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Statistical Evidence to Support the Housing Health and Safety Rating System

Volume I – Project Report

May 2003
University of WarwickLondon School of Hygiene & Tropical Medicine
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Chapter 1
Introduction and Background

1.01 In December 2000, the then Department for Transport, Local Government and the Regions (now the Office of the Deputy Prime Minister, ODPM) commissioned the Legal Research Institute of Warwick University Law School (LRI) and the London School of Hygiene and Tropical Medicine (LSHTM) to review, refine and up-date the statistical evidence supporting the Housing Health and Safety Rating System (HHSRS).

The Housing Health and Safety Rating System

1.02 The HHSRS[1] is a means of evaluating the potential effect of any faults on the health and safety of occupants, visitors, neighbours and passers-by. It provides a structured approach for the surveyor to grade the severity of any dangers present in a dwelling, and to differentiate between dwellings that pose a low risk to health and safety and those where there is a threat of serious injury or death.

1.03 The principles underlying the HHSRS are that –

- any dwelling should be free from both unnecessary and avoidable hazards; and
- where any hazard is necessary and unavoidable, then the likelihood of an harmful occurrence and the potential harm which could result should be reduced to a minimum.

1.04 A hazard is the potential threat to health or safety which could result from a fault whether that fault is inherent or caused by deterioration[2]. Twenty-four categories of potential housing hazards have been identified for the HHSRS as devised (see Table 1).

1 See *Housing Health and Safety Rating System: The Guidance (version 1)* (DETR, July 2000) and *Housing Health and Safety Rating System; Report on Development* (DETR, July 2000).

2 See Glossary.

Table 1 - Categories of Hazards: HHSRS Version 1

1. Hazards associated with Excessive Low of High Temperatures
    1.1 Hazards from Excessive Cold
    1.2 Hazards from Excessive High Temperatures
2. Fall Hazards
    2.1 Hazards from Falls on Stairs, Steps or Ramps
    2.2 Hazards from Falls on the Level
    2.3 Hazards from Falls between Levels
        Falls involving Windows
        Falls from Balconies and Landings
    2.4 Hazards from Falls associated with Baths etc
3. Hazards from Fire
4. Hazards associated with Hot Surfaces and Materials
5. Hazards associated with Damp and Mould Growth etc
6. Hazards from Carbon Monoxide etc
    6.1 Hazards from Carbon Monoxide
    6.2 Hazards from Oxides of Nitrogen
    6.3 Hazards from Sulphur Dioxide
    6.4 Hazards from Volatile Organic Compounds
    6.5 Hazards from Biocides
7. Hazards from Radiation
8. Electrical Hazards
9. Hazards from Noise
10. Hazards from Lead
11. Hazards from Asbestos and Other Fibrous Materials
12. Hazards associated with Entry by Intruders
13. Hazards associated with Crowding and Space
14. Hazards from Explosions
15. Hazards associated with Domestic Hygiene, Pests etc
    15.1 Hazards associated with Pests and Design
    15.2 Hazards associated with Household Waste
16. Hazards from Inadequate Provision for Food Safety
    16.1 Storage
    16.2 Preparation
    16.3 Cooking
    16.4 Design and Layout
17. Hazards associated with Inadequate Provision for Personal Hygiene
18. Hazards associated with Inadequate Sanitation or Drainage
    18.1 Collection and Removal of Human Excreta
    18.2 Collection and Removal of Waste Water
    18.3 Carriage of Foul Sewage and of Waste and Surface Water
19. Hazards from Contaminated Domestic Water
20. Hazards from Structural Failure
21. Hazards from Inadequate Lighting
22. Hazards from Uncombusted Fuel Gas
23. Entrapment and Collision Hazards
24. Hazards from Poor Ergonomics

1.05 The grading of hazards present in a dwelling is achieved through a formula which generates a Hazard Score (see Figure 1). For this formula, weightings have been given to the four Classes of Harm used by the HHSRS[3], the weightings reflecting the severity of incapacity resulting from the harm. The formula also uses the likelihood of a potentially harmful occurrence is expressed as a ratio (eg, 1 in 100), and the spread of possible harm outcomes expressed as a percentage.

3 See paras 5.19-5.23 post for discussion on the Classes of Harm.

Figure 1 – **Formula for Generating Hazard Score**

	Class of Harm Weighting		Likelihood 1 in		Spread of Harm (%)		
I	10,000	÷	100	X	0	=	0
II	1,000	÷	100	X	10	=	100
III	300	÷	100	X	30	=	90
IV	10	÷	100	X	60	=	6
				Hazard Score		=	**196**

1.06 To rate the condition, the surveyor first inspects the dwelling identifying any faults. Once the inspection is complete, the surveyor determines to which of the twenty-four hazards the faults contribute and then, for each hazard, judges –

- the likelihood, over the next twelve months, of an occurrence that could cause harm; and
- the spread of the possible health outcomes from such an occurrence.

1.07 These judgments entered into the formula generate a Hazard Score for each hazard found at the dwelling. This approach enables very different hazards to be compared. The formula produces a Hazard Score for hazards which could cause death (excess cold) and those where death is not a possibility (poor ergonomics). It also produces Scores for hazards which involve a relatively instantaneous event (such as a fall) and those which involve exposure over a period of time (such as dampness and mould growth).

Statistics and the Housing Health and Safety Rating System

1.08 The formula devised for the HHSRS (Figure 1) made it possible to provide average likelihoods and average spread of harm outcomes for each hazard using existing data from various sources. This information served two purposes. For the first time it provided evidence to enable housing hazards to be ranked by seriousness. Equally important for the practical application of the HHSRS, it informed the surveyor's judgement when assessing the hazards present at a dwelling, giving benchmarks for the averages for each hazard.

1.09 The sources of information used for the statistics to support Version 1 of the HHSRS included the Home Accident Surveillance System (HASS)[4], the English House Condition Survey (EHCS)[5], and the BRE Reports on Building regulation and safety and health[6]. The averages were broken down by age of dwelling (eg, pre-1919 and post 1980). They also provided information on the age group of person most vulnerable to each hazard.

4 Collected and published by the Department of Trade and Industry.

5 Collected and published by the DETR (now the ODPM).

6 *Building regulation and safety*, and *Building regulation and health* (1995) CRC.

Version 2 of the Housing Health and Safety Rating System

1.10 The ODPM has stated its intention that the HHSRS will replace the current Fitness Standard[7] as the means for determining the minimum standard for the condition of existing dwellings. To this end, the ODPM commissioned three projects –

- an evaluation of Version 1 of the HHSRS;
- a study of the application of the HHSRS to houses in multiple occupation; and
- a review of the statistical evidence supporting the HHSRS (this project).

The results of these projects will provide the basis for the development of Version 2 of the HHSRS.

This Project

1.11 The project aimed to –

i. dentify possible sources of data to produce the likelihood and health outcome statistics for each of the 24 hazard categories and their sub-groups;

ii. recommend the most suitable data sources to produce robust and accurate statistics within the next twelve months taking account of long and short term needs and value for money;

iii. provide detailed statistics at national level on the likelihood of an occurrence, classified by different types of person and, as appropriate, different types/condition of housing.

iv. provide detailed statistics at national level on the distribution of health outcomes, classified by different types of person and, as appropriate, different types/condition of housing;

v. advise on the accuracy and robustness of the evidence in relation to each hazard; and

vi. make recommendations on improving the provision of evidence over the longer term.

1.12 Specifically excluded from this project (and the other two projects – see para 1.10 above) was a review of the underlying principles of the HHSRS, including the formula for calculating the hazard scores. These had been found to be sound and robust.

1.13 The account of the project is issued in three Volumes –

- Volume I, this Report, which gives the background to the project and summarises the stages and processes involved, and makes recommendations for the future.

7 Housing Act 1985, s604 (as amended).

- Volume II, the Results Summary, which contains the main results together with literature reviews.

- Volume III, a Technical Appendix, which gives detailed explanations of the stages and processes, and full tables of the results.

Chapter 2
Overview

2.01 There were several stages necessary to achieve the aims of the project. These included –

i. Determining the form and content of the results to be produced, including –

a. the dwelling type and age bands;

b. the base for calculating the likelihoods; and

c. the vulnerable group age bands.

ii. Analysing the Injury, Health, and Mortality data, including –

a. Creating a Housing and Population Database.

b. Quantifying Housing Risks.

iii. Compiling literature reviews for each hazard.

2.02 The results from this project needed to provide the likelihood of an occurrence for specific type and age bands of dwellings. That likelihood was dependent on the base used, ie, the number of dwellings from which the averages have been calculated. For Version1, the base varied depending on the hazard. The project would review the type and age bands of dwellings based on the strength and reliability of the evidence available. It would also review the base to be used for the calculation of the averages.

2.03 The HHSRS gives the likelihood and the spread of health outcomes for the Vulnerable Group, defined as ''*an age range of people for whom the risk arising from a hazard is greater than for any other age group*''[8]. Determining the age bands for the Vulnerable Group would depend on the data available.

2.04 To both simplify and standardise the analysis of the injury, health and mortality data a Housing and Population Database was created. This overcame the problem that no there was no single source of data on housing and population giving all the information in sufficient detail necessary for the project.

2.05 Once the Housing and Population Database had been created and decisions made on the form and content of the results, the injury, health and mortality statistics could be analysed to provide the results needed for Version 2 of the HHSRS. Because the nature of the injury data differed from the health data, different approaches were needed for the analysis although the final results are comparable.

8 See Glossary for full definition.

2.06 Reviewing the literature relating to the HHSRS hazards would provide, for each hazard, information on the health effects, the potential for harm and the relevant dwelling features which might mitigate or increase the likelihood of an occurrence.

2.07 The next chapter gives details of the datasets identified and used in the project, and a description of the stages outlined above is given in the subsequent chapters.

Results[9]

2.08 The result of the project contain, for each hazard –

- the likelihood of an occurrence which could cause harm for all dwellings;
- the spread of outcomes;
- a literature review giving information on the potential for harm, the vulnerable group, a summary of the evidence and key references; and
- where appropriate, an explanation of the method adopted for the analysis and any caveats.

2.09 Where there are differences in the hazard scores between this report and Version 1 it is in part related to different classifications of exposure and in other instances due to the attribution of risks into harm classes. Where the discrepancies appear to be large, detailed information relating to the source of the information used in calculations and the methods of calculation is given to allow transparency.

9 The results are published in Volume II.

Chapter 3
Datasets Identified and Used

3.01 The various sources for data used in this project are described below. The information used from each and processes involved in the analysis are explained in the following chapters.

3.02 The following data sources provided the information for creating and validating the Housing and Population Database.

3.02.1 ENGLISH HOUSE CONDITION SURVEY

An English House Condition Survey (EHCS) has been undertaken every five years since1971. These surveys inform the development and monitoring of national housing policies on the repair, improvement and energy efficiency of the housing stock.

These are sample surveys, the 1996 EHCS starting with interviews with 15,800 householders. This was followed with a physical survey of a sub-sample (nearly 11,600) of these dwellings and a sample of vacant dwellings (over 500) to provide a description of the stock and its present condition. A postal survey of local authorities and registered social landlords and a valuation survey of private sector properties were also carried out.

The surveys give information on –

- the housing stock in terms of its composition, ownership, condition and the range and quality of facilities and services that it provides and how this has changed since the previous survey;
- limited information on the occupants health, accidents and fires in the home;
- the profile of household groups and the housing in which they live; and
- the relationship between housing conditions and the circumstances of different household groups.

The DTLR supplied the data from the 1991 and 1996 EHCS including separate post code data.

3.02.2 ACORN

ACORN is a classification system developed by CACI for the market analysis industry. It describes the population according to the neighbourhood in which they live, working on the premise that people living in the same neighbourhood will have similar purchasing habits and attitudinal characteristics.

Nearly every full postcode in Great Britain, approximately 1.9 million, is assigned one of the 54 ACORN types according to the neighbourhood within which it falls, using the 79 key demographic variables for the census. The Census data is supplemented and updated using 4 million survey records provided by Consumer Access Ltd, electoral rolls and CACI lifestyle databases. The dwelling characteristics were derived for a spatial unit, such as the enumeration district or the postal sector, and then applied to all the postcodes in that larger unit.

The data obtained from CACI, HousePlus, provided details of the residential population by 20 age bands and the 54 ACORN neighbourhood categories at full post code level.

3.02.3 RESIDATA

Intermediary Systems Ltd (ISL) have developed Residata Housetypes which provides data on house type and age, size and tenure mainly for the insurance industry. It provides reliable and up to date information on dwelling age and type for each postcode in the UK, with an indicator of the confidence level associated with the age and house type classification.

Residata Housetypes is based on 12 million survey records, including building surveyor reports, insurance proposal forms and marketing survey forms.

The data obtained from ISL provided, at post code level, the dwelling age and type (25 categories), the tenure and number of bedrooms, the property value band, and the number of postal addresses in each postcode based on the Royal Mail's postal address file (PAF).

3.02.4 POSTZON

As part of the validation of the Housing and Population Data Base, the Postzon file was obtained through the UK Data Archive. Postzon is generated by the Royal Mail Address Management Centre. It is extracted from the Central Postcode Directory which is based on a file originally created by the then Department of Transport for their Regional Highway Traffic Model project. This file was enhanced and updated by the Office for National Statistics.

The Postzon file consists of a single data record for over 1.6 million postcodes in the UK. It includes the local government ward codes for the first address in each postcode and the Ordnance Survey (OS) Grid Reference (to 100-metre resolution).

3.02.5 NEIGHBOURHOOD STATISTICS DATA

Also used in validating the Housing and Population Database was the Neighbourhood Statistics dataset. The Social Disadvantage Research Group of Oxford University developed a method to give Population Estimates to give, at ward level, the total population in England broken down into the following age groups – under 16, 16-59, and 60 and over. They also provide estimates of the economically active adults aged 16-59. This data is freely available as part of the Neighbourhood Statistics dataset held on the National Statistics website.

3.03 Information on accidents and injuries in dwellings was obtained from the following sources.

3.03.1 HOME ACCIDENT SURVEILLANCE SYSTEM

Since 1976, domestic accidents have been monitored by the collection of case histories from a sample of Accident and Emergency Units in hospitals throughout the UK. The information, now collected by the Department of Trade and Industry (Dti), includes details of the essential characteristics of accidents such as the product or dwelling feature involved and the type and seriousness of the injury caused. The data from the Home Accident Surveillance System (HASS) is made available to industry, safety professionals, health authorities and manufacturers. In addition, annual reports summarising the data are published.

The HASS data also includes records for persons who attended the sample A&E Units for treatment for injuries caused by accidental fires in the home. The Dti provided full HASS data, with postcodes, for the three years 1997 to 1999, a total of 408,797 cases.

3.03.2 FIRE BRIGADE RETURNS

Returns are collected by the Home Office on fires attended by the Fire Brigade. These national records include records of any fatalities and injuries caused by these fires. This information was used to supplement and improve the data provided by the HASS and the EHCS. The Home Office provided data on a total of 38,064 cases for the three years 1997 to 1999.

3.03.3 BRITISH CRIME SURVEY

The British Crime Survey (BCS) is a sample survey collected by the Home Office and was used to provide information on burglary and attempted burglary. It also includes information on all fires (including those resulting from arson) whether or not the Fire Brigade attended and whether or not they resulted in death or injury, and this was used to supplement the HASS, the EHCS and Fire Brigade returns.

Statistics from the BCS data on fires for the years 1995 to 1999, and on burglary and attempted burglary for 1999 were supplied by the Home Office.

3.04 Information on health outcomes was provided by the Hospital Episode Statistics supplemented by published data on notifications for infectious diseases and General Practitioners consultation rates.

3.04.1 HOSPITAL EPISODE STATISTICS

Permission to obtain and use the Hospital Episode Statistics (HES) for 1996-1999 was applied for and given by the Bellingham Committee. The HES contain records of inpatient admissions for all NHS hospitals in England. The records include the patients postcodes – which allows matching to housing and population data – and 28 other variables detailing the patient including diagnosis codes, age and sex. . The diagnosis coding follows the International Statistical Classification of Diseases and Related Health Problems, tenth revision[10] (ICD-10).

Emergency admissions, excluding maternity and high security psychiatric admissions, were

10 The Tenth Revision of the International Statistical Classification of Diseases and Related Health Problems is the latest in a series that was formalized in 1893 as the Bertillon Classification or International List of Causes of Death.

linked to the EHCS 1996 postcodes to give 612, 302 records, or 4.2% of the total records. For some of the analyses the HES dataset was matched to the Residata postcodes allowing event rates to be determined using the population data supplied for these postcodes.

3.04.2 GENERAL PRACTICE RESEARCH DATABASE

The General Practice Research Database (GPRD) is held by ONS. It is the world's largest computerised database of anonymised longitudinal patient records from general practice, containing more than 35 million patient years of data. This provided data on new GP consultations and was used to provide information on minor health conditions.

3.04.3 FOURTH MORBIDITY SURVEY IN GENERAL PRACTICE

The fourth national morbidity study (MSGP4) contains details of all patient consultations conducted at 60 general practices in England & Wales, collected over a 12 month period, together with socio-economic patient data. The database covers slightly in excess of half a million patients. This supplemented the data from the General Practice Research Database.

3.04.4 STATUTORY NOTIFICATION OF DISEASE (NOIDS)

Since the 19th century, Doctors in England and Wales have had a statutory duty to report suspected cases of certain infectious diseases. The responsibility for administering the NOIDS system is now with the Communicable Disease Surveillance Centre. Data is available on the Public Health Laboratory Service web-site[11].

3.05 Information on accident mortality and mortality as a result of health conditions was provided by the Office of National Statistics.

3.05.1 MORTALITY DATA

This data for 1997-2000 was obtained from the Office of National Statistics for England and Wales (ONS). As well containing 15 variables including cause of death, age and sex, the records include the patient's postcode allowing the files to be linked to the EHCS 1996 and to population data. The underlying cause of death was used in the analysis and there was a 99.4% coding for this field.

The Coding is by International Statistical Classification of Diseases and Related Health Problems, ninth revision (ICD-9) and was matched to the ICD-10 codes used in the HES analysis. In the period 1997-2000 there were over 2,200,000 deaths recorded in England and Wales, of these 3.6% were matched to the EHCS 1996 postcodes to give around 78,000 records for matched analysis with housing characteristics.

Mortality data relating to accidental causes contains an additional field which codes the where an accident occurred. This information was supplied for the accident and injuries analysis for 1997-1999. There was 68% coding of place in the accident data and of this 65% occurred in the

11 http://www.phls.org.uk/topics_az/noids/menu.htm.

home. However, it is not possible from the data to ascertain whether it was inside or outside the dwelling.

3.06 Other data used.

3.06.1 TEMPERATURE DATA

For the time-series analyses of heat and cold related deaths, temperature data was obtained from the British Atmospheric Data Centre. There were difficulties, however, with compilation of the meteorological data as some of the stations were not complete in their data recording. Above 90% completeness was achieved for most areas, although not for the North West region.

3.06.2 CARSTAIRS INDEX OF DEPRIVATION

Originally developed for the Scottish health experience, it is calculated using England and Wales as a population base and controls for unemployment, overcrowding, non-car ownership and social class. The higher the number, the more deprived is the area.[12]

12 See Carstairs, V. and Morris, R. (1989) *Deprivation, mortality and resource allocation*. Community Medicine, 11, 364 – 372, and Carstairs, V. and Morris, R. (1991) *Deprivation and Health in Scotland*, Aberdeen University Press.

Chapter 4
Data Quality and Characteristics

4.01 As detailed in Chapter 3 above, the data used for this project came from a variety of sources. Each set had been collected for its own particular purpose and, presumably, met the needs for which it had been collected. However, for the purposes of this project, the data quality and consistency varied considerably. This meant that, to make it suitable for the project, a considerable amount of time was involved the validation and modelling of data (see paras 5.02-5.07 below[13]). This also means that uncertainties in the statistics arise due to both the quality of the original data sources and the modelling of the data required for its subsequent analysis in the project[14].

4.02 That said, we believe that the statistical evidence supporting the HHSRS provides, for the first time, the most accurate information on the threats to health and safety in the national housing stock. Any criticisms made are intended to highlight problems which, if resolved or reduced, will refine the evidence.

Housing Estimates

4.03 Both the health and safety statistics are based on the assumption that individual postcodes, being generally small (an average of 14 dwellings), are reasonably homogeneous in terms of their housing type and date of construction. To validate Residata and test this assumption, the Residata information on the predominant tenure, dwelling age, type, size and property value in each postcode was matched to the equivalent 1996 EHCS data on each sample dwellings and/or on the surrounding neighbourhood.

4.04 Given possible definitional differences and the fact that the former data set was postcode based while the latter was dwelling and neighbourhood based, the housing characteristics as described by the two data sources were found to be generally very similar. The greatest discrepancies tended to occur where the sample sizes were smallest, for example, where Residata records the housing in the postcode to be of mixed age or predominantly large dwellings with 5 or more bedrooms. Generally, for housing of the most common tenures, ages, types and value, the two data sets were fully compatible in the vast majority of cases. Overall, it appeared that Residata provided a broadly accurate description of the housing characteristics in each postcode.

13 For detailed explanation see Volume III – Technical Appendix.

14 Statements on the reliability and robustness of the results of this project are given in the Results publication.

Postcode Population Estimates

4.05 Producing reliable statistics on the likelihood of a particular type of accident affecting a particular age group in a particular type and age of dwelling depends critically on having accurate estimates of the population of that age group in the postcodes where that type or age of dwelling predominates. It is believed that the final postcode population estimates, determined using the methodology described in the Technical Appendix, are approaching the best than can be produced given the information currently available, the time constraints and the particular needs of the project.

4.06 However, despite the considerable amount of modelling using other sources such as the 1996 EHCS and the Oxford University mid 1998 population estimates for local authority wards, of necessity, the final postcode estimates continue to rely heavily on the postcode population estimates included in the CACI Year 2000 demographics data. Although extended by modelling to virtually all postcodes with Residata, these original estimates were available for only a half of all postcodes. Because, the current estimates are based on 1991 Census data or later sample surveys and are heavily reliant on modelling techniques, the population estimates remain one of the main sources of potential error in the reliability of the statistics.

HASS Injury and Accident Data

4.07 As part of this project the number of recorded HASS accidents are related to fixed population estimates. Therefore, any reduction in the HASS accident numbers due to missing or inadequately specified data will underestimate the true likelihood of a relevant accident occurring. Using falls on inside stairs as an example, there are three levels of missing data –

- accident known to be falls on stairs or steps, but where the location of the fall, inside, outside or at the threshold, was not known;
- accidents known to be falls, but where the type of fall was not recorded (as it was important for this project to differentiate between falls on stairs, falls on the level, and falls between levels); and
- accidents where nothing was known about the type of accident.

4.08 To deal with this and try to improve the number of accidents, missing data was distributed pro-rata[15]. This added respectively some 15%, 60% and 8%, or a total of 83%, to the estimated number of falls on inside stairs by the vulnerable group in the HASS catchment areas. While the accuracy of this procedure is likely to be increased by distributing pro-rata within each housing type and construction date, as well as for a particular age group, it nevertheless relies on the assumption that the missing data is evenly distributed therein.

4.09 The missing HASS data, which is common for all hazards, adds to the uncertainty of the safety statistics. Further uncertainties are introduced by the procedure for accounting for the loss of cases from the HASS catchment areas to other A & E hospitals, these adding, for example, a

15 As described in paras 6.03-6.07.

further 33% to the estimated number of falls on stairs. These uncertainties are in addition to the normal sampling errors arising from the fact that the HASS data represents only a sample of accidents, which are assumed to be representative of all accidents in England and Wales.

Number of Occurrences

4.10 It is recognised that, for some hazards, there may be a reduction or increase in the number of occurrences in a particular year. For example, a relatively mild winter will mean a reduction in the number of occurrences from excess cold. To compensation for this, data was obtained for more than one year, and annual average occurrences calculated. Ideally, data for at least five years should be the minimum. However, for HASS data for only three years was obtained, and four years for HES.

4.11 There is also the problem of the relatively small number of annual occurrence for some hazards. This makes the results of any analysis questionable. Ensuring housing becomes safer and healthier will mean this particular problem is likely to become more wide-spread.

Chapter 5

Housing Data, Format of Results and Categories of Harm

5.01 There were three pre-stages before the analysis of the injury and the health data could be analysed. These were –

- to combine the necessary housing and population data into a single database;
- to determine the format and content of the results; and
- review the categorisation of harms.

Creating a Housing and Population Database[16]

5.02 For the project to provide reliable results of sufficient detail, the most recent data was needed at postcode level for the whole of country. As no single housing and population dataset provided all the necessary information, a Housing and Population Database was created by combining information for various datasets. This Housing and Population Database was then used to analysis the injury and the health data.

5.03 Two main housing datasets were identified at the start of the project; these were the English House Condition Survey, and ACORN.

5.04 The English House Condition Survey (EHCS)[17] data is based on surveys and interviews of a sample of the total housing stock. The then DTLR supplied data from the 1991 and 1996 EHCS which was used to give information on –

- the composition, ownership, condition and the range and quality of facilities of the housing stock;
- limited information on accidents and fires in the home; and
- the profile of household groups and the housing in which they live.

16 A full description of the creation and validation of the Housing and Population Database is given in the Technical Appendix.

17 See Chapter 3 for more detailed information.

5.05 ACORN is an internationally recognised classification system developed by CACI Ltd for the market analysis industry. CACI Ltd supplied HousePlus[18] which gave details of the residential population by 20 age bands and the 54 ACORN neighbourhood categories at full post code level. Although HousePlus gave information at postcode level (on average about 14 dwellings), the dwelling characteristics were derived for enumeration districts or postal sectors (which may contain over 150 postcodes) and then applied to all postcodes in that larger unit.

5.06 To improve the data, an additional source was identified, Residata Housetypes supplied by Intermediary Systems Ltd[19]. This provided, at postcode level, the dwelling age and type (25 categories), the tenure and number of bedrooms, the property value band, and the number of postal addresses in each postcode based on the Royal Mail's postal address file (PAF).

5.07 Using the data from these three sources, a Housing and Population Database was created[20]. This comprised housing and population data on 1,925,750 cases by post code. It includes, for each postcode, variables giving details of the predominant housing type and age, value band, tenure, number of bedrooms, ACORN type and a detailed age distribution of the population. It also includes an indication of the confidence level for the housing information.

Format and Content of the Results

5.08 The form and content of the results to be generated from this project were dependent on the needs of those who would survey dwellings and apply the HHSRS and also on the data available. As stated above (para 1.08) the results are intended to inform the judgement of those assessing hazards, providing benchmarks in the form of the average likelihood and spread of health outcomes. Version1 of the HHSRS gives information on the likelihood of an occurrence for three categories of dwellings – pre-1919, post 1980, and all dwellings.

The Dwelling Type and Age

5.09 The Housing and Population Database created for this project (see paras 5.02-5.07 above) contained 25 categories on the predominant house types in each postcode. These categories were made up of –

- the five types of dwelling, ie – detached, semi-detached, terraced, bungalow, and flats; and
- the five age groups of dwellings, ie, pre 1920, 1920-1945, 1946-1979, post 1979, and mixed ages.

5.10 This meant that reliable results could be provided by the five identified types of dwelling for all hazards. This will give additional information to those using the HHSRS. Although not always available, where possible, results were to be provided for multi-occupied buildings (to support one of the other projects commissioned by the ODPM – see para 1.10 above).

18 Ibid.

19 Ibid.

20 A detailed explanation of the creation and validation of the Housing and Population Database is given in the Technical Appendix.

5.11 The age banding (in 5.09) generally reflects the dates when obvious changes in building control were introduced and which could affect the characteristics of the property. For example, the requirement for all new dwellings to be constructed with a damp proof course was introduced in 1920.

5.12 Three dwelling age bands were given in Version 1 of the HHSRS – pre 1919, post 1980 and all dwellings. The data contained in the Housing and Population Database means that, for this project, sound and reliable results could be given for the four dwelling age bands – pre 1920, 1920-1945, 1946-1979, and post 1979. Again, this will refine the information available to those using the HHSRS.

The Dwelling Base

5.13 For Version 1 of the HHSRS, average likelihoods were given for each hazard, but the number of dwellings used as the base differed for each hazard. The base used depended on two factors – the first was whether or not the particular relevant feature or facility exists, eg, does the dwelling have stairs or steps; and the second was whether there were defects to that feature or facility; e.g., disrepair or excess gradient.

5.14 The adoption of different bases for each hazard has been criticised. It can be a hurdle to the understanding of the System and what judgement was required, and also an additional complication in the application of the System by requiring a mental adjustment for each hazard to be scored.

5.15 It has become apparent since the release of Version 1[21] that this variation in the base was not immediately obvious to potential users of the HHSRS. If it is not appreciated, it could mean a mistaken assessments of conditions.

Example – Assessment of Damp, Mould Growth etc in a pre-1919 Dwelling.
Version 1 gives the average likelihood of an occurrence as 1 in 32. The base used to calculate this likelihood is "the population of people living in dwellings that are damp or have defective ventilation or heating". This requires the surveyor to judge whether any dampness present in the dwelling surveyed is average, better than average or worse than average for a damp pre-1919 dwelling, and, if better or worse, assess the reduction or increase in the likelihood.

If the surveyor assumes that the base used is all pre-1919 dwellings, then, if any damp or mould growth has been identified, he or she mistakenly would be assessing by how much the likelihood should be increased.

5.16 Using all dwellings as the base for calculating the average likelihood for each hazard can also be misleading. First, it will reduce the average likelihood implying that, for example, the threat from damp and mould growth in a damp dwelling is less than it really is, also implying that there is some threat to health from dampness in dwellings which are not damp or mouldy. If this is not appreciated, then it also could lead to mistaken assessments if the surveyor did not reduce the likelihood where there is no damp or mould present.

5.17 However, the building features which result in hazards can be either a matter of fact , such as

21 Through training courses and seminars involving members of the project team. It is also an issue raised by those Evaluating Version1 – see para 1.10 above.

the presence or absence of stairs, or of a window, or a matter of judgement, for example, noise or damp. While the question of fact is clear, matters of judgement may lead to variability in determining the base.

5.18 While this is a decision to be taken during the development of Version 2, on balance, it seems most appropriate that the average likelihoods for each hazard provided by this project should be calculated using the total number of dwellings in the housing stock.

5.19 This also acknowledges that hazards relate to people as well as to dwellings. People, particularly from the vulnerable group, fall on the level even when there are no dwelling defects, and also on so-called Ideal stairs. Giving the averages for the Ideal acknowledges that, for example, falls occur on any stairs and on any floor surface, and also means that the end user of the HHSRS is being asked to judge the likelihood over and above the Ideal having regard to any defects present – the extra or excess risk. This follows the approach surveyors and EHOs do naturally, and should make the System easier to understand and also make a fuller and more obvious use of professional judgement. However, it also means that for some hazards, such as uncombusted fuel gas, there may be some risk in any dwelling with a gas supply, but no risk in a gas free dwelling. In such a case the average likelihoods calculated will show some risk. In such cases, the surveyor should reduce the average likelihood, recognising that there is zero risk.

Vulnerable Groups

5.20 The data available made it possible to identify if a particular age range of people would be more vulnerable to a hazard than others[22]. For consistency of the results, five age groups were used for the analysis. These are –

- under 5 years old;
- 5 – 15 years old;
- 16 – 59 years old;
- 60 – 74 years old; and
- 75 years and older.

Classes of Harm

5.21 To enable different health outcomes to be compared, the HHSRS uses a method for categorising outcomes according to the degree of incapacity. This approach allows injuries to be compared with illnesses and other health conditions. For Version 1, four Classes of Harm were adopted based on those developed by the Building Research Establishment (BRE)[23]. Examples of the Version 1 health outcomes are shown in Table 3.

22 See Glossary for full definition of *vulnerable group* for the purposes of the HHSRS.

23 See Raw, G., et al., *A risk assessment procedure for health and safety in buildings* (1999), CRC; and Raw, G., et al, *Building regulation, health and safety* (2001) CRC.

Table 3 – **Examples of Classes of Harm – HHSRS Version 1**

CLASS I	Death
	Permanent paralysis below the neck
	Malignant lung cancer
	Permanent loss of consciousness
	80% burns
CLASS II	Stroke
	Loss of hand or foot
	Serious fractures
	Serious burns
	Loss of consciousness for days
CLASS III	Loss of a finger
	Malignant but treatable skin cancer
	Fractured skull
	Severe concussion
	Serious puncture wound
	Severe burns to hands
CLASS IV	Occasional severe discomfort
	Chronic skin irritation
	Some benign tumours
	Moderate cuts to face or body
	Severe bruising to body
	10% burns

5.22 It was found, however, that not all the injury or the health outcomes for which information was available[24] were included in the original BRE's classifications. This meant that before analysing the data, those outcomes not categorised had to be assigned to appropriate Classes of Harm.

5.23 For the health outcomes, the LSHTM expertise was used to classify un-categorised health conditions and illnesses following the framework laid out by the BRE[25]. For example, Mesothelioma from asbestos was assigned to Class I (with malignant lung cancer)[26].

5.24 The information on the injuries sustained from accidents in dwellings in the HASS data includes details of the type of injury (eg, open wound or burn) and the body part affected (eg, head/face or neck/throat). Unfortunately, for the majority of injuries detailed in the HASS data there was a poor match with those originally categorised. Again, following the BRE framework, the un-categorised injuries were classified.

5.25 As the HASS data included details of the result of the hospital visit and, if appropriate, the number of inpatient days, this information was used to check, validate, and if necessary adjust the classification. For example, where the outcome was recorded as "did not wait/examined but no treatment", these were omitted from any category; where it was recorded that a victim spent 3 days or less in hospital, these were assigned as Class III Harms; and where the victim spent 15 days in hospital were categorised as Class II Harms.[27]

24 That is the Home Accident Surveillance System and the Hospital Episode Statistics – see paras 3.03.1 and 3.04.1 respectively.

25 As described in *A risk assessment procedure for health and safety in buildings*, op. cit.

26 A list of the health outcomes classified during this project is given in Figure 3, page 199, Volume III – Technical Appendix.

27 A matrix showing the categorising of each HASS injury is given in the Technical Appendix.

Chapter 6

Analysis of the Injury, Health and Mortality Data

6.01 As the nature of the HASS data and the HES data differed, this required different approaches to the analysis of the injury data and the health condition data. The expertise of the team members form the SHHRU was more suited to the analysis of the accident and injury data, while that of the team members from the LSHTM was suited to the health condition data. Which hazards related to HASS data and which to HES data is shown in Table 2.

Table 2 – **Relating HASS and HES Data to Hazards**

Injury related Hazard HASS Data	**Health related Hazard HES Data**
Falls on level	Excessive cold
Falls on stairs	Radiation
Hot surfaces and materials	Damp and mould growth
Fire	Carbon monoxide etc.
Falls between levels	Noise
Electrical hazards	Asbestos etc.
Entry by intruders	Lead
Uncombusted fuel gas	Crowding and space
Explosions	Domestic hygiene, pests etc
Entrapment or collision	Personal hygiene and sanitation
Falls related to baths etc.	Inadequate provision for food safety
Structural failure	Contaminated water
Inadequate lighting	Excessive high temperature
Poor ergonomics	

Methods – Injuries and Accidents

Overall methodology

6.02 Once the Housing and Population Database had been created, there were three stages involved in producing the statistics for each of the accident and injury hazards –

- determining the number of relevant non-fatal accidents and their breakdown into Class II to IV harms;
- determining the number of relevant fatal (Class I) accidents; and

- relating the number of fatal and non-fatal accident to the population estimates for a common sample of postcodes and calculating the annual likelihood and spread of harms.

The component stages

6.03 As the HASS data relates only to a sample of Accident and Emergency Units (see para 3.03.1 above) it was necessary to match the data on accidents by postcode to the information on housing and populations. This produced four distinct parts for the total HASS accident sample. These comprised the sub-samples of postcodes –

i. in HASS catchment areas for which there was also housing and population data (the key catchment sample);

ii. in HASS catchment areas, but for which there was no housing or population data;

iii' outside the catchment areas, but for which there was housing and population data; and

iv. outside the catchment areas and for which there was no housing or population data.

6.04 First, the average annual number of accidents were apportioned to the key catchment sub-sample 6.03(i). Then, for each hazard, the number was corrected to allow for missing accident records and the loss of HASS cases to other hospitals. This correction was based on the assumption that the number of accident cases lost from the catchment areas to other non-HASS hospitals was offset by the cases gained from outside the catchment areas (i.e, those cases recorded in sub samples 6.03(iii) and (iv)). Based on this assumption, the total number of relevant accidents in those sub-samples were apportioned to sub-samples 6.03(i) and (ii), and the four sub-samples amalgamated to give the national total.

6.05 As the corrected numbers for non-fatal accidents were based on all relevant accident cases (including those from sub-samples 6.03(iii) and (iv)), the spread, as a percentage, of non-fatal harms was determined from the key catchment (sub-sample 6.03(i)).

6.06 There are very few Class I harms in the HASS data, although it does include some chronic non-fatal accidents as well as death. For each safety hazard and age group, the number of fatal accidents was determined from ONS mortality data[28] for the same three years (1997 to 1999). For most hazards, the number of fatalities are far fewer than the number of non-fatal outcomes and, for increased accuracy, the number was initially determined for all the postcodes for which there were housing data and population estimates (that is for sub-samples 6.03(i) and (iii)). The fatality numbers were then scaled down, in proportion to the relative populations, to give the number of Class I harms for the key catchment sub-sample (6.03 (i)) compatible with the final number of Class II to IV harms obtained from the HASS data.

6.07 Finally, for each safety hazard, the average annual number of accidents, fatal plus non fatal, and the full range of harms, Classes I to IV, was determined for each age group in the key catchment sub-sample (6.03(i)). From this the accident rate per 1000 population or the likelihood of an accident was determined and, with the spread of harms, the average HHSRS score and bandings to be calculated. This also gave the most vulnerable age group for each safety hazard.

6.08 Disaggregating the relevant accidents and population for the vulnerable group enabled the

28 See Chapter 3.

average likelihoods and spreads of harm to be calculated by housing type and date of construction.

Methods – Health Data

6.09 Because of the nature of the information available and the type of health outcome, three approached were used to analysed the HES data. These were –

i. Linkage of health statistics to housing data, and then tabulation of health risks by dwelling characteristic. A 'baseline' risk group was defined, and excess risks calculated by reference to this group. For example, with cold-related death, residents of dwellings built after 1980 have a lower risk of excess winter mortality than those living in older properties. The difference in risk between older and newer properties is the risk attributable to the hazard.

ii. Use of published epidemiological evidence quantifying the direct relationship between exposure and the relevant health risk. For example, for asbestos, the estimates of risk primarily was based on a large meta-review which provides a risk relationship between fibre-years of exposure and lifetime risk of premature cancer death. From this graph the lifetime excess risks for people subject to asbestos exposure in the home can be obtained.

iii. Ad hoc approaches, entailing semi-subjective adjustments to some average level of risk. For example, for carbon monoxide poisoning, the data is presented on the national rates of accidental CO-related mortality and hospital attendance, and categorising all dwellings with badly maintained boilers or heaters as having a substantial risk of high indoor CO level.

6.10 Approach 6.09(i) was used to derive cold and heat related risks (though in the latter case, the emerging evidence was too imprecise to be useful) and some aspects of damp, food-safety and overcrowding. Approach 6.09(ii) provided the basis for quantifying attributable risks for asbestos, radon, lead and contaminated water. For carbon monoxide, hygiene and noise ad hoc approaches were followed (6.09(iii)).

6.11 As the analysis used depended on the hazard and the data available, (unlike the analysis of the injury data) a description of the source of the data for both health and exposure and of the calculation method used is given for each in the Annex to Volume III. This will allow replication of the calculations in the future as new data is obtained.

6.12 Generally, the proportions of dwellings exposed to each hazard were derived from the EHCS 1996.

Chapter 7

Recommendations for Improvement of the Statistical Evidence

7.01 The HHSRS is an evidence based system. It requires the environmental health officer or surveyor to determine the severity of the risks due to the hazards in any particular dwelling, with reference to the actual risks to health and safety that such hazards present in the housing stock. However, although no longer insignificant, knowledge of the links between health and safety and housing conditions is still somewhat limited and, as a result, the production of the current statistics has been constrained at a number of levels by the paucity and inconsistency of the evidence base.

7.02 A major advantage of the HHSRS is that it provides a clear focus for further work in this field and an important part of this project has been to identify and recommend improvements in the statistical evidence that can be made in future years. It is likely that in future, the health and safety statistics will be further updated and that there will be other projects relating health statistics to other data sources. Consequently, it would be helpful if standard protocols for recording the information could be adopted. While commercial companies may not follow such protocols, it would seem appropriate for these to be followed by the various central, regional and local government departments.

Housing estimates

7.03 While it may be unrealistic to expect the variables in commercial surveys to be standardised, Residata, for example, would have been of even greater use in producing the HHSRS statistics had it distinguished converted from purpose built flats and provided dwelling age bands exactly comparable with those used in the (then) DTLR's national housing surveys, particularly the EHCS.

7.04 There is a particular need to improve the statistical evidence for houses in multiple occupation (HMOs). The HASS, general mortality and Fire Brigade data should all distinguish accidents and fires in HMOs, using standard common definitions of multiple occupation, possibly based on those used in the EHCS.

Population Estimates

7.05 The accuracy of the HHSRS statistics relies on having accurate population estimates at postcode level. The publication for the 2001 Census of enumeration district data, including a breakdown of population by age, should substantially increase the reliability of any postcode population estimates for two main reasons –

- Firstly, the 2001 Census will provide up-to-date primary information on the age distribution of the population in the whole of England and Wales. In contrast, all currently available information is either well over 10 years out of date being reliant on the 1991 Census, incomplete being based on sample surveys, and/or heavily reliant on modelling techniques, these being largely undisclosed in the case of commercially available data.

- Secondly, because of their significantly smaller size, enumeration district populations can be related to postcodes much more accurately than ward or postcode sector based populations. Compared with an average of some 2,330 dwellings in a local authority ward and 2,730 dwellings in a postcode sector, an average enumeration district contains only some 130 dwellings. The average postcode in the HASS catchment areas comprises just over 18 dwellings. This is slightly larger than the national average of 14 dwellings, but postcodes of between 30 and 60 dwellings are common in urban areas.

7.06 For the above reasons, we would strongly recommend that the HHSRS statistics be recalculated on the basis of the 2001 Census enumeration district population data, once this data becomes available.

Injury and Accident Data

7.07 Both this project and the original development of the statistical evidence supporting Version 1, have been possible because of the data collected through the Home Accident Surveillance System (HASS). For the HHSRS to be maintained and updated in the future the continued collection of HASS data is vital. It is important therefore, that the following comments on HASS data are seen as constructive and only relate to the use made of that data for the purposes of the HHSRS.

7.08 The analysis of the Home Accident Surveillance System (HASS) was based on data for the three years 1997 to 1999, these being the years with the best post coded data currently available. However, despite averaging the statistics from a number of years, for less frequent hazards such as falls between levels and electrical hazards, the sample sizes are still generally too small to be accurately broken down by both age group and type and age of dwelling. In future, it is recommended that the safety statistics be repeated, using at least five years of fully validated HASS data.

7.09 As described in Chapter 4 above, the HASS accident records contain a particularly large proportion of unspecified or only partially specified data. It is recognised that there are inherent difficulties encountered in collecting accident data in the Accident and Emergency Units. Obviously, the first priority of the victim will be in getting early treatment, and that of the

hospital staff will be in diagnosing and administering the appropriate treatment. Asking and answering details about the circumstances of the accident will rarely be seen as a major priority by either side. However, in the interests of reducing the number of future accidents in the home, we believe efforts are required to improve the amount and quality of the HASS data. How this might best be done could be the subject of a small research project in its own right. However, the validation and analysis of the 1997, 1998 and 1999 HASS samples carried out for this project has provided a number of pointers.

7.10 HASS clerks in hospitals should be reminded of the importance of the data for housing policy and preventative medicine. This project has shown that while there is a generally good response rate for the basic information on the age of the victim and the medical details of the injury and body-part affected, insufficient attention seems to be given to collecting the ancillary, non-medical information on the circumstances of the accident, such as on the room location, the dwelling type and person's activity at the time.

7.11 Missing data on inpatient days also suggests that the HASS data is generally collected at the time of admission to the A & E Unit or soon afterwards and is not necessarily revised when the full details of the injuries are known. Checking and finalising the HASS forms just before the person is discharged, when the accident victim may be more receptive to answering detailed questions on the circumstances of the accident, might help to improve the quality of the information collected, particularly that concerned with hospital outcomes and in-patient days.

7.12 As well missing data, the HASS figures also significantly underestimate the number of non-fatal accidents in the HASS catchment areas due to the loss of cases to neighbouring A & E units. The definitive solution to the determination of the true accident rates in the HASS catchment areas would be to use the national hospital episode statistics to determine all the accidents from the postcodes in the catchment areas that were treated at other non-HASS hospitals in the same period as covered by the HASS data. This is a large piece of work involving a larger accident sample and was outside the scope of this project. However, this might be one way of increasing the reliability of the HHSR statistics in future. Generally, such an analysis could also confirm the accuracy of Dti's national accident estimates.

7.13 Depending on the year, up to a fifth of all HASS postcodes were found to be mis-punched or mis-formatted and these had to be corrected to maximise the sample that could be matched to other data. The quality of the HASS postcode data could probably be improved substantially by using an experienced punching agency and adopting the common commercial procedure of double punching when transferring the HASS records to a data file.

Small Number of Occurrences

7.14 Using data for five or more years to produce the average number of occurrences will help flatten peaks and troughs. It will not, however, increase the number of occurrences where those are infrequent. And, as dwellings become safer and healthier, the number of hazards should drop generally, increasing the problem. For the current infrequent hazards, and generally, consideration should be given to alternative methods of using other evidence to prove the risk.

Defining the Hazards

7.15 Relating the HASS categories for the accident mechanism, article involved, the activity and location of the accident to specific hazards in the home, as covered by the HHSRS, has proved tenuous in many cases. That said, it is still possible with the HASS data to distinguish certain critical attributes of a hazard, for example, to distinguish falls on inside stairs from falls on outside stairs and steps. Such an analysis shows that there is a far stronger link between non-fatal accidents and housing type and age in the case of inside stairs than for outside stairs and steps, where such factors as the topography of the site may be more important.

7.16 In the final statistics, however, such distinctions are lost due to the need to also consider fatal accidents, as provided by the mortality data held by National Statistics (ONS). These data are categorised according to the external causes codes of the International Statistical Classification of Diseases and Related Health Problems, tenth revision[29] (ICD-10) and provide significantly less detail of hazards than is possible from the HASS data.

7.17 To improve the HHSRS safety statistics, the mortality data needs to be made more compatible with the HASS data. While it may not be feasible to extend the record of all fatal accidents, we would recommend extending the record in line with the HASS data, at least, for all deaths occurring in the HASS catchment areas. With respect to fatal accidents, we welcome the Dti's current review of the Home Accident Deaths Database (HADD) which was last compiled for the year 1995.

7.18 Generally, there is insufficient statistical evidence to directly relate health and safety outcomes to specific hazards and, particularly, to specific faults in a dwelling. To counter this problem for falls on stairs, in 1998 the Building Research Establishment (BRE) undertook a postal follow-up survey of HASS cases to determine the particular physical characteristics, steepness, balustrade design etc, of the stairs involved. This was accompanied by a sample postal survey, using a similar questionnaire, to determine the incidence of each particular type of stair in the housing stock. From the findings of these two surveys, it was possible to assess which types of stair were more likely to be involved in accidents.

7.19 Although this approach requires more development, further surveys of this kind may be needed to cover other frequent hazards. However, it might be possible to achieve the same results, more economically, by extending the HASS questions on the physical aspects of the accident and by including comparable questions in the EHCS to determine the incidence of particular physical conditions in the housing stock. At the very least, a feasibility study is required to determine how this issue might best be addressed.

Determining Classes of Harm

7.20 For the specific purposes of the HHSRS, the HASS questions on health outcome could also be improved. For example, none of the questions on the type of injury, body part affected, hospital outcome and inpatient days give a particularly good indication of the true severity or class of health outcomes.

29 Op cit.

7.21 Data relevant to non-fatal classes of harm also varies substantially between different databases. For example, for the HASS data, classes of harm have been determined from variables giving the type of injury, the body part affected, the nature of treatment and the number of in-patient days. However, for the Fire Brigade data, the most relevant information concerned a different categorisation of type of injury, the circumstances of the injury and the number of people killed or injured. Moreover, although the HASS data came closest, none of the variables or their combination was wholly compatible with the BRE's classification of injuries into classes of harm.

7.22 The classification of harm adopted for the HHSRS based on that developed by the BRE[30], while appropriate for the HHSRS, is not the only system in use for categorising health outcomes according to the degree of incapacity or the severity of the outcome. Consideration should be given to a separate project to identify the various different systems, perhaps both national and international, and to investigate the development of a single standardised classification methodology which would meet the various needs. Such a standard classification system could then be used in all Government funded surveys in which information on injuries and illnesses is collected.

And, finally

7.23 In summary, this project has identified the need for further work in the following areas –

i. A repeat of the safety statistics using population estimates from the 2001 Census and HASS data and HES for the 5 years, 1997 to 2001, once these are available.

ii. A study of the potential improvements in the collection and validation of HASS data for the purposes of continued updating and refining of the statistical evidence supporting the HHSRS.

iii. The review of the determination of HASS catchment areas and the loss of cases to other A&E units, perhaps using the HES.

iv. An investigation of alternative methods of determining the risk from infrequently occurring hazards.

v. A feasibility study to determine ways of making the statistical evidence more directly relevant to housing conditions.

vi. A study of the different sources and methods for the categorisation and recording of injuries and health conditions to recommend standardised classification of harm.

30 *A risk assessment procedure for health and safety in buildings*, op. cit.

Glossary of HHSRS Terms

CLASS OF HARM	The possible Harms which may result from an occurrence, categorised according to their perceived severity. Four Classes of Harm are used for the purposes of the Housing Health and Safety Rating System[31].
FAULT	The failure of an element to meet the ideal, whether that failure is inherent, such as a result of the original construction or manufacture, or a result of deterioration or want of repair or maintenance.
HARM	An adverse effect, such as an illness, condition, symptom, or injury, to the health of a person.
HAZARD	The effect that may result from a fault and which has the potential to cause harm. A *Primary hazard* is a hazard resulting directly from a fault. A *Secondary hazard* is one that increases the likelihood of an occurrence or the severity of harm likely to result from a primary hazard.
HAZARD OR RISK SCORE	The Hazard Score is the sum of the products of the weightings for each class of harm which could result from the particular hazard, multiplied by the likelihood of an occurrence, and multiplied by the set of percentages showing the spread of harms. (See the formula shown in Figure 1 above.)
HEALTH	An individual's state of physical, mental and social well-being. This is not limited to the presence or absence of disease, infirmity or physical injury, and can also include psychological injuries and distress.
HEALTH OR HARM OUTCOME	The potential consequences of a hazard on the health of an individual. See *Class of Harm*.
IDEAL	The currently perceived model for an element which defines the functions and safest performance criteria that can be expected of that element.
LIKELIHOOD	The probability of an occurrence. For the purposes of the HHSRS, this is the probability of an occurrence during the twelve months following the assessment.
OCCURRENCE	An event or period of time exposing an individual to a hazard.
VULNERABLE GROUP	An age range of people for whom the risk arising from a hazard is greater than for any other age group, and who might typically be expected to occupy the dwelling (but excluding those who could be registered as chronically sick or disabled.) A *Vulnerable Person* is a member of a Vulnerable Group.

31 See Table 2 for examples of each Class of Harm used in Version 1 of the HHSRS. Further details of Health Outcomes in each Class is given in the Technical Appendix.