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Volume II – Summary of Results

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Introduction

The objectives of this project were to refine and update the statistical evidence behind the Housing Health and Safety Rating System (HHSRS). The report on the project is published as three documents. The background to the project and summary of stages involved are given in Volume I. Volume III is the Technical Appendix which discusses and explains the steps involved. It is intended to give sufficient information to enable the processes and the analyses to be reproduced.

This Volume II contains, for each hazard, brief literature reviews and summaries of the results from the analyses. The summaries provide the averages for the vulnerable group for the particular hazard by age of dwelling. They also show the averages, by age for houses and for multi-occupied buildings. The results are given in two parts – first, those relating to accidents and injuries; and second, those relating to health conditions. This reflects the differences in the analyses to generate the results.

Accident and injury results

The accident and injury results are all presented in the same format. First, a summary from the literature, followed by the results showing the average likelihoods and spread of outcomes by housing type and age. (Note – For these results, housing type is divided into *houses* and *flats* – this latter being all multi-occupied buildings, whether purpose built or converted and whether self-contained or not.)

For these results, HASS[1] data was analysed for Classes II, III, and IV outcomes, and ONS Mortality data analysed to give the results for Class I outcomes. The exceptions to this are the results for Hazards associated with Entry by Intruders and those for Fire Hazards. The results for Entry by Intruders are based on data supplied by the Home Office and British Crime Survey[2], and the results for Fire Hazards are based on information form HASS data, the Home Office and from the Fire Brigade[3].

1 Home Accident Surveillance System – see Volume I, Chapter 3, para 3.03.1.

2 See ibid, para 3.03.3.

3 See ibid, para 3.03.2.

Where appropriate, brief explanations of the basis for the estimates and comments are also given[4]. The Hazards included in this section are –

Falls on stairs	Structural failure
Falls on level	Inadequate lighting
Falls between levels	Poor ergonomics
Falls related to baths etc.	Explosions
Hot surfaces and materials	Uncombusted fuel gas
Electrical hazards	Fire
Entrapment or collision	Entry by intruders

Results for illnesses and other health conditions

Again, for these results a summary from the literature is presented first, followed by the results showing the average likelihoods by housing type and age and spread of outcomes. (Note – For these results, housing type is divided into *non-HMOs* and *HMOs* – the former being single household occupied dwellings, and latter being houses converted into multi-occupation, whether self-contained or not.)

While following a similar and comparable format, the nature of the information available on hazards and on health outcomes meant that the analyses could not follow a standard form. This means there is some variation in the detail. The main source of information analysed for Classes II, III, and IV outcomes was the HES[5], and for Class I outcomes, the ONS Mortality data[6].

Brief explanations of the basis for the estimates and comments are also given[7]. The Hazards included in this section are –

Excessive cold	Crowding and space
Radiation	Domestic hygiene, pests etc
Damp and mould growth	Personal hygiene and sanitation
Carbon monoxide etc.	Inadequate provision for food safety
Noise	Contaminated water
Asbestos etc.	Excessive high temperature
Lead	

4 More information and results are given in Volume III – Technical Appendix.

5 Hospital Episode Statistics – See Volume I, Chapter 3, para 3.04.1.

6 Ibid, para 3.05.1.

7 More information and results are given in Volume III – Technical Appendix.

Content of Results Tables

Spread of health outcomes as a percentage for each age band of dwellings[1]

Hazard Category

Average Hazard Score for each dwelling age and type, rounded to nearest whole number[2]

Vulnerable Group (if any)

Hazards associated with Falls on Stairs

Average Likelihood and Health Outcomes by All Persons aged 60 years or more, 1997–1999

	Dwelling type & age	Average likelihood 1 in	Spread of health outcomes Class I %	Class II %	Class III %	Class IV %	Average HHSRS scores
Houses	Pre 1920	218	2.18	7.73	22.14	67.95	169
	1920-45	226	2.08	7.39	20.45	70.08	155
	1946-79	256	1.57	6.63	21.55	70.26	115
	Post 80	256	1.38	6.28	25.25	67.09	111
Flats	Pre 1920	214	3.87	8.02	19.27	68.84	249
	1920-45	263	1.57	2.79	20.12	75.52	96
	1946-79	410	2.83	5.33	17.68	74.16	97
	Post 80	409	2.61	5.22	19.41	72.76	93
	All	**245**	**1.89**	**6.66**	**21.71**	**69.73**	134

"Houses" covers all single household occupied houses[3]

"Flats" includes all multi-occupied buildings, whether purpose-built or converted, and whether the dwellings within the building are self-contained or not[4]

Dwelling age bands

For each dwelling type and age band, the average likelihood of an occurrence over twelve month period involving a member of the vulnerable group, rounded to the nearest whole number

Average likelihood, spread of outcomes and Hazard Score for all dwellings

1 For the health related hazards, because of the data available and the methods of analyses used, the spread of outcomes is given as the same for all dwelling type and age categories.

2 In exceptional cases, where the Hazard Score is very small, the figures are given to two decimal places.

3 For the health related hazards because of the data available and the methods of analyses used, the term ''Non-HMO'' is used and includes all single household occupied dwellings.

4 For the health related hazards because of the data available and the methods of analyses used, the term ''HMOs'' is used and includes all multi-occupied dwellings but excludes purpose-built flats.

Chapter 1
Hazard Results

Hazards associated with Falls on Stairs

Potential for harm

Over 75% of all deaths due to falls are in the home environment. Falls on stairs in the home account for about 24% of all fatal and non-fatal accidents. 52% of all fatal home accidents are falls, and falls also account for 42% of all non-fatal home accidents.

Over 80% of falls on stairs or steps at home to the general population are minor. Although numerically more accidents involve younger people, proportionally the elderly are most at risk of a fall, and their falls result in worse injuries and they take longer to recover.

Vulnerable groups

Around two thirds of deaths and very serious injuries from falls on stairs or steps in the home are to victims of 65 years and over.

After the age of 40 men are much more likely to die of a fall on stairs or steps in the home than women. In the age bands 40 to 64, and 75+, a man is almost twice as likely to die from a fall on stairs/steps at home than a woman in the same age band (when the rate per million population of each sex is considered). In the age bands 65 to 74, a man is more likely to die from a fall than a woman, although the difference between the sexes is less marked.

Trends and summary of evidence

For falls generally, from 1983 to 1996 there has been an increasing number of non-fatal falls annually, and a decreasing number of fatal falls. When the trends from 1982/83 to 1996 are extrapolated, it is projected that between 1996 and 2010 non-fatal accidental falls will increase by 17.3% while the population will have increased by only 2.7%, and accidental deaths cases will decrease by 36%. The figures for falls associated with stairs are an increase of 22.1% in non-fatal stair falls and a decrease in accidental deaths by 19.6%.

Non-fatal falls have been increasing in all age bands except the 0-4 band. For deaths, the numbers are very small for children under 15. Apart from this, there has been a steady decline in the numbers of fatalities particularly for older people. When the trends from 1982/83 to 1996 are extrapolated, it is projected that between 1996 and 2010 fatal accidents to people in the 65-74 age range will decrease by 39.7%, and in the 75+ age band, there will be a 48.5% decrease in fatal falls.

The decline in fatalities is highest amongst the elderly population. Mortality rates are more stable amongst the younger age groups.

Key References

DTI, 1998, "Home accident surveillance system: 22nd annual report"

DTI, 1999, "Research on the pattern and trends in home accidents"

DTI/University of Newcastle Upon Tyne, 1999, "Accidental Falls: Fatalities and Injuries. An examination of the data sources and review of the literature on preventative strategies"

Loughborough University ,"Safety of Older People on Stairs Behavioural Factors – A report prepared for The Department of Trade and Industry"

DTI, 2000, "Avoiding slips, trips and broken hips – falls on stairs in the home involving older people- statistics"

Raw, GJ, et al (ed), 2001, "Building regulation health and safety" BRE/DETR

DTI, 1999, "Guidance for professionals who work with older people"

Cayless, SM "Slip, trip and fall accidents: relationship to building features and use of coroners' reports in ascribing cause" (2001) Applied Ergonomics 32(2), 155-162

Hazards associated with Falls on Stairs
Average Likelihood and Health Outcomes by All Persons aged 60 years or more, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class I %	Class II %	Class III %	Class IV %	
Houses	Pre 1920	218	2.18	7.73	22.14	67.95	169
	1920-45	226	2.08	7.39	20.45	70.08	155
	1946-79	256	1.57	6.63	21.55	70.26	115
	Post 80	256	1.38	6.28	25.25	67.09	111
Flats	Pre 1920	214	3.87	8.02	19.27	68.84	249
	1920-45	263	1.57	2.79	20.12	75.52	96
	1946-79	410	2.83	5.33	17.68	74.16	97
	Post 80	409	2.61	5.22	19.41	72.76	93
	All	**245**	**1.89**	**6.66**	**21.71**	**69.73**	**134**

Basis of estimates

Number of persons aged 60 years or more involved in non-fatal accidents during 1997, 98 and 99 in HASS catchment areas, corrected for missing data and loss of cases to other hospitals.

Number of persons aged 60 years or more involved in fatal accidents during 1997, 98 and 99 in total sample with housing and population data, corrected for missing data.

Number of falls "on/from stairs/steps", whether inside or out including trip steps and common stairs and falls at porch/thresholds where so coded. Includes communal homes.

Comment

While it is possible in the HASS data to distinguish between falls on inside and outside steps and at thresholds, this is no the case in the mortality statistics. These overall statistics tend to mask the differences in the risks between different types and ages of dwellings, particularly in the case of houses, the incidence of falls on outside steps, for example, often being determined by the topography of the garden rather than the age of the dwelling. That said, older houses and flats do tend to have higher average HHSRS ratings than more modern dwellings.

The highest ratings are for areas of mixed age and pre 1920 flats, the majority of which are conversions. These may have dangerous stairs and other awkward changes of floor levels, in the flat and/or in the common areas, as a result of poor conversion.

Hazards associated with Falls on the Level

Potential for harm

Falls on the level represent a significant number of non-fatal fall accidents. It is estimated that, in 1998, there around 350,000 falls on the level, this representing 32% of all the falls.

Vulnerable groups

Most accidents occur to people in the 15 to 64 age group. However, proportionally, children and the elderly are most at risk of non-fatal injury from a fall on the level.

Trends and summary of evidence

As with the trend for fall accidents generally, the number of non-fatal falls on the level is increasing and the number of fatal falls on the level is decreasing. When the trends from 1982/83 to 1996 are extrapolated, it is projected that between 1996 and 2010 non-fatal stair falls will increase by 14.3% while the population will have increased by only 2.7%, and accidental deaths will decrease by 60.1%. The decrease is highest amongst people over 70.

In 1994/95 there were no deaths to children under the age of 15, rates gradually increased in adulthood, with increased risk in people aged 60 and over and a further increase in risk in those over the age of 75 years. 85% of deaths from falls on the level were in people over the age of 60 years.

Key References

DTI, 1998, “Home accident surveillance system: 22nd annual report”

DTI, 1999, “Research on the pattern and trends in home accidents”

DTI/University of Newcastle Upon Tyne, 1999, “Accidental Falls: Fatalities and Injuries. An examination of the data sources and review of the literature on preventative strategies”

Raw, GJ, et al (ed), 2001, “Building regulation health and safety” BRE/DETR

DTI, 1999, “Guidance for professionals who work with older people”

Cayless, SM “Slip, trip and fall accidents: relationship to building features and use of coroners’ reports in ascribing cause” (2001) Applied Ergonomics 32(2), 155-162

Hazards associated with Falls on the Level
Average Likelihood and Health Outcomes, All persons aged 60 years or over, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class I %	Class II %	Class III %	Class IV %	
Houses	Pre 1920	124	0.19	13.83	27.32	58.67	198
	1920-45	139	0.16	12.75	26.20	60.90	165
	1946-79	152	0.18	13.34	28.67	57.80	165
	Post 80	126	0.08	13.83	33.87	52.22	201
Flats	Pre 1920	87	0.10	14.33	18.59	66.99	248
	1920-45	101	0.24	14.41	24.39	60.96	244
	1946-79	132	0.29	15.34	22.63	61.74	194
	Post 80	112	0.07	17.53	24.93	57.46	236
	All	**134.5**	**0.17**	**13.80**	**27.26**	**58.77**	**181**

Basis of estimates

Number of persons aged 60 yrs or more involved in non-fatal accidents during 1997, 98 and 99 in HASS catchment areas, corrected for missing data and loss of cases to other hospitals.

Number of persons aged 60 yrs or more involved in fatal accidents during 1997, 98 and 99 in total sample with housing and population data at postcode level.

Number of falls "on same level (slip/trip/stumble)", whether inside or out including falls at porch/thresholds where so coded. Includes such falls in communal homes.

Comment

While it is possible from the HASS data to distinguish between falls inside and outside and at thresholds, this is not the case for the mortality statistics. These overall statistics tend to mask the differences in the risks between different types and ages of dwellings, particularly in the case of houses, the incidence of falls on outside paths, for example, often being determined by the topography of the garden rather than the age of the dwelling.

The highest ratings are for areas of mixed age and pre 1920 flats, the majority of which are conversions. These may have uneven floors, in the flat and/or in the common areas, as a result of poor conversion or poor maintenance

Hazards associated with Falls between Levels

Potential for harm

Falls from or out of domestic buildings, from windows, balconies and roofs (this includes DIY repairs to roofs), account for 3.9% of fatal accidents.

Vulnerable groups

Falls out of or from buildings mortality data revealed no clear patters in terms of age related risk, although the numbers of deaths is slightly elevated in younger adults (20-29), but then remaining fairly constant through into old age. However, falls out of or from buildings and other structures represented an important cause of death in children and young adults.

Trends and summary of evidence

As with the trend for fall accidents generally, the number of non-fatal falls between levels is increasing and the number of fatal falls is decreasing.

For falls from windows, 50% of fatal falls are from bedroom windows, and around 50% of fatal falls are from first floor windows. For falls from balconies, 75% of cases occur where the height of guarding (where known) is less than the recommended height of 1100mm.

Key References

DTI, 1998, "Home accident surveillance system: 22nd annual report"

DTI, 1999, "Research on the pattern and trends in home accidents"

Raw, GJ, et al (ed), 2001, "Building regulation health and safety"

DTI/University of Newcastle upon Tyne, 1999, "Accidental Falls: Fatalities and Injuries. An examination of the data sources and review of the literature on preventative strategies"

Webber, GMB, Aizlewood, CE, 1993, "Falls from domestic windows" BRE Information Paper 17/93, CRC Ltd.

Webber, GMB, Aizlewood, CE, 1993, "Falls from domestic balconies" (1993) BRE Information Paper 18/93, CRC Ltd.

Hazards Associated with Falls between Levels Average Likelihood and Health Outcomes by Persons aged under 5 years, 1997-1999							
Dwelling type & age		**Average likelihood 1 in**	**Spread of health outcomes**				**Average HHSRS scores**
			Class I %	**Class II %**	**Class III %**	**Class IV %**	
Houses	Pre 1920	2117	0.10	0.00	10.52	89.38	2
	1920-45	1564	0.18	1.58	7.92	90.31	4
	1946-79	1259	0.24	3.09	10.28	86.39	8
	Post 80	2132	0.00	0.00	16.67	83.33	3
Flats	Pre 1920	2742	0.00	0.00	0.00	100.00	0
	1920-45	2451	1.33	0.00	16.45	82.23	8
	1946-79	1791	0.38	5.86	5.86	87.90	7
	Post 80	1235	0.00	0.00	0.00	100.00	1
	All	**1693**	**0.19**	**1.77**	**9.85**	**88.20**	**4**

Basis of estimates

Number of persons aged under 5 years involved in non-fatal accidents during 1997, 98 and 99 in HASS catchment areas, corrected for missing data and loss of cases to other hospitals.

Number of persons aged under 5 years involved in fatal accidents during 1997, 98 and 99 in total sample with housing and population data at postcode level, corrected for missing data.

Number of falls "from building/structure" and "from one level to another" where main article involved is stair/landing element, roof, ceiling, window or balcony. Excludes falls from ladder/steps.

Comment

At first sight, there appears little systematic correlation between the likelihood of young children falling between levels and their health outcomes and the type and age of the dwelling. However, horizontal pivot windows and other less secure types are quite comon in post war dwellings built before 1979 and inter-war and early post war flats also often feature open access balconies. These types have the highest average ratings, while flats built after 1979 have the lowest average rating. However, it should be noted that the frequencies are low and the sample sizes consequently small.

Hazards from Falls associated with Baths and other Facilities

Potential for harm

Baths, showers and their fittings were involved in 16,954 recorded home accidents in 1996, giving a UK estimate of 32,600. The most common injuries that result from bath falls are cuts or lacerations (27%), swelling or bruising (26%), or fractures (11%).

Vulnerable groups

Children and the elderly are at greatest risk of injury from a fall in the bath.

Trends and summary of evidence

The main cause of falls in the bathroom is slipping when getting into or out of the bath. The fall itself accounts for around 40% of injuries, and 23% resulted from 'striking against a stationary object' (secondary hazards).

Key References

DTI (1998) "Home accident surveillance system: twentieth annual report"

Raw, GJ, et al (ed) (2001) "Building regulation health and safety" BRE/DETR

Cutbill, M, (1982) "Analysis of accidents located in the bathroom" DTI

Hazards from Falls associated with Baths and other Facilities
Average Likelihood and Health Outcomes by Persons aged 60 years or over, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class I %	Class II %	Class III %	Class IV %	
Houses	Pre 1920	4,428	3.00	1.54	13.86	81.60	8
	1920-45	3,861	2.38	5.92	4.44	87.27	8
	1946-79	4,324	0.84	3.28	5.74	90.15	3
	Post 1980	2,915	0.61	0.00	20.46	78.92	5
Flats	Pre 1920	2,758	2.80	0.00	21.60	75.60	13
	1920-45	1,976	4.72	10.59	21.17	63.52	33
	1946-79	4,015	3.44	6.23	21.80	68.53	12
	Post 80	4,448	0.00	9.09	0.00	90.91	2
	All	**4,026**	**1.88**	**3.63**	**10.33**	**84.16**	**7**

Basis of estimates

Number of persons aged 60 yrs or more involved in non-fatal accidents during 1997, 98 and 99 in HASS catchment areas, corrected for missing data and loss of cases to other hospitals.

Number of persons aged 60 yrs or more involved in fatal accidents during 1997, 98 and 99 in total sample with housing and population data at postcode level, corrected for missing data.

Number of falls on same level, from one level to another, slip/trip or body part gave way where main article involved is bath or shower and drownings/near drownings in bath.

Hazards associated with Hot Surfaces and Materials

Potential for harm

Around 112,000 people visit A&E units each year suffering from burns or scalds incurred in the home or from leisure activities. At least a further 250,000 people visit GP surgeries for burns and scalds injuries. Each year, over 7,700 people (21 people each day) are admitted as in-patients to A&E departments or specialist burns units suffering from accidents involving burns and scalds. Burn or scald injuries result in the death of over 200 people each year (about 4 a week). These numbers exclude those resulting from uncontrolled fires (eg, house fires), but include burns from spilt hot liquids, baths, irons, cookers, and fires/heaters.

Some of these accident include accidents not be directly associated with dwelling conditions. For example, spilt tea and coffee, which are the greatest cause of injury to children under 5 years olds. A sixth of the accidental burn and scald severe injuries (430 per year) and half of the deaths (over 2 per year) to children under 5 result from scalding in hot baths. Most of these accidents involve the child being left unsupervised. Many of the children under 3 suffer 20-50% body burns, as they submerge in the hot water.

Burns or scalds in this hazard category account for the great majority of non-fatal burn accidents (burns in the Fire hazard category result in the most deaths).

Over 50% of all severe injuries (ie, 4,500 a year, or over 12 a day) involve victims being admitted for 5 or more days as in-patients at hospitals or specialist burns units. Apart from the obvious physical pain, many victims, and also parents of children that are burnt or scalded, suffer acute psychological distress for many years.

Vulnerable groups

The age group at highest risk for accidents involving burns and scalds is children aged 0-4 years. However, the outcome for adults aged 65 years and over is more likely to be fatal.

Children under 5 years old suffer nearly 45% of all non-fatal severe burns and scalds accidents. Their risk level is 6-7 times greater than the average level for the population as a whole, with boys at slightly higher risk than girls. Apart from adults aged 65 or more, children under 5 are at high risk levels of fatal accidents compared to most other age groups. The elderly are at 4-5 times greater risk of fatal injuries than the average level for the population as a whole

The relatively small body area (especially when hot liquids are involved), the more sensitive nature of young children's skin, and their low position in relation to hot objects (ie, usually at floor level) means that young children are particularly at risk of suffering severe injuries when involved in scald or burn injuries.

Trends and summary of evidence

About 50% of the accidents to children under 5 years happen in the kitchen. The most common items involved in these accidents are cups/mugs of hot drinks (which account for over a third of the severe burn/scald injuries to A&E in-patients), kettles, teapots/coffee pots, saucepans, cookers and chip pans/deep fryers. It is not clear what proportion of these accidents relate to dwelling design/repair matters and what proportion to behaviour and/or carelessness.

Burns from fires and heaters involve 10% of the severe injuries to small children and about 2 deaths a year. Children under 5 years old tend to fall onto or touch a fire. Many adults and older children suffer burns when their clothes catch alight.

Fires and heaters cause the most deaths from burns, about 30 per year, over all age groups (mainly the elderly).

Cookers are involved in about 290 severe injuries a year (requiring admission as in-patients), and 13 deaths a year (most involve the elderly). Annually, around 110 severe injuries involve to children under 5 years old – usually a child touches a hot plate/ring or cooker grill. Adult injuries (160 severe injuries and 13 deaths) mostly involve items of clothing igniting when leaning over the cooker.

Key References

DTI, 1999, "Government Consumer Safety Research - Burn & Scalds Accidents in the Home"

DTI, 1998, "Home accident surveillance system: 22nd annual report"

DTI, 1999, "Research on the pattern and trends in home accidents"

Raw, GJ, et al (ed), 2001, "Building regulation health and safety"

Hazards associated with Hot Surfaces and Materials
Average Likelihood and Health Outcomes by Person aged under 5 years, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class I %	Class II %	Class III %	Class IV %	
Houses	Pre 1920	178	0.01	0.78	17.21	82.00	39
	1920-45	191	0.02	2.52	16.41	81.05	44
	1946-79	156	0.00	1.19	16.35	82.46	44
	Post 80	230	0.00	0.93	17.06	82.01	30
Flats	Pre 1920	246	0.10	2.56	20.49	76.85	42
	1920-45	306	0.17	0.00	14.98	84.86	23
	1946-79	161	0.03	1.87	24.25	73.86	64
	Post 80	138	0.00	0.00	27.08	72.92	64
	All	**182**	**0.01**	**1.33**	**17.77**	**80.88**	**42**

Basis of estimates

Number of persons of under 5 years involved in non-fatal accidents during 1997, 98 and 99 in HASS catchment areas, corrected for missing data and loss of cases to other hospitals.

Number of persons of under 5 yrs in fatal accidents during 1997-99 in total sample with housing and population data, corrected for missing data.

Number of persons suffering burns or scalds by hot object or appliance, hot liquid, steam or gas and burns by controlled fire or flame.

Comment

Unlike the HASS data where it is possible to distinguish burns & scalds in the kitchen and from heating appliances, the mortality statistics are only available for a wider definition of such accidents. These broader statistics tend to mask the differences in the risks between different types and ages of dwellings.

However, apart from a possibly higher rate in post war flats, there appears little difference in the likelihood of young children suffering burns and scalds from hot surfaces and materials with different types and ages of housing. The spread of harms, which include a significant proportion of more serious classes, tend to be higher in older dwellings.

Electrical Hazards

Potential for harm

Annually about 1,900 electric current home accidents result in hospital attendance, and, in recent years, under 20 have caused fatality. However, a study of 1985 data revealed that of the 39 fatalities that year, just 3 resulted from a fault in the wiring and accessories from the National Grid down to and including the final fixed socket on the wall or ceiling. The majority of the electric current fatalities resulted from faults in plugs, leads, and appliances.

Injuries are primarily burns (53%) to the finger or thumb (58%). 84% of injuries are not serious – 38% of victims are sent home and 47% are referred to out-patients or a GP. Of those admitted to hospital, 71% stayed for less than 3 days.

Vulnerable groups

Males have more accidents (59%), and those under 40 have 80% of all accidents. Boys between 5 and 14 are three times more likely to have accidents than girls of the same age.

Trends and summary of evidence

From 1983 to 1996 there has been a decline in the numbers of fatalities from electricity, from over 40 cases in 1983 to 20 or less cases per year in 1993, 1994 and 1995. When the trends from 1983 to 1995 are extrapolated, it is projected that by 2010 there will be a reduction in fatalities from electricity by over 50%. This is likely to be due to the increased use of Residual Current Devices (RCDs) and general improvements in design of equipment, despite the use of more and more electrical devices. The HASS data for non-fatal electric current accidents are combined with cases involving radiation (ie sunburn), and the numbers of non-fatal cases each year are erratic. It is therefore impossible to predict trends from this data. However, it should not be inferred that because there is a decrease in the number of fatalities resulting from increased use of RCDs, that there will be an associated decrease in non-fatal injuries, because a serious electric shock can occur below the current levels at which an RCD will operate.

About half of the non-fatal accidents appear to involve parts of the dwelling, eg, wires or cables (30%), plugs (12%) and light fittings (8%). The remainder involve appliances, lamps and lawnmowers. Of the fatal accidents not associated with plugs, leads and appliances, 50% involve mains wire or cables, 24% sockets, 13% light fittings and 10% a fuse or fuse board.

Where a location is known (62% of cases) most occur in the living or dining room (27%), kitchen (23%) or bedroom (18%). For adults the location is most likely to be the kitchen or the living/dining room; for children the living/dining room or bedroom.

Key References

DTI (1998) “Home accident surveillance system: 22nd annual report”

Raw, GJ, et al (ed) (2001) “Building regulation health and safety” BRE/DETR

DTI "Fatal Electrical Accidents 1979-1985"

DTI (1989) "Electrical Safety"

DTI (1990) "Electric current accidents"

DTI (1997) "Residual Current Devices"

Electrical Hazards
Average Likelihood and Health Outcomes by Persons aged under 5 years, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class I %	Class II %	Class III %	Class IV %	
Houses	Pre 1920	31506	0.00	25.00	50.00	25.00	1
	1920-45	19439	0.00	0.00	60.00	40.00	1
	1946-79	9694	0.37	5.86	35.16	58.61	2
	Post 80	19577	0.00	0.00	75.00	25.00	1
Flats	<46/mixed	240179	100.00	0.00	0.00	0.00	4
	Post 45	17284	0.00	34.23	65.77	0.00	3
	All	**16869.2**	**0.58**	**8.22**	**49.24**	**41.96**	**2**

Basis of estimates

Number of persons aged under 5 years involved in non-fatal accidents during 1997, 98 and 99 in HASS catchment areas, corrected for missing data and loss of cases to other hospitals.

Number of persons aged under 5 years involved in fatal accidents during 1997, 98 and 99 in total sample with housing and population data at postcode level, corrected for missing data.

Number of persons suffering electric shock, electrocution, burn, cardiac fibrillation, convulsion, puncture wound or respiratory paralysis caused by an electric current.

Comment

The sample for postcodes with houses of mixed age and for flats of each age are not sufficiently large to give reliable ratings, many of the flat type/ages recording no fatal or non-fatal electrical accident in the years 1997 to 1999. Consequently, the statistics for just pre war and post war flats are shown, postcodes of mixed age being included in the former. Over the entire stock, there appears little correlation with electrical accidents by young children and the age of their homes, although flats appear to have higher ratings than houses

Entrapment and Collision Hazards

Potential for harm

Collision and entrapment accidents involve trapping body parts in doors and windows (and much more rarely, lifts), and striking objects such as low ceilings, walls, doors and windows. The majority of accidents are non-fatal.

More than 200,000 injuries per year through collisions and entrapments involving doors in dwellings, and nearly 40,000 from collision and entrapment involving windows (1998 HASS data). However, the injuries sustained from window injuries tend to be worse, particularly when the accidents result from cutting and piercing from architectural glass. Nearly 1,000 injuries each year are caused by entrapment and collision involving lifts in domestic accommodation.

The most common type of door accident involves a door shutting on, or trapping, part of a body (39% of door accidents), with hitting or falling against a door being the next most common (37% of accidents).

Vulnerable groups

Most door accidents occur to children aged 9 years and under, and these children are most vulnerable to a door shutting on part of the body. However, accidents involving kicking doors and falling through door glass (15% of door accidents) are most likely to occur to young adults (20 to 29 years).

Children and young adults (15 to 24 years), are most vulnerable to window accidents.

In a study of serious injuries associated with architectural glass in New Zealand, the highest incidence rate (60 per 100,000 per year) was in the 15-24 year old males. The largest category of accidents associated with door glazing (39%) involved young adults (20 –29 years)".

Children and the frail elderly are vulnerable to lift accidents.

Key References

DTI (1998) "Home accident surveillance system: twentieth annual report"

Raw, GJ, et al (ed) (2001) "Building regulation health and safety" BRE/DETR

Tomalin, N (1985) "Analysis of Architectural Glass Accidents" DTI

Entrapment and Collision Hazards Average Likelihoods and Health Outcomes by Persons aged under 5 years, 1997-1999							
Dwelling type & age		**Average likelihood 1 in**	**Spread of health outcomes**				**Average HHSRS scores**
			Class I %	**Class II %**	**Class III %**	**Class IV %**	
Houses	Pre 1920	40	0.00	0.06	4.27	95.67	57
	1920-45	41	0.00	0.11	3.83	96.07	55
	1946-79	31	0.00	0.02	4.04	95.93	71
	Post 80	42	0.00	0.05	4.16	95.79	54
Flats	Pre 1920	76	0.00	0.00	2.78	97.22	24
	1920-45	80	0.00	0.00	2.00	98.00	20
	1946-79	43	0.00	0.12	4.00	95.88	53
	Post 80	32	0.00	0.00	7.60	92.40	100
	All	**39**	**0.00**	**0.06**	**4.06**	**95.89**	**57**

Basis of estimates

Population of persons aged 0 to 4 years in accidents in HASS catchment areas corrected for missing data and loss of cases to other hospitals.

Number of persons of such ages involved in fatal accidents during 1997, 98 and 99 in total sample with housing and population data, corrected for missing data.

Struck by/against or caught, crushed, trapped or pinched in or between moving/stationary object or person, excluding falls, explosions and injury caused by other than building elements, fixtures and fittings.

Comment

There appears little difference in the likelihood of young children suffering non-fatal collision and entrapment accidents in different ages and types of dwelling. The spread of harms, which fall predominantly in Class IV, also shows little correlation with housing characteristics.

Hazards from Structural Failure

Potential for harm

Objects falling from the fabric of a building and as a result causing injury are extremely rare. Potential injuries range from minor bruising to death.

Vulnerable groups

No vulnerable group has been identified.

Trends and summary of evidence

The most common incident is for a fixture (such as a light fitting or kitchen cabinet) falling from the ceiling or wall, because of a combination of poor fixings and vibration. The most common part of the fabric of buildings to fall and injure someone is ceiling plaster. Being hit by chimney pots and roof slates/tiles is much more rare.

Injury due to structural instability and collapse of a building is extremely rare.

Key References

DTI (1998) “Home accident surveillance system: 22nd annual report”

Raw, GJ, et al (ed) (2001) “Building regulation health and safety” BRE/DETR

Hazards from Structural Failure
Average Likelihood and Health Outcomes by Persons of all ages, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class I %	Class II %	Class III %	Class IV %	
Houses	Pre 1920	10825	0.16	0.55	9.33	89.96	1
	1920-45	9010	0.24	0.00	9.62	90.14	1
	1946-79	10440	0.27	0.00	7.47	92.26	1
	Post 80	14701	0.33	0.00	4.46	95.20	0
Flats	Pre 1920	24098	0.57	0.00	22.10	77.34	1
	1920-45	21126	0.00	0.00	0.00	100.00	0
	1946-79	14561	0.73	0.00	4.73	94.54	1
	Post 80	14762	1.02	0.00	16.50	82.48	1
	All	**11170**	**0.28**	**0.13**	**8.17**	**91.43**	**1**

Basis of estimates

Number of persons of all ages involved in non-fatal accidents during 1997, 98 and 99 in HASS catchment areas, corrected for missing data and loss of cases to other hospitals.

Number of persons of all ages involved in fatal accidents during 1997, 98 and 99 in total sample with housing and population data, corrected for missing data.

Number of persons fatally stuck by falling object (including collapse, except due to fire) and non-fatal strikes by moving objects where article is fixed building element or structure.

Comment

There appears to be little relationship between the likelihood and health outcomes of fatalities and injuries caused by structural failure and the type and age of the housing. However, the small sample sizes and the difficulty of distinguishing structural failure in the data may be a problem.

Hazards from Inadequate Lighting

Potential for harm

There are a number of distinct types of injury and illness which can result from inadequate light. These are –

- Depression and psychological effects can result from a lack of natural light or the lack of a window with a view. Increasing numbers of people are disturbed by intrusive artificial external lighting at night.

- Eye strain can result from glare and a lack of adequate light (natural or artificial).

- Flicker caused by certain types of artificial light causes discomfort and may cause photoconvulsive reactions to those susceptible.

There is little quantitative information on the numbers of people affected by the hazard of lighting, particularly those suffering from Class I to III harms. There are in excess of 100,000 people affected by Class IV harms annually.

Inadequate lighting (artificial or natural) can increase the likelihood of an occurrence for other hazards, such as falls associated with stairs or steps. Similarly, glare can affect the sensitivity of the visual system, and can also therefore be a cause building features not to be properly seen. In such cases, lighting should be assessed as a secondary hazard, increasing the likelihood of the primary hazard.

Vulnerable groups

The elderly and those with impaired vision are more likely to be unable to detect potential hazards, where there is inadequate or excessive light. In addition, the vision of the elderly is slow to adjust to changes in light levels.

Key References

DTI, 1998, “Home accident surveillance system: twentieth annual report”

DTI, 1999, “Research on the pattern and trends in home accidents”

Raw, GJ, et al (ed), 2001, “Building regulation health and safety” (2001) BRE/DETR

ODPM, “Lighting in the Countryside: Towards Good Practice” www.detr.gov.uk/planning/litc/03.htm

Jukes GM “Light pollution”, 1996, CIEH, www.cieh.org.uk/about/policy/papers/light.htm

Hazards from Inadequate Lighting

The data available on likelihoods and outcomes since the analyses carried out for Version 1 of the HHSRS were limited. This has meant that it was not possible to produce robust refinement of those original estimates. Therefore, the likelihoods and outcomes given for Version 1 have not been revised.

Hazards from Poor Ergonomics

The literature available on ergonomics provides little information relevant to the HHSRS. While data samples sizes are small, they suggest that the most vulnerable are those aged 60 years or more.

Hazards from Poor Ergonomics
Average Likelihood and Health Outcomes by all Persons aged 60 years or over, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class I %	Class II %	Class III %	Class IV %	
Houses	Pre 1920	11495	0.00	2.56	28.21	69.23	1
	1920-45	11106	0.00	2.70	10.81	86.49	1
	1946-79	12859	0.00	1.52	10.61	87.88	0
	Post 80	17679	0.00	0.00	55.56	44.44	1
Flats	Pre 1920	9074	0.00	0.00	0.00	100.00	0
	1920-45	8443	0.00	0.00	33.33	66.67	1
	1946-79	22883	0.00	0.00	11.11	88.89	0
	Post 80	22421	0.00	0.00	25.00	75.00	0
	All	**12925**	**0.00**	**1.71**	**16.88**	**81.41**	**1**

Basis of estimates

Number of persons aged 60 years or over involved in non-fatal accidents during 1997, 98 and 99 in HASS catchment areas, corrected for missing data and loss of cases to other hospitals.

Number of persons aged 60 years or over involved in fatal accidents during 1997, 98 and 99 in total sample with housing and population data at postcode level, corrected for missing data.

Number of cases of acute over exertion, where the main article involved is a fixed building element, fixture or fitting, such as a fixed kitchen unit.

Comment

The sample sizes are too small to draw any firm conclusions, but there appears to be little or no correlation with instances of over exertion amongst the most vulnerable group and the type and age of the dwelling.

Hazards from Explosions

Potential for harm

There are around 10 deaths per year in dwellings as a result of explosions. It is estimated that there were 508 non-fatal "struck – explosion" accidents in 1998.

A study for the Building Research Establishment between 1985 and 1991 showed that the most frequent causes of explosions were mains gas (42%) and stored gas (17%). Water vapour explosions accounted for 5%, and fire for 4%, of the total recorded explosions.

The health risk to occupants from explosions in buildings is from debris generated by the blast or partial or total collapse of the building.

Vulnerable groups

The low number of cases means that no vulnerable group can be identified.

Trends and summary of evidence

The numbers of fatal and non-fatal accidental injuries from explosions in dwellings is too small to allow the establishment of reliable trends.

Key References

DTI, 1998, "Home accident surveillance system: 22nd annual report"

DTI, 1999, "Research on the pattern and trends in home accidents"

Raw, GJ, et al (ed), 2001, "Building regulation health and safety" (2001)

Hazards from Explosions
Average Likelihood and Health Outcomes by Persons of all ages, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class I %	Class II %	Class III %	Class IV %	
Houses	Pre 1920	139439	11.83	0.00	14.70	73.48	1
	1920-45	295326	22.22	0.00	0.00	77.78	1
	1946-79	123913	5.62	0.00	4.49	89.89	1
	Post 80	134544	3.83	0.00	0.00	96.17	0
Flats	Pre 1920	116270	16.45	0.00	0.00	83.55	1
	1920-45	561344	100.00	0.00	0.00	0.00	2
	1946-79	187231	16.45	0.00	0.00	83.55	1
	Post 80	482054	100.00	0.00	0.00	0.00	2
	All	**156528**	**11.19**	**0.00**	**5.40**	**83.41**	**1**

Basis of estimates

Number of persons of all ages involved in non-fatal accidents during 1997, 98 and 99 in HASS catchment areas, corrected for missing data and loss of cases to other hospitals.

Number of persons of all ages involved in fatal accidents during 1997, 98 and 99 in total sample with housing and population data, corrected for missing data.

Number of persons killed by accident caused by explosion of pressure vessel or gases or injured by blast/objects from explosion.

Comment

The sample sizes are too small to draw any firm conclusions from the figures. For example, the relative high average rating for post 1980 flats could be due to an extreme incident in a single dwelling. What is clear, is that over the whole housing stock, the likelihood of the risk of explosions is extremely small. However, the outcomes from an explosion are severe

Hazards from Uncombusted Fuel Gas

Potential for harm

Spillage of fuel gas causes asphyxiation. According the HASS data, in 1996 there were 60 non-fatal asphyxiation accidents that may be attributable to this hazard, and none that were fatal. However, other sources, including Hospital Episode Statistics, suggest there may be around 7 fatalities per annum. Of the 60 non-fatal accidents, 50 did not result in in-patient admission. This is therefore a very rare cause of home accidental injury.

Vulnerable groups

Although there is no evidence that one group is more at risk than any other, theoretically, children, the elderly (particularly those with respiratory problems) and pregnant women may be more vulnerable than others.

Key References

DTI (1998) "Home accident surveillance system: twenty second annual report"

DTI (1999) "Research on the pattern and trends in home accidents"

Hazards from Uncombusted Fuel Gas
Average Likelihood and Health Outcomes for Persons of all ages

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class I %	Class II %	Class III %	Class IV %	
Non HMOs	Pre 1920	48,807	0.25	0.00	48.36	51.39	0.4
	1920-45	117,830	3.06	0.00	24.24	72.70	0.3
	1946-79	103,618	0.51	0.00	38.93	60.56	0.2
	Post 80	181,609	5.88	0.00	75.30	18.82	0.5
HMOs	Pre 1920	58,411	0.28	0.00	24.93	74.79	0.2
	1920-45	2,395,541	100.00	0.00	0.00	0.00	0.4
	1946-79	53,065	0.20	9.98	39.92	49.90	0.5
	Post 80	201,933	4.69	0.00	95.31	0.00	0.4
	All	**83,784**	**1.15**	**2.32**	**41.38**	**55.15**	**0.3**

Basis of estimates

Number of persons of all ages involved in non-fatal accidents during 1997, 98 and 99 in HASS catchment areas, corrected for missing data and loss of cases to other hospitals. Number of persons of all ages involved in fatal accidents during 1997, 98 and 99 in total sample with housing and population data, corrected for missing data.

Number of accidental deaths and injuries due to gas poisoning, specifically excluding those arising from carbon monoxide, smoke/fumes or gas from an uncontrolled fire.

Comment

Due to the small sample sizes, the breakdown by housing type has been undertaken for all persons, although the very young and older persons are confirmed to be the most vulnerable groups. However, the table still does not show any clear relationship between the risk of an accident involving uncombusted fuel gas and the age and type of property.

Fire Hazards

Potential for harm

Dwelling fires account for one-third of all property fires, but two-thirds of all casualties occur in the home. The majority of fires are accidental (81% in 1999).

Of all fatal home accidents 11% are the result of uncontrolled fires, mainly house fires, but this percentage also includes burns from clothing fires (for example, those which might have been ignited by a gas cooker), which fall under the hazard category “hot surfaces and materials”. Burns resulting from exposure to the hazard of fire (ie, uncontrolled house fires), result in the majority of deaths from burns, whereas, the great majority of non-fatal home accidents resulting in burning and scalding occur under the “hot surfaces and materials” hazard category.

In 2000 accidents whilst cooking accounted for 59% of all fires in the home; accidents involving electrical appliances accounted for 6% of fires, and other electrical accidents accounted for 4% of fires; heating fires (eg, chimney fires, things being left too close to heaters) accounted for 9% of home fires. 66% of domestic fires started in the kitchen, 15% in the lounge/dining room, and 4% in the bedroom.

The level of harm suffered is influenced by the presence or absence of fire detection and alarm system. In 2000, 65% of households who had a fire reported having a smoke alarm installed at the time of the ‘last’ fire.

Vulnerable groups

People in the oldest age group (80 and over) have the highest rate of deaths per million population, and 36% of fire deaths are to people 65+. Death rates were also higher than average for children aged four or under.

Single person households are least likely to own a smoke alarm.

Trends and summary of evidence

3% of households in England and Wales experienced a fire in 1999. The equivalent figure was 3.4% in 1995 and 3.9% in 1993. It is estimated that 89 per cent of all fires do not result in any injury (BCS, 2001).

Home Office fire statistics showed a steady downward trend of 4% per year in numbers of deaths resulting from fire over the years 1985 to 1995. However, the number of fatal casualties from accidental fires in dwellings increased from 1995 to 1996, remained unchanged in 1997 and dropped in 1998.

Numbers of non-fatal casualties from fire from 1985 to 1995 show an upward trend of 3.5% per year, and the upward trend continued to 1998.

The most common injuries are due to smoke inhalation but other than fatalities the information available does not help distinguish between classes of harm. It would seem that about 40% of outcomes would be Class IV (shock only and check up). The elderly are more vulnerable as there is a sharp increase in disability for those over 70 years of age. The main sources of ignition for accidental fires with casualties is cooking appliances and most fires with casualties start in the kitchen/cooking area and cooking appliances account for over half non-fatal casualties in accidental dwelling fires.

The use of solid fuel as the main fuel lead to higher likelihood of fire.

Flats are more likely to have a fire than houses, and dwellings constructed after 1980 have a lower likelihood of fire.

There has been a marked increase in residential fires due to candles in recent years, which is proportional to the increasing number of candle sales. In 2000 candles were the cause of 5% of domestic fires.

The Furniture & Furnishings (Fire) (Safety) Regulations 1988 have saved at least 710 lives following their introduction to 1997, because upholstered furniture complying with the Regulations did not catch fire. In addition, where a fire started in another item but involved upholstered furniture in the house, furniture complying with the Regulations will not catch fire as quickly as non-compliant furniture, thus allowing occupants more time to escape from a fire. This is particularly relevant where smoke alarms detect the fire early. These additional benefits could mean that the actual number of lives saved could be as high as 1,860 in the period from 1988 to 1997. There is a similarly marked decrease in the number of injuries resulting from furniture associated fires as there is with fatal fires (5,770 fewer people were injured in fires as a result of the Regulations between 1988 and 1997).

The more widespread introduction of Residual Current Devices (RCD's) in UK homes is expected to have only limited impact on the incidence of domestic fires, because they will only prevent fires associated with electrical faults where surface tracking across insulation is a cause of fire ignition (only one of a range of conditions in wiring and electrical equipment which causes fires).

Key References

Aust, R (2001) "Fires in the home: findings from the 2000 British Crime Survey" DTLR

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DTI (1999) "Research on the pattern and trends in home accidents"

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Cox, SJ, Cheyne, A, Walker, D, and Wenham, D (1999) "Building Regulations and Fire Safety", prepared for Centre for Fire Protection Systems, FRS

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Raw, GJ, et al (ed) (2001) “Building regulation health and safety” BRE/DETR

DTI/Home Office (2000) “The Safety and Use of Tea Lights and Candles”

DTI (1999) “Electric blanket fires and related injuries”

DTI (2000) “Effectiveness of the Furniture & Furnishings (Fire) (Safety) Regulations 1988”

DTI (1997) “Residual Current Devices” (1997)

DTI (1993) “Upholstered furniture fires: European Study”

Fire Hazards
Average Likelihood and Health Outcomes for all Persons aged 60 years or over, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class I %	Class II %	Class III %	Class IV %	
Houses	Pre 1920	4496	8.70	3.17	35.41	52.72	23
	1920-45	6248	10.22	5.12	15.59	69.07	18
	1946-79	6341	5.36	4.31	31.79	58.54	11
	Post 80	5701	5.67	0.00	32.83	61.51	12
Flats	Pre 1920	1681	7.30	0.00	51.49	41.21	53
	1920-45	3372	10.98	0.00	14.84	74.19	34
	1946-79	2729	6.04	0.00	26.48	67.48	25
	Post 80	2157	3.08	0.00	17.19	79.73	17
	All	**4760**	**6.96**	**2.58**	**29.14**	**61.32**	**17**

Basis of estimates

Number of persons aged 60 years or over involved in non-fatal fires during 1997, 98 and 99 in HASS catchment areas, corrected for missing data and loss of cases to other hospitals.

Number of persons aged 60 years or over involved in fatal fires during 1997, 98 and 99 in the total sample with housing and population data at postcode level, corrected for missing data.

Number of fires attended by Fire Brigade where there was a fatality, casualty or person rescued, plus number of unattended fires recorded by HASS as ‘any injury from uncontrolled fire/flames’ .

Comment

Although still relatively low, the likelihood of a fire causing death or injury to the vulnerable group is significantly higher in flats than in houses. In both flats and houses, older dwellings have a greater proportion of fatal fires and the average HHSRS score also generally increases with the age of the property.

The highest average rating score is for flats built before 1920, the majority of which are conversions. These have an average score well over four times greater than that for post 1979/80 houses, the latter having the lowest score.

Hazards from Entry by Intruders

Potential for harm

The 1998 BCS had estimated that 9.6% of households were the victims of an attempted burglary in the period 1993 to 1997, and 12.1% were the victims of burglary with loss in that period. Between 1997 and 1999 burglary fell by 21%. The 2000 BCS estimates that there were a total of 1,284,000 burglaries against domestic premises in 1999. Around four in ten (532,000) were attempted burglaries in which entry was not gained.

Offenders use violence in about 9% of burglaries, although in many incidents involving violence the offender had some prior relationship with the victim. Most harm is emotional stress. Some 34% of victims of burglary experienced loss of sleep, and 42% experienced shock.

In the 12 months to March 2001 there were 3,057recorded cases of aggravated burglary.

Vulnerable groups

Households most at risk are those with a head of household aged between 16 and 24 (15.2%), where one adult lives alone with children (11.2%), head of household's single (9.7%) divorced (7.7%) or separated (9.1%). Socio-economic circumstances are also related to the risk of burglary. It has been found that whilst elderly people may be more fearful of walking on the streets after dark, they are less anxious about burglary than other age groups.

Generally economically disadvantaged households are at a higher risk. Also at high risk are flats (7.2%) or terraced properties (6.6%). However when modified for other factors such as location, detached houses are at higher risk than other types of housing.

Only 6% of all burglaries involved the use of false pretences to gain access but this increased to 13% among households headed by someone aged 60 or over.

Those who are already in poor health have heightened levels of anxiety about entry by intruders.

Trends and summary of evidence

Crime and fear of crime have become areas of national social concern. On average 4.3% of households in England and Wales experienced at least one burglary in the year 1999. The level of crime has been most marked in residential areas particularly social housing with over 93% of crimes being property offences.

Recorded crime for the 12 months to March 2001 shows 399,927 burglaries in dwellings and 3,057 aggravated burglaries in dwellings.

In the majority of successful burglaries some force was used to effect entry. The risk of entry increases with declining levels of security, the use of window locks or deadlocks reduce risk of an occurrence considerably, and burglar alarms, security lights or window grilles have even lower risks.

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BS: PAS 23-1: 1999 General performance requirements for door assemblies. Part 1, single leaf external door assemblies

BS: PAS 24-1: 1999 Enhanced security performance requirements for door assemblies. Part 1 single leaf, external door assemblies

BS: 7950 Specification for enhanced security performance of casements, tilt/turn windows for domestic applications

BS 4873: 1986 Specification for aluminium windows

BS 7412:1991 Specification for plastic windows made from PVC-U extruded hollow profiles

BS 644-1: 1989 Wood windows. Specification for factory assembled windows – various types

BWF:TWAS Timber window accreditation scheme

BS 6510:1984 Specification for steel windows, sills, window boards & doors

BS 3621: 1998 Specification for thief resistant locks

Hazards from Entry by Intruders
Average Likelihood and Health Outcomes for all Person, 1999-2000

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class I %	Class II %	Class III %	Class IV %	
Houses		40	0.0	0.1	10.0	90.0	100
Flats	Council	8	0.0	0.1	10.0	90.0	500
	HMOS	12	0.0	0.1	10.0	90.0	333

Basis of estimates

Data for entry by intruders from the British Crime Survey (BCS) is not available at the post-code level. It is possible, however, to calculate the average likelihood of an occurrence for all dwellings and for areas of housing.

Nor does the BCS give data for aggravated burglary (ie, burglary which includes some physical injury to an occupier) and gives no information to indicate where any harm results from entry by an intruder.

The spread of health outcomes given above are those used for Version 1 of the HHSRS. (NB – For Version I the base was all dwellings with insecure doors and windows.) This assumes that for all entry there is some harm.

Information from the Home Office on recorded crime shows there is an ratio of between 147:1 and 131:1 burglaries to aggravated burglaries (1999-00 and 2000-01 respectively). The Table below shows the average likelihood of aggravated burglaries.

Average likelihoods of aggravated burglary

All dwellings	1 in 5,556
Areas of council flats, greatest hardship and high proportion of lone parents	1 in 1,000
Multi-occupied houses in multi-ethnic low income areas	1 in 1,667

Unfortunately, there appears to be no information from which the spread of health outcomes from aggravated burglaries can be calculated.

Hazards from Excess Cold

Potential for harm

A comfortable indoor temperature is around 21 degrees Celsius. Below 18 degrees Celsius there begins to be some discomfort, and risk of adverse effects – respiratory infections, bronchitis, heart attacks, stroke. Below 10 degrees Celsius the risk of hypothermia becomes appreciable, especially for the elderly.

The range of health effects from exposure to cold are from death, through cardio-respiratory disease to respiratory ailments

There are approximately 40,000 more deaths between December and March than expected from the death rates in other months of the year. This seasonal fluctuation is greatest for cardiovascular and respiratory mortality, is larger in Britain than in many other countries of continental Europe and Scandinavia, and is largely explained by changes in ambient (outdoor) temperature. But seasonal infections, and changes in behavioural patterns, air pollution levels and micro-nutrient intake may also account for some of the seasonal pattern.

Indoor temperature is a function both of dwelling characteristics and the household - especially household income. It is difficult to separate the importance of dwelling characteristics – energy efficiency and the effectiveness of the heating system – from personal and behavioural factors. Some families maintain a low indoor temperature from choice, others do so from financial necessity, and yet others do so because the heating and insulation are simply inadequate.

Vulnerable groups

Excess winter death is observable in all age groups and in residents of all types and ages of dwelling. The proximate dwelling-related determinant of risk can be assumed to be indoor temperature, and the ability to maintain a comfortable indoor environment even when the outdoor temperatures fall.

However, the most vulnerable group is the elderly, especially those on low income who are least able to heat the dwelling to a comfortable temperature during periods of cold. This is particular so if the dwelling has poor thermal efficiency.

Trends and Summary of Evidence

The extent to which housing contributes to the large seasonal swing in mortality is not clearly known, but there has been recent work in England based on linkage of mortality statistics to the 1991 English House Conditions Survey. This research found that the magnitude of the winter excess was greater in people living in dwellings that appear to be poorly heated. The percentage rise in deaths in winter was greater in dwellings with low energy efficiency ratings, and in dwellings predicted to have low indoor temperatures during periods of cold. There was a gradient of risk with age of the property, the risk being greatest in dwellings built before 1850, and lowest in the more energy efficient dwellings built after 1980. Absence of central heating and dissatisfaction with the heating system also showed some association with increased risk of excess winter death.

This evidence suggests that vulnerability to low outdoor temperatures is in part determined by the characteristics of the dwelling. This finding is consistent with current knowledge about indoor environments in winter and our understanding of the physiological effects of exposure to cold. It may also offer a part explanation for Britain's apparently high excess winter mortality. Compared with many north European countries British housing has low thermal efficiency, and thus offers poorer protection against cold. However, other factors are also important, such as behaviour, which determine vulnerability.

There is less evidence regarding the relationship between housing characteristics and health impacts other than mortality. It is very probable, however, that the findings in relationship to cold-related mortality can be extended in broad terms to cardio-respiratory morbidity and health related quality of life. Emergency hospitals admissions do not show the same degree of seasonal fluctuation as mortality does, which is likely to reflect the fact that social and operational factors influence admission probabilities. There is little doubt that as hospitals fill up in winter, so the threshold for admission rises and this blunts the rise in admissions that would otherwise occur. Evidence so far from our own (unpublished) analyses does not show the same association between thermal efficiency of dwellings and hospital admission as was seen for mortality.

Further evidence on the relationship between home heating and a range of health outcomes, including symptom levels, primary care consultations and quality of life, will come from the national evaluation of the government's Home Energy Efficiency Scheme (*Warm Front)*, which is being conducted over the next two years.

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Hazards from Excess Cold
Average Likelihood and Health Outcomes for all Persons aged 65 years and over, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class I %	Class II %	Class III %	Class IV %	
Non HMOs	Pre 1920	330	34	6	18	42	1,066
	1920-45	340	34	6	18	42	1,035
	1946-79	400	34	6	18	42	880
	Post 80	530	34	6	18	42	664
HMOs	Pre 1920	340	34	6	18	42	1,000
	1920-45	290	34	6	18	42	1,035
	1946-79	370	34	6	18	42	951
	Post 80	350	34	6	18	42	1,005
	All	**380**	**34**	**6**	**18**	**42**	**926**

Basis of estimates

Class I harm for this hazard comprises cold-/winter-related mortality. For the calculations, this has been expressed as a proportion of all deaths in the year as a whole. The quoted baseline event rate for Class I is therefore the total annual rate of all deaths in the 65+ age-group. In this age-group the death rate in winter is around 25% greater than it is in summer, a winter excess that is equivalent to around 8% of all deaths in the year.

Classes II and III include cardiovascular and respiratory illness serious enough to lead to hospital admission. As with mortality, the baseline is the rate of emergency admissions in the year as a whole calculated from Hospital Episode Statistics data for England, 1996/97 to 1999/00. The attributable Class II & III harms are calculated as a proportion of these annual totals. Data on new GP consultations in the 65+ age-group provided the information for Class IV harms, estimated from the General Practice Research Database figures, and those of the Fourth Morbidity Survey in General Practice. Also included were pneumonia, of chronic obstructive lung disease (including asthma), ischaemic heart disease and stroke.

The relative risks were taken from research that examined mortality patterns in relation to the 1991 EHCS, and from extensions of this work undertaken for this project.

Comment

There appears to be a continuous relationship between indoor temperature and vulnerability to cold-related deaths — the colder the home, the greater the risk. Thus, the assumption that no cold-related deaths occur in houses which achieve a 18°C hall temperature when external temperature falls to 5°C is probably conservative.

The high risk scores associated with cold homes are in part related to the very high underlying risk of death in the vulnerable group (about 5% per year). This translates into a large attributable risk of death, even though the relative risk in relation to cold homes is small (1.03 or a 3% excess).

Hazards from Radiation

Potential for harm

Radon is a naturally-occurring, radioactive, noble gas formed as part of the decay chain of uranium-238. It readily diffuses through air and is soluble in water. It is present in small quantities in soil and rock, and can accumulate in enclosed structures, including buildings.

The health hazards from radon are well characterized. They have been extensively reviewed by the National Academy of Sciences in the US, and in the UK they remain under the review of the Sub-Group on Radon Epidemiology of the Advisory Group on Ionizing Radiation (AGIR).

The potential health effects include death from lung or other cancers and non-fatal cancer incidence. The hazard derives from the short-lived and chemically reactive isotopes of polonium, lead, and bismuth that are its daughter products. When inhaled or formed inside the lungs, these isotopes increase the risk of lung cancer. After smoking, radon and its radioactive progeny are thought to be the most important risk factor for lung cancer in Britain. Other organs may also be targeted by radon through ingestion and skin contact. Malignancies resulting from these exposures may include leukemia (acute lymphatic leukemia in children) and skin cancer.

Although not often thought of as major public concern, the risk estimates suggest that around one in 20 cases of lung cancer in the UK can be attributed to residential radon exposure, and this figure will be higher in some areas.

Vulnerable groups

The elderly (those over 60 years) with long/lifetime exposure to radon are the most vulnerable. Smoking increases the vulnerability.

Trends and summary of evidence

Epidemiological evidence for the health effects of the inhalation of radon derives mainly from extrapolation from the results of studies of high dose occupational exposures among uranium miners, but there have also been case-control and ecological studies of residential populations. As yet, studies of residential exposure to low dose radon have not provided conclusive results. They are broadly consistent however, with modelling-based extrapolations from the studies of miners.

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Hazards from Radiation
Average Likelihood and Health Outcomes for all Persons aged 60-64 years, following lifetime exposure to Radon

Measured Radon Level Bq.m-£	Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
		Class I %	Class II %	Class III %	Class IV %	
800	277	90	10	0	0	3,285
400	518	90	10	0	0	1,757
200	1,000	90	10	0	0	910
150	1,322	90	10	0	0	688
100	1,961	90	10	0	0	464
50	3,902	90	10	0	0	233
25	7,853	90	10	0	0	116

Basis of estimates

Calculations of excess annual risk of lung cancer are based on the models presented in the BEIR VI report[8]. This contains tabulations of lifetime relative risks of lung cancer against lifetime indoor exposure to radon. It should be noted therefore, that the basis for the Hazard Score calculations for Radon is different from that for most other hazards because it is this lifetime exposure that is used. In the above table, the likelihood is still for the average annual risk, but only refers to persons aged 60 to 64 years who have already had a lifetime exposure to radon.

8 *Biological Effects of Ionizing Radiation (BEIR) VI Report: "The Health Effects of Exposure to Indoor Radon"*. Washington, DC: National Academy Press. 1998.

It should also be noted that, using the 75-79 age-group for the calculations would have a markedly increase the Hazard Scores as the lung cancer risk rises with age and duration of exposure.

Comment

The average exposures of miners in the epidemiological studies are approximately an order of magnitude greater than those from indoor exposure. Extrapolation from the (more definitive) occupational studies to lower exposure levels therefore entails uncertain assumptions about the shape of the exposure-response relationships.

There is also some inconsistency between the results of case-control and ecological studies of residential exposure

There is appreciably variation in excess risk of radon-related lung cancer with smoking status, age and gender[9]. In particular, smokers have a substantially greater excess risk than non-smokers (even though the model is thought to be 'sub-multiplicative'). If the high risk group were defined to be smokers, the hazard sores would be appreciably larger.

9 See Report Volume III – Technical Appendix for further details.

Hazards from Damp, Mould Growth Etc

Potential for harm

Damp and mould growth in the home have been consistently linked to a number of health outcomes. These include nausea and vomiting and general ill health as well as respiratory illness. Humidity in the dwelling can cause condensation which encourages the growth of fungal spores. Damp is also associated with an increase in house dust mites. Both of these are known allergens. This suggests that there is a causal link between respiratory disease, in particular asthma, and exposure to damp and mould. In addition there is an observed dose response relationship noted with this finding: asthma severity increasing with increasing levels of damp and mould in the home.

House dust mites can trigger allergic reactions. There is an observed dose-response rate between increasing mite levels and the severity of asthma. There is a consistent and significant relationship found between respiratory symptoms and damp and mould in dwellings. Whether this is an exacerbation of existing disease or the initiation of new disease is as yet unclear.

The health affects include from death from respiratory causes (rare), asthma, respiratory disease, rhinitis, cough, and wheeze.

Vulnerable groups

Symptoms have been found both in children and adults, but the most vulnerable groups are young children, the elderly and allergy suffers including the immuno-compromised.

This assessment uses children 0-14 as the most vulnerable group.

Trends and summary of evidence

Housing that is damp and prone to condensation tends to be associated with poor maintenance of the dwelling and with the socio-economic deprivation of the householder.

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Hazards from Damp, Mould Growth Etc
Average Likelihood and Health Outcomes for all Persons aged 14 years or under, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class I %	Class II %	Class III %	Class IV %	
Non HMOs	Pre 1920	446	0	1	10	89	11
	1920-45	400	0	1	10	89	12
	1946-79	446	0	1	10	89	11
	Post 80	725	0	1	10	89	7
HMOs	Pre 1920	430	0	1	10	89	11
	1920-45	219	0	1	10	89	22
	1946-79	967	0	1	10	89	5
	Post 80	644	0	1	10	89	8
	All	**464**	**0**	**1**	**10**	**89**	**11**

Basis of estimates

Class I harms were calculated from the mortality statistics for England and Wales for respiratory disease in children aged 0-14. Harm Class II and III were calculated under the same criteria from the from HES data. Class IV harm was taken from GP consultation rates for cough and wheeze.

Comments

There is some suggestion that post 1980 houses are also at risk from damp and mould due to sealed double glazing and a reduction in ventilation rates, more research is currently being undertaken in this area.

Hazards from Carbon Monoxide

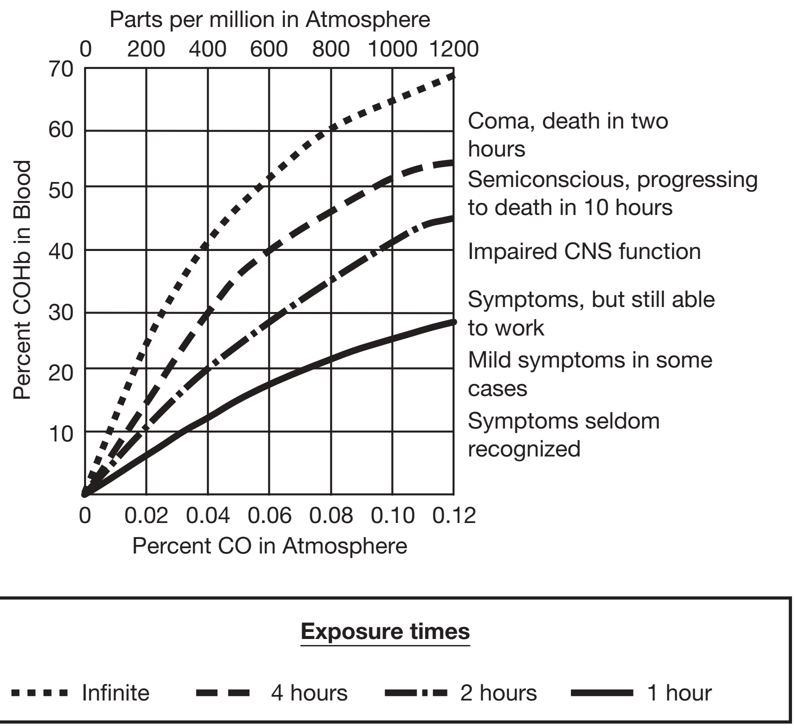
Potential for harm

Carbon monoxide (CO) is a colourless, odourless gas formed by the incomplete combustion of carbon fuels. If inhaled, it binds with high affinity to haemoglobin forming carboxy-haemoglobin (CO-Hb). This reaction is slow to reverse, and the formation of CO-Hb reduces the oxygen-carrying capacity of the blood. This reduction in oxygen transport make account for many of the pathophysiological effects of CO poisoning.

The health effects have been extensively reviewed by the MRC Institute for Environment and Health. As shown in Figure 1, the level of health effects depend on the concentration of CO to which the individual is exposed, together with the duration of exposure. At high concentrations CO can cause unconsciousness and death in minutes. At lower concentrations it causes a range of symptoms from headaches, dizziness, weakness, nausea, confusion, and disorientation, to fatigue – symptoms which are sometimes confused with influenza. In people with ischaemic heart disease it can result in episodes of increased chest pain.

The total burden of acute CO poisoning is uncertain because a proportion of non-fatal cases are unrecognised. It is likely that CO toxicity contributes to a small but unattributed number of deaths and acute episodes of cardiovascular disease.

Figure 1. Health impacts of CO exposure as a function of exposure time and ambient concentration



Source: Feldman RG. Carbon monoxide.

Vulnerable groups

Those most vulnerable to CO exposure include unborn children, infants, the elderly and people with anaemia or a history of heart or lung disease.

The highest rate of deaths from CO poisoning occurs in older age-groups, especially in people aged 75+ years. This may be for several reasons, including the increasing prevalence of cardio-vascular illness and neurological decline at older ages, and the fact that the elderly tend to spend a high proportion of their time at home indoors.

Those with established coronary or cerebro-vascular disease are likely to suffer more frequent ischaemic episodes, whether symptomatic or asymptomatic, although experimental clinical studies have not provided conclusive evidence of change in exercise capacity, cardiac rhythm disturbance or myocardial ischaemia.

Trends and summary of evidence

Use of a gas cooking range increases the ambient CO by about 2.9 mg/m ^{3} (2.5 ppm). In dwellings with faulty or unvented combustion appliances, ambient levels can exceed 110 mg carbon monoxide/m^3 (100 ppm), leading to carboxyhaemoglobin levels in excess of 10% with continued exposure. At these very high levels, numerous studies suggest that clinical impairment of cognitive and motor function occur.

The reported figures are that around 60 CO-related fatalities occur per year; perhaps five times this number of non-fatal cases occur.

It is less clear, however, what effects occur from long-term exposure to much lower (but above normal) concentrations of CO. Many of the reported symptoms (physical, cognitive, emotional and visual) appear to be related to the central nervous system. Nonetheless, there have been repeated indications of persistent neurological sequelae which, pathologically, may reflect damage to both gray and white matter of the nervous system. Neurological signs may be absent but impairment of attention, short-term memory, and executive functioning have been reported following detailed neuropsychological testing.

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Hazards from Carbon Monoxide
Average Likelihood and Health Outcomes for all Persons aged 65 years and over, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class I %	Class II %	Class III %	Class IV %	
Non HMOs	Pre 1920	1,150	0	0	2	98	1
	1920-45	1,080	0	0	2	98	1
	1946-79	870	0	0	2	98	2
	Post 80	-	0	0	2	98	-
HMOs	Pre 1920	1,410	0	0	2	98	1
	1920-45	1,160	0	0	2	98	1
	1946-79	630	0	0	2	98	2
	Post 80	-	0	0	2	98	-
	All	**1,250**	**0**	**0**	**2**	**98**	**1**

Basis of estimates

As with several of the home hazards, data allow only very approximate estimation of the risks associated with acute and chronic CO poisoning.

Data on reported CO-related deaths in the target age-group (65+ years) was used to calculate Class I harms. Although the reported number is very probably a significant under-estimate, there are no data on which to base any upward correction. However, it has been assumed that all these deaths are concentrated in the 4 or 5% of dwellings which are estimated to have inadequate maintenance of combustion appliances. Thus the attributable rate of CO poisoning in such dwellings was taken to be 25 times that of the national average rate for the relevant age-group.

With regard to Class II & III harms, there is almost no direct evidence on their frequency of occurrence. However, rather than omit a probable significant health impact , first the emergency hospital admission rates for cardio-respiratory diseases in those aged 65+ were estimated, assigning 25% to Class II, 50% to Class III and the remainder to Class IV. Then, 4% of these rates was taken to be the number from dwellings where there would be evidence of poorly maintained appliances or defective ventilation. Of these, it was assumed that 10% may have had their emergency admission precipitated or exacerbated by elevated CO levels.

Neuropsychological impairment from CO exposure (Class IV) remains controversial and again does not have clear data on frequency. As an indicative guide, it was assumed that 5% of people in dwellings with poor combustion appliances/ventilation have some adverse consequence from their chronic low-level CO exposure.

Comment

The figure of 4% was taken to represent the proportion of dwellings where there is evidence of a potential problem with one or more combustion appliance, and concentrated all CO-related events to such dwellings. This was on the basis that where there is no evidence of defect with a combustion appliance there is no excess risk.

There remains much uncertainty about the true frequency of CO-related adverse health events (mortality, hospital admission) because there is suspicion that a substantial proportion go unrecognized or unreported. Any under-recording in mortality (Class I harm) or more serious hospital admissions (Classes II & III) will have a comparatively large impact on the hazard score.

Hazards associated with Noise

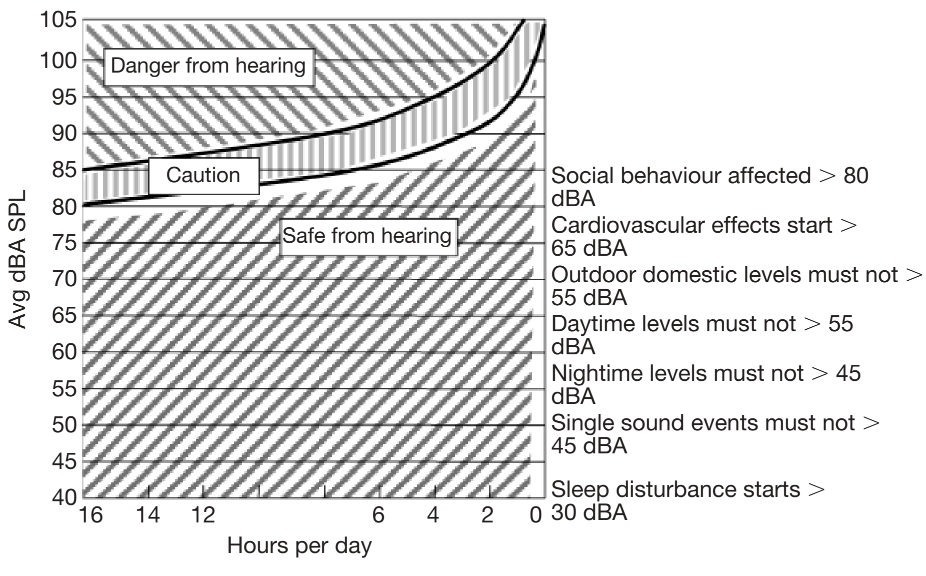
Potential for harm

Noise is more of a cause of stress or disturbance than a cause of specific pathology. It is suggested that noise causes disturbances of activities and communication resulting in annoyance and then stress responses. In turn these may lead to symptoms and, possibly, overt illness. There is uncertainty about the non-auditory effects of noise, that is the effects on health and well-being that are caused by exposure to noise, excluding effects on the hearing organ and communication problems; masking auditory information.

There is some evidence of correlation between noise and stress related outcomes including raised blood pressure and altered blood constituents. Headaches anxiety and irritability are also associated with noise, and the effects of sleep disturbance may affect the mood the following day.

The effects of continuous noise are generally small and complex, short exposure to noise may result in arousal, perhaps due to increased levels of nor-adrenaline. Intermittent noises result in impairments related to timing of changes in encoding or timing. Low frequency noise can reduce alertness resulting in lapses of concentration. There is weak evidence of association of noise disturbance with ischaemic heart disease. Most studies are occupational, where exposure is higher and lasts much longer than would be expected in a domestic setting, for example, exposures to high noise levels of more than 85dB(A) for 20 to 25 years or to very high levels of greater than 95dB(A) for five years. It is difficult to assess at what point the individual's blood pressure began to increase. Daily exposure over a long time period (5-25 years) would probably be required before blood pressure and other cardiovascular effects are manifested as a diseased state.

Outcomes include suicide, assault due to aggravation over noise, psycho-physiological effects, sleep disturbance, reduced performance, and hypertension. Hearing loss caused by noise in dwellings is unlikely.



Health effects associated with different noise levels.
Source: Amalgamation of information from CDC, OSHA, WHO and DEFRA [Centres for Disease Contol and Prevention, 1998 #663][DEFRA, 1998 #661][OSHA, 1995 #662][WHO, 2001 #594]

Vulnerable groups

Elderly, individuals with pre-disposition to common anxiety disorders and children are the most vulnerable.

Trends and summary of evidence

Noise in the home is a common complaint; a national noise attitude survey found that one in three people said that environmental noise disturbed their home lives to some extent.

People vary greatly in their sensitivity and tolerance to noise, tolerance may in part be determined by age, sex, working status, lifestyle and personality. While noise levels can be measured, people differ in what sources of noise they find offensive. Noises likely to be tolerated are from neighbours in the daytime, some traffic noise and deliveries of milk, post and newspapers. Unlikely to be tolerated are usually loud and continuous noises which seems to go on indefinitely, noises thought to be unnecessary or inconsiderate, noises with uncertain sources, especially at night. Emotive and frightening noises shouting and violent rows are badly tolerated. Men tend to respond to noise with outwardly directed aggression, describing their feelings as annoyance, aggravation, bitterness and anger. Women tended to suppress their reactions to noise and direct them inwards, saying that they were tense, fraught or anxious.

More residents of renting tenures found noise to be a serious problem than did owner occupied households. Of those in flats, 26.3% reported noise to be a problem and 11.4% a serious problem; the percentages for terraced houses were 20.8% and 6.4% respectively. Lone parents and large adult households tended to perceive noise as a serious problem as did black, Pakistani or Bangladeshi groups.

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Hazards associated with Noise Average Likelihood and Health Outcomes for all Persons, 1997-1999							
Dwelling type & age		**Average likelihood 1 in**	**Spread of health outcomes**				**Average HHSRS scores**
			Class I %	**Class II %**	**Class III %**	**Class IV %**	
Non HMOs	Pre 1920	760	0	1	9	90	6
	1920-45	870	0	1	9	90	5
	1946-79	940	0	1	9	90	5
	Post 80	940	0	1	9	90	5
HMOs	Pre 1920	620	0	1	9	90	7
	1920-45	670	0	1	9	90	7
	1946-79	840	0	1	9	90	5
	Post 80	2,070	0	1	9	90	2
	All	**900**	**0**	**1**	**9**	**90**	**6**

Basis of estimates

It is difficult to estimate attribute risks attributable to noise. The data that is required to characterise Class IV harms, such as sleep disturbance or psychological effects are not simply obtained from routine databases. For Harm Classes I, II and III there are specific ICD-10 codes that relate to the psychological effects of noise. This potentially allows an examination of Class II and III harms associated with hospital admissions and mortality from suicide. It is unclear, however, how well these figures reflect the true risks from noise as patients may be admitted (or die) under other more general diagnosis codes leading to a dilution of effect. The other reported health outcomes are difficult to separate from the background levels.

For Class IV, it has been assumed that around 5% of the population have some evidence of common mental disorder, and that, of these, one in twenty of such people are adversely affected by noise.

Comment

There is uncertainty about the non-auditory effects of noise. Annoyance, sleep disturbance, ischaemic heart disease and altered performance of school children have all been linked with an increase in environmental noise. The data on other outcomes linked with environmental noise such as low birth-weight and psychiatric disorders are inconclusive.

The lack of evidence of low level health effects prevents a more thorough risk calculation. Noise is a significant reported nuisance and affects many dwellings and individuals within those dwellings. Many of the effects of noise are individual and related to factors outside the domain of the structure of the dwelling such as stress and susceptibility to noise. Further studies at an individual level would add to the evidence of low level effects of noise.

Hazards from Asbestos and Man-Made Mineral Fibres

Potential for harm

Asbestos

The adverse health effects from the inhalation of asbestos fibres include Interstitial lung fibrosis (asbestosis), Pleural disease (pleural plaques and fibrosis), Lung cancer and Mesothelioma (malignancy of the pleura, the lining around the lung). There is also evidence that asbestos exposure is associated with increased risk of intestinal tract cancers and altered cell-mediated immunity.

While here have been reports of asbestos-related diseases in association with domestic exposure or occupancy of dwellings with asbestos-containing materials, most of the understanding of asbestos-related health risks stems from occupational exposure to asbestos. Estimates of risks to occupants of asbestos-containing dwellings are thus largely based on extrapolations from the results of these high-exposure studies.

It is assumed that dwelling-related exposures are too low to give rise to asbestosis. While pleural plaques are not in themselves harmful, but they are included because, if discovered, they may cause significant anxiety about the risk of more serious asbestos-related conditions.

Man-Made Mineral Fibres

Man-made Mineral Fibres (MMMF) appear to have substantially lower biological toxicity than asbestos, which may reflect differences in their physico-chemical properties. As the fibres tend to be larger but shorter than those of asbestos they have lower penetration into the lung. They are also more soluble and they have much lower bio-persistence (a biological half-life of days to months) by comparison with asbestos and do not bio-accumulate as asbestos does.

The balance of evidence suggests that there is no clinically significant risk of Class I to IV harms following non-occupational exposure.

Vulnerable groups

Those at greatest risk include children and adults with long exposure in a dwelling with friable, exposed, asbestos material. Because the lag between exposure and clinical disease may be 30 to 40 years, the risks of exposure are less important for the elderly.

Trends and summary of evidence

There is little evidence of significant asbestos release in traditionally built houses and flats. However, asbestos materials, mainly chrysotile products, were widely used during the 1950s and 1960s in non-traditionally built properties – especially flats. In total, approximately 394,000 flats in England (2 to 3% of the housing stock) are likely to have significant use of asbestos in construction, and it is these dwellings that constitute the major concern with regard to asbestos-related health risks. Three quarters of these dwellings were built between 1945 and 1980. Buildings most likely to be affected include high rise council estates built in the 1950s.

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Hazards from Asbestos and Man-Made Mineral Fibres
Average Likelihood and Health Outcomes for all Persons, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class I %	Class II %	Class III %	Class IV %	
HMOs and Non-HMOs	Pre 1920	-	19	1	0	80	0
	1920-45	6,600,000	19	1	0	80	0
	1946-79	1,700,000	19	1	0	80	0
	Post 80	-	19	1	0	80	0
	All	**3,300,000**	**19**	**1**	**0**	**80**	**0**

Basis of estimates

Method of Calculation

Risk estimates are based on extrapolations from studies of high exposures – mainly occupational cohorts. The extrapolations assume no threshold effect and a linear relationship between dose and risk and are probably conservative assumptions.

There is scarce evidence about the frequency of exposed asbestos material in dwellings of different kinds.

Comments

The epidemiological base regarding health risks is very good, but uncertainty remains about (i) the level of exposure of residents in dwellings with asbestos material, and (ii) in the extrapolation of risk from high to low dose exposure. This makes precise risk characterization difficult.

Despite some uncertainties, the estimates, which are based on probably conservative assumptions, show that the disease risk is usually small. Few dwellings are likely to exceed acceptable hazard levels. In terms of national burden, the most pessimistic risk estimates suggest that the number of cases per year of lung cancer or mesothelioma attributable to building-related asbestos exposure may be in double figures; optimistic risk estimates suggest that the number of cases per year is less than one.

Hazards from Lead

Potential for harm

Lead has toxic effects on the nervous system, cognitive development and blood production. Children appear to be particularly sensitive to lead toxicity. The main health outcomes are acute lead poisoning (rare), and IQ deficiency. Studies in the 1980s demonstrated that children with elevated lead levels in their deciduous teeth had poorer school performance.

Lead is readily absorbed from the intestinal tract, especially in children, and its absorption is enhanced by dietary deficiency of iron and calcium.

However, overall the risks even to the most vulnerable group are small.

Vulnerable groups

The highest risk group is young children aged 0-3 years as they mouth objects and engage in pica of paint fragments and soil.

Pregnant women and fetuses have also been identified as a risk group, this tends to be in relation to levels of lead in water.

Trends and summary of evidence

Until recently, the principal source of environmental lead exposure was leaded petrol. As this has been phased out there has been a parallel reduction in blood lead levels. Drinking water is now one of the main sources of lead intake.

Water obtains lead from pipes, solder and fittings through leaching. The longer the water has sitting in a pipe, the more potential leaching is possible. However, even if a 1-3 year old consumed only the first flush water then they would still not reach levels of concern.

The Drinking Water Inspectorate estimates that over 5 million households in England and Wales, receive their water supply through lead pipes, but that they are being replaced at a rate of around five per cent a year. These lead pipes are mostly to be found in properties built before 1970.

Another source of lead in the home is from lead based paint. This is primarily found in housing built before 1978 (although not much after 1960). There is likely to be lead paint in two-thirds of dwellings built before 1940 and in half of those built between 1940-1960.

Lead is released during DIY activities if appropriate precautions are not taken. Very young children may also be at risk if engage in pica - biting or picking and eating paint from window sills or furniture for example. While studies in the USA suggest that the contribution of lead based paint to blood lead levels is insignificant, it may be inappropriate to generalize this to the UK as background levels (due to lead based petrol) are lower in the UK and paint may therefore have a higher contribution.

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Hazards from Lead
Average Likelihood and Health Outcomes by Persons aged under 3 years, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class I %	Class II %	Class III %	Class IV %	
Non HMOs	Pre 1920	39,060	0	1	9	90	0.12
	1920-45	40,710	0	1	9	90	0.11
	1946-79	99,580	0	1	9	90	0.05
	Post 80	179,600	0	1	9	90	0.03
HMOs	Pre 1920	38,680	0	1	9	90	0.12
	1920-45	33,730	0	1	9	90	0.14
	1946-79	63,930	0	1	9	90	0.07
	Post 80	59,740	0	1	9	90	0.08
	All	**58,400**	**0**	**1**	**9**	**90**	**0.08**

Basis of estimates

Data for harm classes is difficult to obtain. There are published studies that show a decrease in IQ for increasing lead levels. However there is no routinely collected data that will allow an attributable risk to be calculated and there is little detailed data showing recent lead levels in UK dwellings, or blood lead levels of children residing in UK houses. High blood lead levels are linked to primarily proximity to main roads and areas of socio-economic deprivation.

Comment

There are uncertainties in the estimates because mainly US studies or high exposure area studies were used to generalize current background rates of lead exposure for children in the UK. Lead in soil has decreased since the banning of lead in petrol and the burden from lead pipes is thought to be very small, in addition to the removal of lead pipes from the system further reducing the lead levels.

The main exposure in the UK will be through the removal of lead based paint on redecoration.

Hazards associated with Crowding and Space

Potential for harm

A lack of space and living in overcrowded conditions has been linked to a number of health outcomes. Research into health outcomes associated with overcrowding concentrate on the hygiene risks, common mental disorders and increased risk of accidents, as well as a number of other health impacts. Both perceived and actual physical overcrowding is a feature of the housing stock. In some studies overcrowding is defined by the participants, particularly in relation to mental health outcomes and is associated with a lack of privacy.

Overcrowding is not just an issue in single family dwellings, but also houses in multiple occupation such as flats, bedsits and bed and breakfast hostels.

There are a number of health outcomes associated with overcrowding -infectious agents, psychological effects, mortality and outcomes associated with infant morbidity and mortality.

Overcrowding is always connected with spread of infectious disease, spread though the air or physical contact. Measles, mumps, chickenpox, diphtheria and most respiratory conditions, for example, are spread through air and so are more easily spread in crowded conditions, as are conditions that are spread by physical contact, such as scabies. Space limitations and overpopulation are associated with stress and the transmission of infections such as tuberculosis, Meningococcal disease and Otitis media. Childhood diarrhoeas are particularly common in B&Bs where facilities for washing and cooking are shared and responsibility for cleaning these common areas is unclear, and the highest age-standardised level of acute illness was for women living in inner city multi-occupied dwellings.

Several studies have made the link between overcrowding and mental illness and childhood development.

Overcrowding, along with social deprivation, has also been linked to a rise in all cause mortality.

Vulnerable groups

There appears to be no particular age group which is more vulnerable than others.

Trends and summary of evidence

Establishing the relationship is complicated by a number of analytical issues - the fact that individuals may spend only a proportion of their time in the home; differences in cultural practices; confounding by socio-economic factors; and the fact that over-crowded dwellings may also be in substandard condition. In particular, overcrowding is often linked with poverty and it can be difficult to separate the effect of each factor.

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Hazards associated with Crowding and Space
Average Likelihood and Health Outcomes for all Persons, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class I %	Class II %	Class III %	Class IV %	
Non HMOs	Pre 1920	6,950	14	7	26	53	22
	1920-45	8,000	14	7	26	53	19
	1946-79	8,510	14	7	26	53	18
	Post 80	12,570	14	7	26	53	12
HMOs	Pre 1920	4,710	14	7	26	53	33
	1920-45	7,540	14	7	26	53	21
	1946-79	2,840	14	7	26	53	55
	Post 80	-	14	7	26	53	0
	All	**8,000**	**14**	**7**	**26**	**53**	**19**

Basis of estimates

Event rates

For Class I, II & III harms, the reported associations between over-crowding and all-cause mortality may be reflecting socio-economic factors rather than the direct effects of crowding. Its inclusion has a profound effect on the calculation of hazard scores. Without them, the hazard score is well inside the acceptable level. For Classes II and III harms, the baseline is the rate of emergency admissions in the year as a whole calculated from Hospital Episode Statistics data for England, 1996/97 to 1999/00. The attributable Class II & III harms are calculated as a proportion of these annual totals. For Class IV harms the data used was on new GP consultations estimated from the General Practice Research Database figures, and those of the Fourth Morbidity Survey in General Practice.

Relative risk

Based on regression analyses of data on mortality and hospital episode statistics (all ages). Relative risks for dwellings that are below bedroom standard were adjusted for socio-economic status, region, and population density.

Comments

Another measure of the health effects of over crowding using a composite of the main health outcomes observed in published studies may prove to be a better measure than all cause mortality. Establishing relative risks for some of these measures is problematic due to presentation of results in the relevant literature that give no indication of the impact of crowding, just whether it is significant or not.

Measures both of exposure and health effects are difficult to separate from the effect of socio-economic status. The health effects of crowding are also mitigated by an number of factors including cultural, demographic, social and psychological as well as the amount of physical space, or number of bedrooms, this makes the creation of a space or bedroom standard more problematic.

Hazards associated with Domestic Hygiene, Pests etc

Potential for Harm

The actual risk that pests pose to health is difficult to quantify, there has been little epidemiological work in this area. However, the potential health outcomes appear to be asthma and allergic rhinitis (from allergens), and gastro-intestinal disease (from spread of infection).

Vulnerable groups

The highest risk group is likely to be children and allergy sufferers.

Trends and summary of evidence

Pests create a risk of cross-contamination and infection, carry disease and can infect food and surfaces. Structural defects, such as uneven and cracked surfaces, including open-jointed timber floors and skirting, enable the entry of pests and rodents to the house, and make it easier for them to breed and remain in the house.

Inadequate or unhygienic waste disposal can also encourage and sustain pests. Currently rat populations pose greater risks to health in rural areas due to zoonotic cycles of infection.

Dwellings with high temperatures and high humidity support cockroaches. Infestation is possible houses of all ages provided there is a warm moist environment and a food source but is a greater problem in more temperate regions of the world than in England and Wales. Cockroaches carry bacteria that can spread disease and are also a source of allergens. Children who live in dwellings visibly infested with cockroaches show high levels of sensitivity to cockroach allergen. Reaction to the allergen can range from mild, hay fever like, symptoms to anaphylactic shock.

Cats and dogs are also the source of toxoplasmosis and toxicariasis, these are contracted by handling soil or litter.

Household wastes need to be stored in such a way that children do not have access to it, and that pests can not have easy access. One of the major sources of harm from inadequate waste disposal is through the harbouring of pests enabling them to multiple and therefore presenting the hazards described above. If the household waste is stored securely and regularly collected there is little risk of infection. Houses in multiple occupation may have inadequate facilities for the storage of waste and provision for its regular collection.

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Hazards associated with Domestic Hygiene, Pests etc

The data available on likelihoods and outcomes since the analyses carried out for Version 1 of the HHSRS were limited. This has meant that it was not possible to produce robust refinement of those original estimates. Therefore, the likelihoods and outcomes given for Version 1 have not been revised.

Hazards associated with Inadequate Provision for Personal Hygiene and Inadequate Sanitation

Potential for harm

The health outcomes from both poor personal hygiene and lack of sanitation include death from diarrhoeal and gastro-intestinal disease, and severe dysentery, and gastro-enteritis.

In 1995 there were 4651 cases of dysentery notified and in excess of 80,000 cases of viral gastro-enteritis notified. However, it is not clear how many of these cases are due to poor personal hygiene either through behavioural patterns or lack of facilitates.

Inadequate sanitation can lead to a risk of infection in particular from dysentery (*Shigella sonnei)*.

Dysentery and rotavirus infections, a frequent cause of diarrhoea, are carried by the faecal-oral route. Even if the illness is contracted elsewhere up to 50% of family members may become infected if the hygiene levels are poor.

In practice however there is little risk of cross-contamination of potable water by wastewater.

Vulnerable groups

The actual risk is unknown, but the highest risk groups are the young (0-4), the elderly and the immuno-compromised.

However, those in houses in multiple occupancy are at increased risk, as are low income households.

Trends and summary of evidence

Washing of clothes and bedding is also a feature of personal hygiene. Washing removes bacteria, fungi, and other organisms as well as sweat and dirt. It can also remove toxic, irritating or allergenic agents such as house dust mites and lice. There are few studies in the domestic setting that allow quantification of the health risk associated with not washing clothes or bedding. If clothes that have been contaminated with faecal matter are not washed and dried at a high enough temperature, then faecal mater will remain, this can lead to a 1 in 10 risk of passing on infection from rotavirus. Washing to remove dirt will remove most other micro-organisms as well the hotter the wash, the more organisms are destroyed.

The main risk appears to arise from the sharing of facilities and personal hygiene behaviour rather than from the design of sanitary fittings.

The practice of paying for water use through a meter can also contribute to negative health impacts associated with sanitation, especially in low-income households. The extent to which this contributes to ill health related to sanitation is unknown as there have been very few detailed studies.

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Hazards associated with Inadequate Provision for Personal Hygiene and Inadequate Sanitation
Average Likelihood and Health Outcomes for Persons aged under 5 years, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class I %	Class II %	Class III %	Class IV %	
Non HMOs	Pre 1920	7,040	0	2	22	76	1
	1920-45	5,550	0	2	22	76	2
	1946-79	9,260	0	2	22	76	1
	Post 80	24,040	0	2	22	76	0
HMOs	Pre 1920	5,790	0	2	22	76	2
	1920-45	5,340	0	2	22	76	2
	1946-79	12,140	0	2	22	76	1
	Post 80	3,930	0	2	22	76	2
	All	**7,750**	**0**	**2**	**22**	**76**	**1**

Basis of estimates

The health outcomes and exposures for sanitation and personal hygiene are almost identical.

Because of the importance of behavioural factors, and the difficulty of attribution to housing–related factors, the estimation of risk is imprecise. Two methods have been used:

i. extrapolation from the few epidemiological studies that have made direct assessments of the risks associated with inadequate sanitation;

ii. calculation of hospital admission rates and mortality for gastro-intestinal disease by housing type and socio-economic group.

Hazards associated with Inadequate Provision for Food Safety

Potential for harm

It is estimated that in the general UK population there are approximately 86,000 cases of food poisoning annually, of which little over half are formally notified the rest being through other sources. Sources estimate that at least 50% of these cases are thought to arise in the home. Some estimates have put this figure even higher at 86% for *Salmonella* and as much as 97% for *Campylobacter*.

Food poisoning can result in cause death from infectious gastro-intestinal disease, or hospital admission because of severe diarrhoea, vomiting and dehydration

Vulnerable groups

While food poisoning is observable in all age groups, and in residents of all types and ages of dwelling, those most susceptible are the young, especially infants, the elderly and pregnant women, and these groups may also suffer more severe outcomes.

Trends and summary of evidence

Poor hygiene standards as measured through cross-contamination or contamination from an infected food handler are thought to be responsible for about 40% of outbreaks in the home. Inappropriate food storage, inadequate cooking facilities, contamination from an infected food handler and inappropriate food preparation areas (lack of worktop space, lack of storage, lack of running water and poor design) along with hygiene behaviour are thought to be the most significant risk factors.

Pets such as dogs and cats can carry common bacteria associated with food poisoning such as *Salmonella* and *Campylobacter* and are therefore a route for cross infection.

Hospital admissions for gastro-intestinal disease are more common in deprived areas than in affluent area, this is particularly true for under 4's and over 75's where admissions were twice as common.

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Hazards associated with Inadequate Provision for Food Safety
Average Likelihood and Health Outcomes for all Persons aged under 5 years, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class I %	Class II %	Class III %	Class IV %	
Non HMOs	Pre 1920	3,590	0	2	22	76	3
	1920-45	4,880	0	2	22	76	2
	1946-79	5,730	0	2	22	76	2
	Post 80	20,270	0	2	22	76	0
HMOs	Pre 1920	3,150	0	2	22	76	3
	1920-45	3,700	0	2	22	76	3
	1946-79	4,420	0	2	22	76	2
	Post 80	-	0	2	22	76	0
	All	**4,960**	**0**	**2**	**22**	**76**	**2**

Basis of estimates

It is not possible to link routine food-poisoning surveillance data to housing characteristics because of lack of availability of address data (not collected, or access is restricted).

A number of assumptions have been made to establish relative risks for food safety relating to the condition of the dwelling. These include establishing how many cases occur arise in the dwelling compared to elsewhere (anywhere from 50-80%) and how many of these are due to personal behaviour and ignorance of the risks involved in food preparation. It has been estimated that 40% if associated with poor personal behaviour, how much the rest is associated with the various factors relating to food safety is unknown, for instance storage, worktop space etc. More work in this area would enable a better characterisation of specific risks.

Class I harms are derived from the mortality statistics, Class II and III from hospital episode statistics, and Class IV are from notified cases of food poisoning

Comments

Official statistics do not reflect the true burden of food related disease in the community. Work done using GP data for England suggests that there is a 36% non-random under ascertainment for infectious intestinal disease (this suggests inflating the Class IV harm by 1.56)

As food safety related health outcomes are similar to those associated with water, sanitation and personal hygiene it is not possible to separate the different outcomes. There are ICD codes which relate to specific outcomes such as Salmonella, but since most of this type of outcome tends to listed in a generic class it is not possible to ascribe it to particular outcomes or causes leading to under-ascertainment of the true event rates.

Hazards from Contaminated Water

Potential for harm

The potential health outcomes from contaminated water include from death from respiratory failure or from *Cryptosporidosis*,r *Camphylobacter* or Legionnaires disease, and severe diarrhoea.

Campylobacter is the most common illness associated with private water supplies. After private water supplies the most important risk associated with the domestic water supply is from Legionnaire's disease. One in six cases of community acquired Legionnaires disease are due to domestic water systems, usually hot water systems storing water at below 50°C. Other risk factors for the domestic acquisition of Legionnaires disease include low chlorine levels, private water supply, recent plumbing work, electric heating and central heating coils in the tank.

(The metering of water can also contribute to negative health impacts, especially in low-income households by reducing bathing, the frequency of toilet flushing and clothes washing – see personal and domestic hygiene and sanitation.)

Vulnerable groups

Anyone can become infected, the very young and the elderly are at increased risk for a more severe infection. The greatest risk is to those who are immuno-compromised.

Trends and summary of evidence

In the last decade, *Cryptosporidium* has been the prime cause of disease related to mains (public) water supply Cryptosporidiosis has an incidence of 5278 cases in England and Wales in 2000. *Cryptosporidium* oocysts can occur relatively frequently in certain water supplies and can lead to a development of some protective immunity. Despite having greater levels of micro-organisms the private water supplies have lower rate of reported illness from *Campylobacter* and *Cryptosporidium*. There does not appear to be additional disease burden from these organisms which is attributable to private water supplies.

In 2000, there were 173 cases of Legionnaires disease, of which 76 (43.9%) were community acquired.

Most of the UK population is served by a public supply of piped water, about 1% of the population obtains water from a borehole, spring or well, which may not be treated and are generally of a lower quality than public supplies. However, when *Campylobacter* and *Cryptosporidium* levels were examined in areas with private water supplies, the results did not suggest a major health burden from these supplies.

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Hazards from Contaminated Water
Average Likelihood and Health Outcomes for all Persons, 1997-1999

Dwelling type & age		Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class I %	Class II %	Class III %	Class IV %	
Non HMOs	Pre 1920	1,292,201	0	1	9	90	0
	1920-45	1,019,217	0	1	9	90	0
	1946-79	1,700,211	0	1	9	90	0
	Post 80	4,414,406	0	1	9	90	0
HMOs	Pre 1920	1,063,416	0	1	9	90	0
	1920-45	980,981	0	1	9	90	0
	1946-79	2,229,732	0	1	9	90	0
	Post 80	720,721	0	1	9	90	0
	All	**1,423,649**	**0**	**1**	**9**	**90**	**0**

Basis of estimates

Private water supplies

As there are many causes of gastro-intestinal illness it is difficult to make risk attributions for water related illness. However the report *Health Risks from Private Water Supplies* (1996) compares concentrations of *cryptosporidium* and *camphlobacter* and reported infections from these causes for private and public water supplies in England.

Legionnaire’s disease

In 2000 there were 173 reported cases of which 76 cases(43.9%) are community acquired (*PHLS disease facts* (2001)). If 1 in 6 of these arise in the home, then 12.7 cases(7.3%) due to infection from domestic water systems within the home (1.9 fatal cases).

Hazards from Excess Heat

Potential for harm

Heat-related risks are those related to rises in outdoor temperature. Only in very exceptional circumstances will there be risks arising from over-heating of a dwelling because of inability to control the dwelling's heating system or similar problem.

It is known from studies in the UK, Europe and North America that days of high temperature are associated with increases in mortality and morbidity. These increases are greatest in the elderly, primarily from cardiovascular disease, although some increase may occur in a wide range of causes of death and morbidity.

The health effects of heat include death and cardio-vascular disease.

Vulnerable groups

The elderly, especially those with pre-existing cardiovascular disease, and the very young (infants) are more vulnerable than other groups.

Trends and summary of evidence

The most recent British study, which analysed a 21-year series of data for London, found that mortality rose on days when the *mean* temperature exceeded 19°C. The UK has comparatively few such hot days, and over the study period there were only 186 days where the temperature exceeded the threshold for heat deaths. Overall, the burden of heat-related impacts in the UK is currently modest.

Such epidemiological evidence as there is mainly relates to questions about the protective role of air conditioning.

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Hazards from Excess Heat
Average Likelihood and Health Outcomes for all Persons aged 65 and over, 1997-1999

	Dwelling type & age	Average likelihood 1 in	Spread of health outcomes				Average HHSRS scores
			Class I %	Class II %	Class III %	Class IV %	
Flats	Pre 1920	60,000	31	8	25	36	5
	1920-45	90,000	31	8	25	36	4
	1946-79	130,000	31	8	25	36	3
	Post 80	110,000	31	8	25	36	3
	All	**900,000**	**31**	**8**	**25**	**36**	**0**

Basis of estimates

The heat-related mortality is expressed as a proportion of all deaths in the year as a whole, and the baseline event rate for Class I is the total annual rate of all deaths in the 65+ age-group. Classes II and III harms include emergency hospital admissions from cardiovascular illness. Class IV harms are from data on new GP consultations in the 65+ age-group estimated from the General Practice Research Database figures and those of the Fourth Morbidity Survey in General Practice.

As there is no readily available markers of heat-vulnerable dwellings that could be related to health statistics, it has been assumed that the living and sleeping areas of 5% of converted flats are immediately under the roof and suffer from significantly larger temperature rises during heat-waves.

Comment

The risk estimates presented here are illustrative only as there is no quantitative evidence for key elements of the calculation.

Despite the fact that heat-related impacts on health are comparatively uncommon, the hazard scores may be fairly high. The main reason for this is that, as with cold-related hazards, the Class I outcome (mortality) is for a vulnerable group where the underlying risk of mortality is already about 5% per year. So any small increase in risk can translate into a significant hazard score.

By definition, almost all converted flats are in dwellings in multiple occupation. The estimates therefore show the hazard to be almost entirely confined to this sector of the housing stock, though more realistic assessment of heat-vulnerability would very probably also implicate an appreciable number of dwellings in single occupation.