.0%	60	£ 21.71	£ 86.79	£ 108.50	£ 6,510.09	25.6%
two or more families	19.4%	80.6%	100.0%	60	£ 41.36	£ 77.86	£ 119.22	£ 7,153.26	28.1%
lone person sharing with other lone persons	9.4%	90.6%	100.0%	60	£ 19.92	£ 87.60	£ 107.52	£ 6,451.27	25.4%
Single occupier over sixty	32.4%	67.6%	100.0%	60	£ 68.99	£ 65.30	£ 134.29	£ 8,057.43	31.7%
Single occupier under sixty	10.1%	89.9%	100.0%	60	£ 21.42	£ 86.92	£ 108.34	£ 6,500.33	25.5%
total	16.6%	83.4%	100.0%	60	£ 35.33	£ 80.60	£ 115.93	£ 6,955.91	27.3%

In Figure 3, the cost has been changed to TRL values and the housing type changed to detached. The TRL costing makes a considerable difference to the potential savings in the model. On the lower half of the example the assessment is for two-bedroom homes, and the rows are by household type. Each row is therefore now independent, representing the whole 60 years of the expected life of the property. Again, households with older occupants have a larger saving when compared to the average. The final example in Figure 4 applies the age weighting to bungalow data and TRL cost values. This is reaching the limits of the effect of ageing, and hence the majority of time in such dwellings is counted against households with older occupants.

Figure 4: Example of direct health cost model spreadsheet

Using TRL cost of life — Apply weighting for ageing population: yes 0.19% maximum (0.19%)

By distribution across household type

	1 year	60 years	% saving
Average dwelling health costs whole stock	£ 424.11	£ 25,446.82	
House type is: bungalow — Building Regs	£ 68.99	£ 4,139.34	16%
LTH	£ 96.66	£ 5,799.38	23%
LTH converted	£ 212.67	£ 12,760.48	50%
Total saving compared to average	£ 136.88	£ 8,212.94	32%

bungalow

Household type	Does the household include anyone with long term illness or disability (= mobility problem) Yes	No	Total	Assumed years in Lifetime home	Mobility saving	Other Saving	1 Year Total	60 year Total	Percentage Saving from average
couple with no child(ren) oldest person in household over sixty	14.0%	29.8%	43.7%	26	£ 29.68	£ 28.76	£ 58.45	£ 3,506.70	13.8%
couple with no child(ren) oldest person in household under sixty	0.9%	2.6%	3.5%	2	£ 1.88	£ 2.52	£ 4.40	£ 263.91	1.0%
couple with child(ren)	2.0%	8.3%	10.2%	6	£ 4.18	£ 8.00	£ 12.18	£ 730.96	2.9%
lone parent with child(ren)	0.7%	2.9%	3.5%	2	£ 1.42	£ 2.77	£ 4.18	£ 251.01	1.0%
two or more families	0.1%	0.1%	0.2%	0	£ 0.26	£ 0.10	£ 0.37	£ 22.03	0.1%
lone person sharing with other lone persons	0.2%	0.8%	0.9%	1	£ 0.41	£ 0.73	£ 1.14	£ 68.26	0.3%
Single occupier over sixty	16.8%	20.9%	37.7%	23	£ 35.82	£ 20.17	£ 55.98	£ 3,358.99	13.2%
Single occupier under sixty	0.0%	0.1%	0.1%	0	£ 0.09	£ 0.10	£ 0.18	£ 11.07	0.0%
total	34.7%	65.3%	100.0%	60	£ 73.74	£ 63.14	£ 136.88	£ 8,212.94	32.3%

5 Discussion

In a report commissioned by the Department of Health, entitled *Preventing accidental injury: priorities for action*, it was indicated that:

- the estimated cost to the NHS in England of injury in 2000-01 (including poisoning and intentional injury) is £2.2bn
- the estimated value of preventing road traffic accidents in Great Britain in 2000 was £12.2bn
- the cost to society of home accidents in the UK was estimated in 1996 as £25bn per annum.

These are perhaps underestimates of the current day costs, but give us an indication of the burden of injuries in England.

Further research in 2002 by the London Health Observatory in a report entitled *Too high a price: injuries and accidents in London*, also made a calculation for the total cost to society of injury and accidents in London. Injuries in the home account for the greatest part of the costs at just over £16bn a year, which is nine times the cost of transport accidents, 17 times the cost of suicide and 18 times the cost of assault. Since London equates to only 12 per cent of the accident admissions, this could mean a total UK bill in the region of £157bn a year, with over £100bn of that relating to home injuries. The direct NHS-related component of this was calculated at around £2.4bn.

It is worth noting, with both these reports, that these figures relate to costs directly related to injuries. It is highly likely that some of the building-related hazards recorded in the proposed model (in particular, excessive cold, particulates and radon (radiation) will not show up within the NHS as an accidental injury but rather as: heart disease, cardiovascular issues, lung cancer, bronchitis, emphysema or asthma.

The total dwelling health cost in England can be estimated using the average data for each of the HHSRS hazards. Depending on which cost values are used (cost of poor housing estimates or TRL estimates), the total cost of building-related hazards to the NHS is between £2.48bn and £40bn per annum. These figures suggest that the costs used are comparable to what might be expected for direct costs to the NHS and the potential cost to society of home injuries.

For each dwelling this equates to between £113 and £1,812 per annum on average, based on a housing stock of just under 22 million homes in England. Such an average dwelling, with average hazard risk in all hazards, probably does not exist; instead, the stock has some homes that have a much higher risk and some that are much lower, and this will vary across hazards.

Homes built to current building regulations should be much lower on most of these hazards than the average for the stock. This is clearly apparent for hazards such as excessive cold, where the guidance in Part L of the Building Regulations should remove most of the risk associated with this hazard. Using the amount of risk estimated to be controlled by current building regulations, it is possible to conceive of between 23 and 40 per cent of the cost to the NHS remaining in new build housing (depending on the cost values used). The health cost per new dwelling is therefore estimated to be reduced to

between £45 and £421 per annum. It is worth noting that the majority of this cost reduction (71 per cent to 81 per cent) is due to the reduction in excessive cold risk. As more homes undergo energy-related home improvements, as part of the drive for carbon savings, the average home will present a lower risk of harm; this will slowly reduce the amount of saving associated with this hazard.

For these potential health benefits associated with new homes to be fully realised, it is necessary to convince vulnerable people, particularly the elderly, to move from their existing average homes into new homes. It is at this point that we realise that the decision to move house is based on many more factors than just potential health benefits. For many people, the most important factor is location. It is likely that their current home is in a good location, meeting their needs, which is why they moved there in the first place, whereas others are still in the family home where they were born, and have never considered moving. Those with families might have moved into bigger homes as the family grew, resulting in a large home with status associated with it.

For those that do want to move, location may again be the driving factor. They may want to be close to the homes of their children, or close to the seaside or in a rural location. The sensible ones might want to be close to a teaching hospital in a main city. In all of these locations there will be many choices from the existing stock, which might appear to be better value for money in terms of space than an equivalently priced new home. They may be looking for a bungalow or a home with two or three larger bedrooms so that children and grandchildren can come to stay. A research project looking at what would encourage an older person to move to a new home may help to determine the drivers for change in this cohort.

It is possible that homes built to the Lifetime Homes Standard might give an extra incentive to encourage vulnerable groups to move to a newer building. For older people it is highly probable that this would be the last, or second to last move they are likely to make, and hence something that will meet their needs and expectations for the coming years would be an important factor to consider. The model looks at the hazards that are reduced by applying the Lifetime Homes Standard to new buildings. These hazards constitute between 23 and 42 per cent of the total costs, depending on the values used. When using the cost of poor housing figures, the cost related to these hazards is £47 per annum, or £2,833 over the 60-year life expectancy of the property. For the whole of England this equates to just over £1bn per annum. Using the broader TRL values, the cost related to these hazards is £424 per annum or £25,446 over the 60-year life expectancy of the property. For the whole of England using the TRL figures, this equates to just over £9bn per annum.

The total cost associated with these hazards is not removed by the Lifetime Homes Standard, but the amount of saving is dependent on whether or not the easy adaptations are implemented. For example, adding railing to the bathroom is much easier within homes built to the Lifetime Homes Standard, and this should reduce the risk of falls in baths substantially at the critical phase of transferring into and out of the bath. For Lifetime Homes, the model therefore considers the potential saving in two modes, as built and as adapted.

We can use this to see the additional benefit derived from Lifetime Homes Standard built homes compared to the average English home and the average home built to current building regulations, at least for the hazards affected. Compared to average homes, a new-built Lifetime Homes Standard home has the potential to save the NHS a further £691 during its 60-year lifespan above the £3,561 saved on hazards not affected by the Lifetime Homes Standard. This is £194 more than an average new home built to current

building regulations. If converted, the Lifetime Homes Standard home has the potential to save the NHS £515 over the expected lifespan of the building. When using the TRL figures for cost to society, the Lifetime Homes Standard home has the potential to save £1,660 more than an average home built to current building regulations, and a further £6,960 if converted, over the 60-year expected lifespan of the building.

6 Conclusion and recommendations

The model proposed provides a good starting point for the potential direct health benefits associated with building to the Lifetime Homes Standard. Typical savings are dependent upon the assumptions made. Using the cost of poor housing health benefit values, the 60-year benefit will be between £691 and £1,206. This is very close to the expected additional cost of building to the Lifetime Homes Standard for some housing types. However, if the TRL cost values are used, the benefits are estimated to be between £5,800 and £12,800, which is far in excess of the expected additional costs.

The model is heavily dependent on the assumptions made, and it is likely that better assumptions can be made with more research and analysis. In particular, the assumed risk factors for each hazard could be determined by applying HHSRS assessments on a sample of new housing. It is worth noting, however, that the assessment procedure is normally only applied when the potential risk of harm is higher than average, so some assessors may have difficulty in making such an assessment of new dwellings.

As the above values suggest, the model is highly dependent on the benefit values assigned to each class of harm. The cost of poor housing values is an underestimate of the real benefit, and can be used as a cautious estimate. Even at these values, building to the Lifetime Homes Standard could be cost-effective, depending on the accuracy of the additional costs associated with building to these criteria.

The model should be seen as a starting point to consider the health benefits of new buildings built to current building regulations and built to the Lifetime Homes Standard. It also highlights the areas where improvements can be made from further research.

In terms of potential health benefits, the model highlights which hazards are likely to provide the most benefit if improved in current building regulations. Using both sets of cost figures, the main three hazards where improvements could be made are falls on the level, falls on stairs and entry by intruders.

Excessive cold dominates the model, mainly with the high cost associated with the average home in England. It is highly likely that the average home is now better insulated than suggested by the HHSRS data. Excessive cold is a difficult hazard to measure using an inspection route and is usually approximated by a low SAP, typically below 35. It may be possible to determine a relationship between SAP and excessive cold risk, and hence by determining the average SAP of dwellings in the UK, determine the average risk.

Many of the factor weightings used in the model rely on informed estimates of the potential saving. The HHSRS is normally only applied to homes where hazards are considered to be higher than average. It would be helpful to determine the potential for harm of new buildings either through hazard inspections or, better still, through assessment of injury data. Unfortunately, injury surveillance data have not been collected in England since 2002.

The reasons why vulnerable, particularly elderly people move home could be looked at in more detail. It would be useful to determine what would encourage this cohort to choose a new home over an existing home.

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Appendix A: Household breakdowns

Profile of all one-bedroom dwellings					
Household type	Household includes anyone with long term illness or disability = mobility problem				**Assumed years in Lifetime Home**
		Yes	**No**	**Total**	
Couple with no child(ren) oldest person in household over sixty	**N**	54,087	106,067	160,154	5
	%	2.9%	5.7%	8.6%	
Couple with no child(ren) oldest person in household under sixty	**N**	17,674	222,754	240,428	8
	%	1.0%	12.0%	13.0%	
Couple with child(ren)	**N**	2,623	60,042	62,665	2
	%	.1%	3.2%	3.4%	
Lone parent with child(ren)	**N**	906	28,280	29,186	1
	%	.0%	1.5%	1.6%	
Two or more families	**N**	0	1,417	1,417	0
	%	.0%	.1%	.1%	
Lone person sharing with other lone persons	**N**	2,346	24,504	26,850	1
	%	.1%	1.3%	1.4%	
Single occupier over sixty	**N**	300,335	381,830	682,165	22
	%	16.2%	20.6%	36.8%	
Single occupier under sixty	**N**	99,672	551,202	650,874	21
	%	5.4%	29.7%	35.1%	
Total	**N**	477,643	1,376,096	1,853,739	60
	%	25.8%	74.2%	100.0%	

Profile of all two-bedroom dwellings					
Household type	Household includes anyone with long term illness or disability = mobility problem				**Assumed years in Lifetime Home**
		Yes	**No**	**Total**	
Couple with no child(ren) oldest person in household over sixty	**N**	292,510	637,616	930,126	10
	%	5.2%	11.3%	16.5%	
Couple with no child(ren) oldest person in household under sixty	**N**	101,607	812,342	913,949	10
	%	1.8%	14.4%	16.2%	
Couple with child(ren)	**N**	74,970	775,415	850,385	9
	%	1.3%	13.7%	15.1%	
Lone parent with child(ren)	**N**	70,039	615,957	685,996	7
	%	1.2%	10.9%	12.2%	
Two or more families	**N**	7,148	29,604	36,752	0
	%	.1%	.5%	.7%	
Lone person sharing with other lone persons	**N**	18,433	178,399	196,832	2
	%	.3%	3.2%	3.5%	
Single occupier over sixty	**N**	371,381	773,507	1,144,888	12
	%	6.6%	13.7%	20.3%	
Single occupier under sixty	**N**	88,916	794,105	883,021	9
	%	1.6%	14.1%	15.7%	
Total	**N**	1,025,004	4,616,945	5,641,949	60
	%	18.2%	81.8%	100.0%	

Profile of all three-bedroom dwellings					
Household type	Household includes anyone with long term illness or disability = mobility problem				**Assumed years in Lifetime Home**
		Yes	**No**	**Total**	
Couple with no child(ren) oldest person in household over sixty	**N**	428,372	1,414,819	1,843,191	11
	%	4.4%	14.5%	18.9%	
Couple with no child(ren) oldest person in household under sixty	**N**	148,857	1,065,243	1,214,100	7
	%	1.5%	10.9%	12.4%	
Couple with child(ren)	**N**	257,126	3,070,599	3,327,725	20
	%	2.6%	31.5%	34.1%	
Lone parent with child(ren)	**N**	116,608	988,229	1,104,837	7
	%	1.2%	10.1%	11.3%	
Two or more families	**N**	21,594	128,462	150,056	1
	%	.2%	1.3%	1.5%	
Lone person sharing with other lone persons	**N**	32,588	235,759	268,347	2
	%	.3%	2.4%	2.8%	
Single occupier over sixty	**N**	351,163	764,582	1,115,745	7
	%	3.6%	7.8%	11.4%	
Single occupier under sixty	**N**	129,393	601,961	731,354	4
	%	1.3%	6.2%	7.5%	
Total	**N**	1,485,701	8,269,654	9,755,355	60
	%	15.2%	84.8%	100.0%	

Profile of all four-bedroom dwellings					
Household type	Household includes anyone with long term illness or disability = mobility problem				**Assumed years in Lifetime Home**
		Yes	**No**	**Total**	
Couple with no child(ren) oldest person in household over sixty	**N**	118,329	481,911	600,240	11
	%	3.6%	14.7%	18.3%	
Couple with no child(ren) oldest person in household under sixty	**N**	42,395	362,408	404,803	7
	%	1.3%	11.1%	12.4%	
Couple with child(ren)	**N**	117,749	1,494,710	1,612,459	30
	%	3.6%	45.6%	49.2%	
Lone parent with child(ren)	**N**	23,211	190,950	214,161	4
	%	.7%	5.8%	6.5%	
Two or more families	**N**	11,820	45,822	57,642	1
	%	.4%	1.4%	1.8%	
Lone person sharing with other lone persons	**N**	10,155	73,585	83,740	2
	%	.3%	2.2%	2.6%	
Single occupier over sixty	**N**	49,537	130,822	180,359	3
	%	1.5%	4.0%	5.5%	
Single occupier under sixty	**N**	16,452	105,299	121,751	2
	%	.5%	3.2%	3.7%	
Total	**N**	389,648	2,885,507	3,275,155	60
	%	11.9%	88.1%	100.0%	

Profile of all five or more bedroom dwellings					
Household type	Household includes anyone with long term illness or disability = mobility problem				**Assumed years in Lifetime Home**
		Yes	**No**	**Total**	
Couple with no child(ren) oldest person in household over sixty	**N**	30,741	116,316	147,057	11
	%	3.7%	14.0%	17.6%	
Couple with no child(ren) oldest person in household under sixty	**N**	11,240	58,767	70,007	5
	%	1.3%	7.1%	8.4%	
Couple with child(ren)	**N**	19,737	413,101	432,838	31
	%	2.4%	49.6%	51.9%	
Lone parent with child(ren)	**N**	11,638	35,258	46,896	3
	%	1.4%	4.2%	5.6%	
Two or more families	**N**	4,727	31,217	35,944	3
	%	.6%	3.7%	4.3%	
Lone person sharing with other lone persons	**N**	0	47,375	47,375	3
	%	.0%	5.7%	5.7%	
Single occupier over sixty	**N**	15,797	20,480	36,277	3
	%	1.9%	2.5%	4.4%	
Single occupier under sixty	**N**	1,884	15,085	16,969	1
	%	.2%	1.8%	2.0%	
Total	**N**	95,764	737,599	833,363	60
	%	11.5%	88.5%	100.0%	

Profile of all end of terrace dwellings					
Household type	Household includes anyone with long term illness or disability = mobility problem				**Assumed years in Lifetime Home**
		Yes	**No**	**Total**	
Couple with no child(ren) oldest person in household over sixty	**N**	65,201	180,519	245,720	7
	%	3.3%	9.1%	12.4%	
Couple with no child(ren) oldest person in household under sixty	**N**	24,519	251,633	276,152	8
	%	1.2%	12.7%	13.9%	
Couple with child(ren)	**N**	51,021	614,729	665,750	20
	%	2.6%	30.9%	33.5%	
Lone parent with child(ren)	**N**	26,784	256,450	283,234	9
	%	1.3%	12.9%	14.3%	
Two or more families	**N**	7,163	29,558	36,721	1
	%	.4%	1.5%	1.8%	
Lone person sharing with other lone persons	**N**	1,734	56,223	57,957	2
	%	.1%	2.8%	2.9%	
Single occupier over sixty	**N**	62,204	171,859	234,063	7
	%	3.1%	8.7%	11.8%	
Single occupier under sixty	**N**	32,889	153,957	186,846	6
	%	1.7%	7.8%	9.4%	
Total	**N**	271,515	1,714,928	1,986,443	60
	%	13.7%	86.3%	100.0%	

Profile of all mid-terrace dwellings					
Household type	Household includes anyone with long term illness or disability = mobility problem				**Assumed years in Lifetime Home**
		Yes	**No**	**Total**	
Couple with no child(ren) oldest person in household over sixty	**N**	114,945	311,843	426,788	6
	%	2.9%	7.9%	10.7%	
Couple with no child(ren) oldest person in household under sixty	**N**	47,601	484,847	532,448	8
	%	1.2%	12.2%	13.4%	
Couple with child(ren)	**N**	104,853	1,069,197	1,174,050	18
	%	2.6%	26.9%	29.6%	
Lone parent with child(ren)	**N**	63,934	533,666	597,600	9
	%	1.6%	13.4%	15.0%	
Two or more families	**N**	8,922	61,226	70,148	1
	%	.2%	1.5%	1.8%	
Lone person sharing with other lone persons	**N**	17,598	148,649	166,247	3
	%	.4%	3.7%	4.2%	
Single occupier over sixty	**N**	142,978	350,158	493,136	7
	%	3.6%	8.8%	12.4%	
Single occupier under sixty	**N**	55,943	455,120	511,063	8
	%	1.4%	11.5%	12.9%	
Total	**N**	556,774	3,414,706	3,971,480	60
	%	14.0%	86.0%	100.0%	

Profile of all semi-detached dwellings					
Household type	Household includes anyone with long term illness or disability = mobility problem				**Assumed years in Lifetime Home**
		Yes	**No**	**Total**	
Couple with no child(ren) oldest person in household over sixty	**N**	248,044	808,826	1,056,870	11
	%	4.2%	13.6%	17.8%	
Couple with no child(ren) oldest person in household under sixty	**N**	102,797	650,611	753,408	8
	%	1.7%	11.0%	12.7%	
Couple with child(ren)	**N**	151,674	2,030,196	2,181,870	22
	%	2.6%	34.2%	36.8%	
Lone parent with child(ren)	**N**	63,486	550,121	613,607	6
	%	1.1%	9.3%	10.3%	
Two or more families	**N**	14,891	80,620	95,511	1
	%	.3%	1.4%	1.6%	
Lone person sharing with other lone persons	**N**	21,687	109,164	130,851	1
	%	.4%	1.8%	2.2%	
Single occupier over sixty	**N**	201,318	449,062	650,380	7
	%	3.4%	7.6%	11.0%	
Single occupier under sixty	**N**	64,919	385,931	450,850	5
	%	1.1%	6.5%	7.6%	
Total	**N**	868,816	5,064,531	5,933,347	60
	%	14.6%	85.4%	100.0%	

Profile of all detached dwellings					
Household type	Household includes anyone with long term illness or disability = mobility problem				**Assumed years in Lifetime Home**
		Yes	**No**	**Total**	
Couple with no child(ren) oldest person in household over sixty	**N**	180,344	772,734	953,078	15
	%	4.6%	19.8%	24.4%	
Couple with no child(ren) oldest person in household under sixty	**N**	66,737	513,807	580,544	9
	%	1.7%	13.1%	14.8%	
Couple with child(ren)	**N**	98,844	1,552,944	1,651,788	25
	%	2.5%	39.7%	42.2%	
Lone parent with child(ren)	**N**	16,321	145,808	162,129	2
	%	.4%	3.7%	4.1%	
Two or more families	**N**	6,892	36,789	43,681	1
	%	.2%	.9%	1.1%	
Lone person sharing with other lone persons	**N**	9,678	35,939	45,617	1
	%	.2%	.9%	1.2%	
Single occupier over sixty	**N**	82,848	227,872	310,720	5
	%	2.1%	5.8%	7.9%	
Single occupier under sixty	**N**	23,853	138,419	162,272	2
	%	.6%	3.5%	4.2%	
Total	**N**	485,517	3,424,312	3,909,829	60
	%	12.4%	87.6%	100.0%	

Profile of all bungalows					
Household type	Household includes anyone with long term illness or disability = mobility problem				**Assumed years in Lifetime Home**
		Yes	**No**	**Total**	
Couple with no child(ren) oldest person in household over sixty	**N**	239,905	511,495	751,400	22
	%	11.8%	25.3%	37.1%	
Couple with no child(ren) oldest person in household under sixty	**N**	51,826	152,499	204,325	6
	%	2.6%	7.5%	10.1%	
Couple with child(ren)	**N**	39,813	167,597	207,410	6
	%	2.0%	8.3%	10.2%	
Lone parent with child(ren)	**N**	13,485	57,965	71,450	2
	%	.7%	2.9%	3.5%	
Two or more families	**N**	2,496	2,199	4,695	0
	%	.1%	.1%	.2%	
Lone person sharing with other lone persons	**N**	3,894	15,265	19,159	1
	%	.2%	.8%	.9%	
Single occupier over sixty	**N**	289,484	358,624	648,108	19
	%	14.3%	17.7%	32.0%	
Single occupier under sixty	**N**	34,350	83,830	118,180	4
	%	1.7%	4.1%	5.8%	
Total	**N**	675,253	1,349,474	2,024,727	60
	%	33.4%	66.6%	100.0%	

Profile of all converted flats					
Household type	Household includes anyone with long term illness or disability = mobility problem				**Assumed years in Lifetime Home**
		Yes	**No**	**Total**	
Couple with no child(ren) oldest person in household over sixty	**N**	3,964	29,674	33,638	3
	%	.6%	4.2%	4.7%	
Couple with no child(ren) oldest person in household under sixty	**N**	5,876	138,737	144,613	12
	%	.8%	19.4%	20.2%	
Couple with child(ren)	**N**	3,908	70,614	74,522	6
	%	.5%	9.9%	10.4%	
Lone parent with child(ren)	**N**	8,522	56,554	65,076	5
	%	1.2%	7.9%	9.1%	
Two or more families	**N**	0	11,557	11,557	1
	%	.0%	1.6%	1.6%	
Lone person sharing with other lone persons	**N**	764	59,520	60,284	5
	%	.1%	8.3%	8.4%	
Single occupier over sixty	**N**	24,343	60,522	84,865	7
	%	3.4%	8.5%	11.9%	
Single occupier under sixty	**N**	33,918	206,326	240,244	20
	%	4.7%	28.9%	33.6%	
Total	**N**	81,295	633,504	714,799	60
	%	11.4%	88.6%	100.0%	

Profile of all purpose-built flats, low rise					
Household type	Household includes anyone with long term illness or disability = mobility problem				**Assumed years in Lifetime Home**
		Yes	**No**	**Total**	
Couple with no child(ren) oldest person in household over sixty	**N**	67,468	131,380	198,848	5
	%	2.6%	5.2%	7.8%	
Couple with no child(ren) oldest person in household under sixty	**N**	20,316	294,809	315,125	7
	%	.8%	11.6%	12.4%	
Couple with child(ren)	**N**	19,293	262,273	281,566	7
	%	.8%	10.3%	11.0%	
Lone parent with child(ren)	**N**	25,125	224,657	249,782	6
	%	1.0%	8.8%	9.8%	
Two or more families	**N**	4,925	11,033	15,958	0
	%	.2%	.4%	.6%	
Lone person sharing with other lone persons	**N**	8,167	121,337	129,504	3
	%	.3%	4.8%	5.1%	
Single occupier over sixty	**N**	266,173	415,702	681,875	16
	%	10.4%	16.3%	26.8%	
Single occupier under sixty	**N**	87,365	588,302	675,667	16
	%	3.4%	23.1%	26.5%	
Total	**N**	498,832	2,049,493	2,548,325	60
	%	19.6%	80.4%	100.0%	

Profile of all purpose-built flats, high rise					
Household type	Household includes anyone with long term illness or disability = mobility problem				**Assumed years in Lifetime Home**
		Yes	**No**	**Total**	
Couple with no child(ren) oldest person in household over sixty	**N**	6,098	10,258	16,356	3
	%	2.1%	3.5%	5.6%	
Couple with no child(ren) oldest person in household under sixty	**N**	2,101	34,571	36,672	8
	%	.7%	11.9%	12.6%	
Couple with child(ren)	**N**	2,799	46,317	49,116	10
	%	1.0%	15.9%	16.9%	
Lone parent with child(ren)	**N**	4,745	34,791	39,536	8
	%	1.6%	12.0%	13.6%	
Two or more families	**N**	0	3,540	3,540	1
	%	.0%	1.2%	1.2%	
Lone person sharing with other lone persons	**N**	0	14,979	14,979	3
	%	.0%	5.1%	5.1%	
Single occupier over sixty	**N**	23,651	39,863	63,514	13
	%	8.1%	13.7%	21.8%	
Single occupier under sixty	**N**	5,503	61,911	67,414	14
	%	1.9%	21.3%	23.2%	
Total	**N**	44,897	246,230	291,127	60
	%	15.4%	84.6%	100.0%	