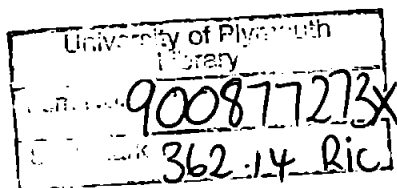


**CAN HEALTH VISITORS ASSIST CLIENTS TO
OPTIMISE HEALTH-DETERMINING ASPECTS OF THE
INDOOR ENVIRONMENT THROUGH PROVISION OF
EVIDENCE-INFORMED MESSAGES?**

by

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ABSTRACT

George Richardson. Can health visitors assist clients to optimise health-determining aspects of the indoor environment through provision of evidence-informed messages?

The aim of the research was to investigate the acceptability and feasibility of health visitors working with their clients to assess health-determining aspects of their clients' home environments and to provide evidence-informed messages about the indoor environment. The research was conducted within a Soft Systems Methodology framework. Following a pilot study in 2003, a proof of concept, feasibility study was implemented (2004 to 2007) with a convenience sample of eight health visitors conducting 29 environmental assessments in clients' homes, using a dedicated, cost effective tool kit. The health visitors were trained to monitor and provide evidence-based messages on indoor environmental quality. Their quantitative and qualitative data from the assessments were compared against a 'gold standard' assessment carried out by an indoor environmental expert. The health visitors' opinions of the concept were investigated using participant observation and face-to-face interviews. The aim and objectives of the research were met. The health visitors were able to collect accurate data. Changes to the tool kit would be needed to adapt it specifically for health visitors. The majority of the health visitors found the concept acceptable and relevant to their work. The study has added to knowledge, in that the feasibility and acceptability of health visitors helping their clients with indoor environmental problems is now more clearly understood. It confirms previous findings that home visiting health professionals are not well informed about health-determining aspects of the indoor environment. Lack of time and resources could be a barrier to health visitors participating in research.

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As a researcher in the field of indoor environmental science, I have had the privilege of being invited into more than 225 homes in the United Kingdom (UK)^{*} to collect indoor environmental data for analysis (from 1999 to 2007). This has given me an insight, beyond the understanding of the physical science of the indoor environment, into the emotional and social influences on the quality of the home environment. I have been involved in designing air-cleaning systems and providing solutions to problems with indoor air quality, some of which were presented in my Masters of Philosophy degree, *"The development and application of novel technology in improving indoor environments"* (University of Plymouth, 2001). Working closely with the same families in their own homes over time, made me realise that the greatest problems (and improvements) in indoor environmental quality were related to household management and the lifestyle of the occupants, albeit at times influenced by housing conditions. In the main, landlords, or owner-occupiers have substantial capital tied up in their properties; therefore, they will uphold a certain level of maintenance to protect their investments. Further, if landlords wish to be approved to let their properties to people on social benefits, their properties must meet current housing standards.

Unfortunately, many young people have not had life skills passed on to them from their parents necessary to manage their homes. Meeting with people on a one-to-one basis in their own homes was a simple, non-compromising, and effective way of providing evidence-informed messages on providing a good

^{*} UK of Great Britain and Northern Ireland

quality indoor environment. Like others, I saw the opportunity of empowering householders with information but realised that not everyone would ever get an enthusiastic environmental scientist in their living room, when there are approximately 21 million households in England alone! I realised the value in researching the concept of teaching home visiting professionals some of the skills associated with indoor environmental science, with the aim of helping families understand their home environment and address deficiencies. Health visitors seemed likely candidates for this role.

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AUTHOR'S DECLARATION


At no time during the registration for the degree of Doctor of Philosophy has the author been registered for any other University award without prior agreement of the Graduate Committee.

The part-time study was self-financed by the author.

Relevant scientific seminars and conferences were regularly attended, where presentations were often made. Six associated papers have been prepared for publication, where five papers have already been published.

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Chapter 1. Introduction, Aim, and Objectives

1.1. Introduction

1.1.1. The History of Indoor Environmental Science

Although the indoor environment, covering all aspects of internal conditions in buildings where humans live and work, is increasingly studied, indoor environmental science is not a new subject. In the 15th century, Gerolamo Cardano highlighted the link between environmental factors and poor health.¹ In 1858, Pettenkofer attempted to quantify indoor air quality by measuring concentrations of carbon dioxide.² Pettenkofer's ideas are still in use today to quantify ventilation rates to dilute human derived airborne contaminants. In 2004, Sundell described the history of indoor air quality and health and noted the problems with the science. There are known associations between the indoor environment and health but a dearth of clinical evidence.³

"In general, scientific studies have not shown an association between health effects and commonly measured agents such as (single) volatile organic compounds, total mass of volatile organic compounds, particulate matter, and microbially produced matter...the results can be viewed as a result of the 'lamp-post effect', meaning that we search where we can see easily (under the lamp post), and not in between the lamp-posts."³

Although research has been conducted on the indoor environment, the emphasis of environmental science for many years was the quality of outdoor air and the 'natural' environment.³ Promoting the protection of the natural environment is important, however the realisation that most people spend the majority of their time indoors has shifted some emphasis away from outdoor

¹ Ventilation is from the Latin word 'ventilare' – 'to expose to the wind'

pollutant exposure studies. People spend more than 90% of their time indoors,⁴ making the indoor environment a potential area for long-term exposure to pollution. Further, the 90% period is often in different localities, with diverse environmental conditions. It is estimated that 70% of time spent indoors is within the home⁴ increasing the importance of a high quality home environment. People who are most susceptible to the effects of indoor air pollution tend to spend the greatest amount of time indoors, particularly children, older people, and those with respiratory diseases.

Multiple combinations of pollutants from different sources have health effects and influence the indoor environment of a home. In 1993, a study in the United States of America indicated that concentrations of some volatile organic compounds (for example, formaldehyde and benzene), inorganic gaseous compounds (for example, carbon dioxide and nitric oxide), heavy metals (for example, lead), particles, and microorganisms were higher in the indoor environment than outdoors.⁵ Certain pollutant concentrations are two to five times higher indoors than outdoors.⁶ The addition of indoor-sourced pollutants such as environmental tobacco smoke, allergens, and gases from cooking and heating further reduce indoor air quality.⁷ In developed countries, environmental tobacco smoke, gases such as nitrogen dioxide, radon, and bio-aerosols dominate health concerns about indoor air quality.⁸ In addition, the indoor environment presents physical risks, fire hazards, and might influence psychological needs, such as adequate space, security, noise levels, aesthetics, comfort, and social status.⁹

Lifestyle differences have the main influence on the quality of the indoor environment, although, housing conditions and location have an impact. The differences between rural and urban settings are due to 'an urban living effect'.¹⁰

"While it is intuitively attractive to link health status and the quality of housing, it is methodologically complex to identify the relative importance of housing because individual characteristics and environmental variables act as confounders."¹¹

The importance of the indoor environment was recognised in 2007 by the Scientific Committee on Health and Environmental Risks.¹² The Committee's report aimed to help the European Commission develop and implement policies on indoor air in private homes and public buildings. In 2003, the formation of the UK Indoor Environment Group, (where the researcher* was a founding member), emphasised the importance of indoor air quality as a subject.

1.1.2. Health-Determining Aspects of the Indoor Environment

1.1.2.1. The Determinants of Health

Human health is an interaction of age, duration of environmental exposure, susceptibility (genetics), and direct exposure (physical or social).¹³ Evans and Stoddart presented a model to describe the determinants of health (Figure 1).¹⁴ This socio-ecological model shows how a human's physical environment is one of many factors to map when investigating an individual's health status. The model serves as a good basis on which to centre discussions when allocating resources for health determinants even though the degrees of relationships are un-quantified.

* Researcher is used throughout to denote the author of this thesis

Another well-known interpretation of the determinants of health is the Dahlgren and Whitehead diagram¹⁵, which demonstrated that 'society' is the ultimate designer of human health. Thus, 'society' should strive to promote equity in all matters linked to health outcomes. Their discussion paper formed a base for the World Health Organisation's report 'Policies and Strategies to Promote Equity in Health'.¹⁶ Since publishing the report, many European countries have strived to eliminate health inequalities. This includes work on the economies of health; the promotion of sustainability^{*}; working lives contra unemployment; information about nutrition; promotion of good physical housing conditions and the promotion of good social conditions available for everyday living; and reversal of the 'inverse care law', whereby those most in need are least likely to receive high standard health services.¹⁷

Barton and Grant adapted Dahlgren and Whitehead's work to represent the challenges to health from the built environment.¹⁸ The closest health determinants are age, sex, and hereditary factors, where lifestyle is recognised as a source of health or disease.¹⁷ The built environment and lifestyle represent the indoor environment. Many aspects of the built environment have a known link with health problems, including temperature, ventilation, fire safety, damp, and vermin.¹⁹ The built environment has many potential links with health, where the indoor environment forms a major part of this as shown in Figure 2 from Rao et al.⁹

^{*} Sustainable economic development, which does not threaten any part of the ecological system¹⁵

1.1.2.2. The Indoor Environment and Respiratory Illnesses

Respiratory illnesses, particularly asthma^{*} are associated with indoor pollutants.^{20,21,22,23,24} The link between asthma and the environment is not a new hypothesis.

*"In our endeavours to find the cause of the (asthma) attack we utilised the known fact that the environment of the asthmatic patient is, as a rule, of primary importance in determining the intensity and frequency of his attacks."*²⁵

In 1927, experiments in Holland indicated that a high altitude, sanatorium type environment could improve the condition of asthma sufferers, highlighting the importance of high quality indoor air.²⁵ The Joint Research Centre for the European Commission has stated that 20% of Europeans suffer from asthma due to substances inhaled indoors.²⁶ Children are more vulnerable to environmental factors compared to adults, since they inhale more air in proportion to their body-weight.²⁷ A stimulus or insult to a child's health during critical periods of their development can have lifelong health effects.²⁸ Early life factors, for example environmental conditions (including the indoor environment), poverty and poor early growth contribute to the risk of developing a chronic disease in later adult life.

In 2004, the World Health Organisation developed the Children's Environment and Health Action Plan for Europe, which emphasised the importance of indoor air quality on respiratory illnesses.²⁹

"We aim to achieve a substantial reduction in the morbidity and mortality from acute and chronic respiratory disorders in children and adolescents by: a) developing indoor air quality strategies that take into account the specific needs

^{*} Asthma is a Greek word meaning 'wind'

of children [and] d) applying and enforcing regulations to improve indoor air quality, especially in housing, child care centres and schools..."²⁹

Part of the evidence base of the Action Plan was a European study conducted in 2003 to understand how environmental conditions relate to health outcomes. The results indicated that finding a dose-effect relationship, or a causal link would allow the determination of the economic value of gains in improved health.³⁰ In 2007, the Health Protection Agency reviewed measures taken in England to address recommendations in the Action Plan. Measures have concentrated on the reduced exposure to carbon monoxide and environmental tobacco smoke. The Health Protection Agency highlighted the lack of co-ordinated action to improve indoor air quality and the need to establish where responsibility for the indoor environment lies.³¹

There has been a continuous rise in asthma cases over the last 30 to 40 years, which cannot be linked to genetic factors alone.³² The other potential factors suggested to cause the rise are:

- The 'hygiene hypothesis' - the protective effect of bacteria and allergens
- Diet
- Allergen exposure
- Atmospheric pollution (mainly traffic pollution)
- Tobacco smoke³²

Both indoor and outdoor environmental conditions have dramatically changed over the last 150 years and there is not a single, simple epidemiological route

³⁰ Epidemiology is the study of factors affecting health in populations

to follow to match the changes to the increase in respiratory illnesses. In 2009, a review about the changes in indoor chemicals since the 1950's indicated that many of the chemicals presently found in indoor environments and in the blood and urine of occupants, were not present 50 years ago.³³ Given the level of exposure to such chemicals, there would be value in monitoring networks that provided cross-sectional and longitudinal information regarding pollutants found indoors.³³

The multitude of variables linked to indoor air quality make it difficult to link respiratory symptoms to one source.³⁴ Andersson suggested that understanding of respiratory illnesses would increase with the use of epidemiological methods and measuring instruments (such as the environmental medicine questionnaire³⁵).³⁶ There are observed relationships and some strong research evidence for certain environmental variables and implications that exposure to indoor problems during different stages of life may cause health problems in some individuals.³⁷

“...statistical associations, in themselves, do not necessarily imply that the underlying environmental causes had their effect in early life. Instead, the observed relationships may reflect the effect of a lifetime exposure to the underlying causal factor, or simply exposure in adult life. Alternatively, if the early life factors are markers of causal processes operating at this stage of life, what might these be, and what are their biological or social significance relative to causal processes in later life?”³⁷

One of the theories behind the association between the change in the indoor environment over time and the rise in respiratory illnesses is the suggestion that a warmer, poorly ventilated home environment provides an ideal habitat for house dust mites and mould, increasing exposure to allergens.^{38,39}

1.1.2.3. Housing Conditions and Health

As well as being influenced by physical housing conditions, asthma is influenced by emotional 'housing related' conditions (fear of paying bills, bad landlord relationship, lack of space).⁴⁰ In 1993, a meta analysis of over three hundred research studies by the Cost Effectiveness in Housing Investment Research Programme,^{41,42} showed that investment in better quality housing and urban environments would reduce exported costs to health, education, and policing services:

- The emergency services (poor housing conditions and 'secondary heating' increase accident and fire risks)
- The education service (poor, overcrowded, and noisy home conditions impede learning)
- The police and judicial services (poor housing, environmental design, and construction are associated with a higher incidence of crimes)
- The energy supply services (poorly designed housing uses excess energy, which has a damaging ecological impact)

Exported costs are defined as being generated by under-investment in the housing sector and then 'exported' to other sectors.^{41,42}

1.1.2.4. Asthma Statistics

Between 1980 and 1994 alone, there was a 75% increase in asthma cases in the United States of America.²⁰ In Australia, 14 to 16% of children had asthma over the same period.⁴³ In 2006, 5.4 million people in the UK were receiving treatment for asthma: 1.1 million children (1 in 11) and 4.3 million adults (1 in

12).⁴⁴ Asthma is the commonest chronic disease among children,⁴⁵ with one in seven children diagnosed in their first six months of life,⁴⁶ leading to high numbers of medical consultations.⁴⁷ Every year in the United States of America, about 38% of asthmatic children miss one school week and 8% miss one school month.²⁰

In 2006, the estimated cost to the UK's National Health Service (NHS) of treating asthma was £850 million,⁴⁴ around 11% of the total (treatment) costs to the NHS.⁴⁶ This figure increases to over £2.3 billion if social security and lost productivity costs are included.⁴⁸

1.1.2.5. Asthma Treatment

Presently the treatment of asthma is predominantly pharmaceutical based, with prescription drugs designed to allow asthmatics to lead a normal life.⁴⁹ However, the drugs cannot cure asthma, prevent the onset of asthma, or prevent further rises in the number of asthma cases. There are a number of strategies currently available to treat allergies and asthma, and allergen avoidance (dietary or environmental approaches) should be part of any therapy.⁴⁵

There is evidence that events during early childhood or on first contact with a sensitising allergen influence allergic sensitisation, therefore treatment should concentrate on this period.⁵⁰ Strachan highlights the importance of the remediation of indoor pollution and sensitising allergens in a child's indoor environment and suggests this as part of a 'life course approach'³⁷ to the epidemiology of respiratory disease.⁵⁰

Custovic and Woodcock indicated three stages within a child's life where avoidance of sensitisers (for the prevention of sensitisation to allergens) and avoidance of triggers (for the prevention of symptoms and attacks) could be important.⁵¹ Custovic and Woodcock summarised the three stages as:

- 1) Prevention of allergic sensitisation - the primary prevention of asthma by allergen avoidance
- 2) Prevention of atopic^{*} disease in sensitised individuals - secondary avoidance of triggers that cause symptoms or an asthma attack
- 3) Treatment of the established disease

1.1.3. Guidelines for Improving the Indoor Environment

In 1996, indoor air quality and housing were target areas for improvement in the Department of Health and Department of the Environment document; UK National Environmental Health Action Plan.⁵²

*"The national environmental health action plan sets out the actions proposed to reduce levels of pollutants in homes, to carry out more research to improve our understanding of the links between indoor air quality and health, and to spread knowledge of practical measures people can take for themselves to improve air quality in their homes."*⁵²

In 1999, the UK Sustainable Development Strategy superseded the Action Plan,⁵³ which did not outline strategies for improving the indoor environment. Since then, guidelines and regulations have been put in place in an attempt to improve the indoor environment in homes and work places. For example, in 2004, the Department of Health Committee on the Medical Effects of Air

^{*} Atopic: a hereditary tendency to allergy where several substances cause allergic symptoms

Pollution, suggested guidelines on safe levels of nitrogen dioxide, carbon monoxide, formaldehyde, benzene, and benzo[α]pyrene. However, the committee was unable to provide guidelines for concentrations of particle pollutants.⁵⁴

One reason there is a dearth of guidelines or legislation pertaining to the control of pollutants in the home environment is because this would be almost impossible to enforce. Individual lifestyles and personal choices provide limitless variations.^{55,56} Regulation is further restricted by the difficulty in gaining consensus in the scientific community as to which pollutants are the most important indoor environmental variables.⁵⁷ Various government departments, including the Department of Health, Department for Environment, Food and Rural Affairs, Department for Communities and Local Government (formerly part of the Office of the Deputy Prime Minister), and other institutions have sought to manipulate, influence, legislate, and encourage good housing quality in terms of health and well-being. This has mainly been through a narrow framework aimed not at the occupants but at manufacturers of building materials, chemical products, and consumer products for the home.⁵⁸ The indoor environment is further regulated by setting building standards to ensure adequate ventilation is provided to dilute indoor pollutants.^{59,60,61}

An example of a departmental interpretation of guidelines on the indoor environment is by the Social Care Institute for Excellence^{*} in their published briefing during August 2005 on the subject "*What is the impact of environmental housing conditions on the health and well-being of children?*"⁶² The reason for

^{*} Developed by the UK government to improve social care services for children and adults

choosing the Social Care Institute for Excellence report as an example was that it was one of the few reports uncovered to address how the indoor environment influences the academic and financial progress of children. The report indicates that there is no way to enforce any law and no way to verify adherence to any form of legislation. The aim of the briefing was limited to the “*impact of non-decent or substandard living conditions*” and gave the examples of dampness and overcrowding. The briefing correctly highlighted the lack of standardised measures to assess housing quality and by default the lack of agreed standards for a number of common variables.

In 2005, the National Institute for Health and Clinical Excellence (UK) provided a review on housing but has not produced any guidance on health issues related to housing.⁶³ They highlighted that guidelines were difficult to determine because there was a lack of evidence on the cost effectiveness and impact on health of some interventions such as air filtration and mite reduction. The National Institute for Health and Clinical Excellence suggested that measures such as intensive cleaning and mattress covers would reduce mite allergen loads.

In 2006, out of the 21 million households in England, local authorities and housing associations were responsible for 3.7 million properties.⁶⁴ The remaining housing stock, 14.8 million owner occupied and 2.5 million private rented homes, are more difficult to monitor and regulate. Recently, there has been a push to improve the condition of all housing stock to meet health and energy efficiency targets and to address some indoor environmental problems. The framework for this includes: The Decent Homes Standard, 2000,⁶⁵ The UK

Fuel Poverty Strategy, 2001,⁶⁶ Tackling Health Inequalities: a programme for action, 2003,⁶⁷ Choosing Health: Making Healthier Choices Easier, 2004,⁶⁸ The 2004 Housing Bill,⁶⁹ and The Housing Health and Safety Rating System, 2006.⁷⁰

1.1.4. Monitoring the Indoor Environment

For each home, whether owned or rented, there are a number of stakeholders, none of which are singularly responsible for the quality of the indoor environment. Landlords and tenants alike have exploited this dilemma, in other words, 'the state of the house is not my responsibility'. As there are limited government guidelines for defining a good quality indoor environment in dwellings, an independent, quantified assessment of the indoor environment could provide evidence to all parties involved that there is a problem. Tailored advice can help pinpoint areas where there is a problem and who is responsible for the cause of the problem. Three key factors influence the indoor environment:

- 1) The lifestyle, housekeeping and maintenance practised by the occupiers
- 2) The quality of the structure of the home, ventilation regimes, and facilities
- 3) The quality of the outdoor environment in the local area

Understanding these factors is important for an investigator to determine indoor environmental quality. There are several methods of monitoring available, from conducting a full scientific investigation - to occupiers completing a simple subjective questionnaire. The most cost-effective method is self-reporting by occupiers; however, there are a number of recognised biases.⁷¹ One type of

reporting bias is the tendency to connect physical phenomena with unrelated causes, particularly when a perceived cause is a health threat.⁷² For example, allergy sufferers report mould more often than non-allergic people do and smokers are less likely to complain about mould than non-smokers are. Self-assessments lack quantitative data and are therefore seen as having limited value, however, there is some correlation between self-reporting and other quantifiable outcomes.⁷³

Too little attention is paid to how young people experience their quality of life and what measures work best for them. Questionnaires filled out by parents about a child's asthma problems might give inaccurate answers.⁷⁴ It is very difficult for a 10-year old to understand that his or her surroundings are negatively influencing their illness and indoor environmental conditions go unreported.⁷⁵

Having a trusted, non-threatening person visiting a home to discuss and record indoor environmental conditions in a face-to-face situation will give less biased results than self-reporting alone. Paper 1 includes a description of current available knowledge on monitoring the indoor environment.

1.1.5. Providing Evidence-based Messages about the Indoor Environment

1.1.5.1. Transfer of Knowledge

It is difficult to translate the physics and biosciences in action in the indoor environment into a language and presentational format that lay people can understand and relate to family members. The same difficulty arises for those

involved in educating students to incorporate current scientific research into their educational programmes.⁷⁶

"In the process of raising public awareness about a topic not well known in a population, it is necessary to develop materials for education and information resources - all targeted toward different audiences. This requires cooperation, coordination, and the expertise of many individuals to:

- (1) Translate current scientific research into information that is readily available and usable*
- (2) Disseminate information to appropriate audiences."*⁷⁶

There is a need to facilitate the conversion of findings from basic, clinical, or epidemiological environmental health science research into information, resources, or the application of tools to improve public health outcomes.¹³

Although, exposure to indoor environmental problems is common, avoidance measures are infrequently adopted⁷⁷ because of a lack of understanding of what the problems are and how to deal with them.

1.1.5.2. Population Approach

When mandatory regulations are not appropriate, as in the case of the home environment, it is reasonable for the public to expect advice and help from the government to aid self-management. The concept of an umbrella approach to education of the public about a universal health issue comes under the remit of 'public health'. The methods currently used to change behaviour include: education and advice, behaviour modification, family therapy, counselling, and self-help groups.⁷⁸ The World Health Organisation has defined public health as:

*"...(the) science and art of promoting health, preventing disease, and prolonging life through the organised efforts of society."*⁷⁹

The government's anti-smoking campaign is an example. Individuals are

encouraged to be responsible for their health, their children's health, and have a collective responsibility for the health of their community. The role of health professionals in this scenario is to support people in better decision-making.⁸⁰

No nationwide public health directed campaign to promote a good quality indoor environment was identified during this research. Over the six years of this research, the public were made aware of the core subject through mainstream television programmes – possibly the most well known being 'How clean is your house?' with Kim and Aggie on Channel 4. These programmes have approached the subject matter of the indoor environment, discussing problems such as mould and house dust mites, but undoubtedly people became interested in the subject due to the voyeuristic aspect of the programme. However, some documentary programmes have approached the subject of asthma, for example, in 2006, the Channel 4 Dispatches programme on managing allergic asthma.

Cunningham talked about getting the message across to the public 'blinded by hyperbole and hysteria' on matters of air quality when actually very few facts and truths are known or promulgated in an understandable way.⁷⁶ Previous research studies have highlighted how little knowledge the public has about the quality of their indoor environment and to what extent the media is influential.⁸¹

1.1.5.3. Individual Approaches

A review of education to manage asthma and the most appropriate measures to convey asthma education to householders has shown that use of limited information does not improve adult health outcomes (over 16 years old)

although perceived symptoms might improve.⁸² The review suggested that education in a hospital emergency room might be more effective, however, this hypothesis needs testing and validation. Groups receiving oral information on avoidance measures from front line health professionals may be less able to understand and implement the suggestions than parallel groups that receive computer-assisted instructions.⁸³ The results suggest that well written instructions can help in the understanding of allergen avoidance measures.

A review of 32 studies of health outcomes resulting from educational programmes, found a modest reduction in days off school and days of 'restricted activity', verifying some uptake of education. The review concluded that self-management programmes for children with asthma could help to mitigate, prevent, and manage attacks.⁸⁴

During the researcher's visits to homes as an environmental assessor, simple suggestions were given to householders such as hot washing bedding and toys and opening windows after showers. Anecdotal evidence from the householders indicated that they were grateful for these suggestions and had requested a list of simple instructions to help day-to-day management of respiratory illnesses.

There are inherent problems in trying to educate and influence the behaviour of people in their own homes. The difficulty in separating out cause and effect for a single variable among all the other variables influencing the indoor environment compounds and the difficulty of advising on remedial actions to address someone's health problems. A few lifestyle changes can be costly to

implement and psychologically distressing, for example, most conversations associated with removing or acquiring a pet are emotional and will seldom contain any reference to the best option for a young child's respiratory health. Researchers must take into account perceived and real difficulties for householders when suggesting remedial actions. Unlike medical treatments, actions taken to improve the indoor environment may give a much slower payback in terms of health. This reduces the perceived need for remedial actions because there is no 'quick fix'.

Although there is reasonably easy access to information on asthma care, for example, information provided by the charity Asthma UK, (including mitigation of attack triggers), this information is often complicated or simply bypasses the non-reading population and families under stress.

Another example of teaching and promoting health awareness to people is the Expert Patient Programme.⁸⁵ This Programme is a six-week course for people with chronic or long-term conditions. It aims to give people the confidence to take more responsibility for, and self-manage their health, while encouraging them to work collaboratively with health and social care professionals.

Face-to-face education in the home can influence the behaviour of clients and encourage them to implement change and participants will implement at least one suggested change to their lifestyle or home.⁸⁶ It is important to emphasise the requirement to visit families in their homes, to influence the management of asthma and other illnesses through physical changes in their own environment.⁸⁷ Front line health professionals have confirmed that their work is

enhanced when they combine education in general practitioner surgeries with home visits (⁸⁸; personal correspondence, Torbay based asthma nurse, 2006). The concept of home visiting has been highlighted as an important point of advice giving, which can also produce positive effects on various dimensions of parenting and can improve the quality of the indoor environment.^{88,89} A home visit allows a health professional to look at potential sources of exposure, particularly for asthmatic patients.⁹⁰

Tailoring advice to an individual family's needs and taking a multifaceted approach to intervention (including education), can reduce pollutants in the indoor environment, and have a positive effect on asthma (for example ^{91,92,93}).

The old adage of 'seeing is believing' applies when suggesting immediate changes to someone's household. The easier it is for individuals to see the results of a change or innovation (observability: the degree to which the results of an innovation are visible to others), the more likely they are to adopt it, as described in Rogers' summary of the characteristics of an innovation.⁹⁴ Unlike the natural environment, it is difficult to get householders to improve their indoor environment through emotive issues such as global warming.

1.1.6. Who Could Teach Families about Their Indoor Environments?

In the built environment, environmental engineers, environmental health officers, and surveyors normally advise on the indoor environment. For someone to conduct a thorough assessment of the indoor environment they need:

- Background knowledge about different indoor variables, the reason for monitoring them, and their interactions within the indoor environment
- Structured assessment methods listing variables, equipment, locations, and timing of measurements
- Guidelines to understand outcomes

When this research was planned it was realised that a group of professionals was required that would have:

- Access to people's homes and most areas within the home
- A broad 'clientele' representing a wide societal strata
- A level of education commensurate with taking on new information and learning new skills
- An ability to connect indoor environmental (physical) conditions with health outcomes and draw their own conclusions
- A personal interest in continuing professional development
- A management broadminded enough to permit staff to learn new skills

There are a number of health professionals regularly visiting homes in the UK. They could report on indoor environmental conditions given training and suitable support. For example, midwives, community nurses, general practitioners, health visitors and health visitors' assistants. Meeting a family's requirements can be difficult unless the investigator already has a relationship with a family, built up over time.⁹⁵ Health visitors and some other health professionals are ideally suited to do this. For clients to act on knowledge from health professionals, they need community-based educational outreach

programmes leading to some degree of health literacy.⁹⁶

Home Start is an example of a community outreach home visiting programme in England, with trained volunteers to support families with young children. In 2007, there were 250 local schemes running with 90 paid staff and 11,000 volunteers. Home Start organisations are independent local structures with their own management committees and charitable status.⁹⁷ However, service delivery in the home tends to be offered mostly to vulnerable or 'hard-to-reach' families, and then for a limited period only.⁹⁷ The service does aim to improve a child's living environment but it does put the home visitor in the unique position where they could advise parents or refer them on to other agencies if they do find a problem with the indoor environment.

Justification for teaching health professionals about the indoor environment is the perceived need to share information about indoor air quality across disciplines rather than it being the domain of specialised scientists.³ Health visitors in particular interact well with clients on many non-health matters and advise on non-medical subjects such as housing conditions, whether in a clinical or non-clinical surrounding.⁹⁸ The health visiting service broadly met the requirements of the research since health visitors:

- Worked in a primary care context, focusing on preschool children
- Assessed their clients' needs and used formal measurement tools
- Were used to being monitored
- Made home visits

- Were active in promoting proactive health education in connection with bringing up young children

1.2. Aim and Objectives

1.2.1 Aim

Investigating the acceptability and feasibility of health visitors working with their clients to assess health-determining aspects of their clients' home environments and to provide evidence-informed messages about the indoor environment.

1.2.2. Objectives

- To develop a cost effective, simplified tool kit with which health visitors can assess the indoor environment
- To assess the feasibility of health visitors quantifying and qualifying environmental variables

Chapter 2. Literature Review

2.1. Related Research

2.1.1. Literature Search Methods

Literature searches were conducted to review similar research involving health professionals and the indoor environment. Searches were carried out using the following keywords in the singular, plural or in combination: indoor environment; indoor air quality; home; indoors; visits; health visitors; front line health professionals; asthma; fuel poverty; energy. The following sources were searched.

Databases: The Cochrane Library; The British Medical Journal's database; The Cumulative Index to Nursing and Allied Health Literature; Ovid libraries; Medscape (Pubmed including Medline by the American National Library of Medicine); Embase; Ingenta; Science Citation Index; Web of Science; the Centre for Reviews and Dissemination: (<http://www.crd.york.ac.uk/crdweb/>); The Intute Educational and Research Database: (<http://www.intute.ac.uk/>); NHS National Research Archive: (<https://portal.nihr.ac.uk/Pages/NRRArchive.aspx>)

Organisations: Government departments and institutions (for example the Environmental Protection Agency, and Department of Health); charities; manufacturers of anti-allergen products; indoor environment organisations; institutes such as: Royal College of Nursing (<http://www.rcn.org.uk/>), Royal College of Midwives: (<http://www.rcm.org.uk>), Nursing & Midwifery Council: (<http://www.nmc-uk.org>),

Royal Society of Medicine: (<http://www.rsmpress.co.uk>)

Other sources: Information from local initiatives and agencies; researcher's Reference Manager 9 library (over 1500 references); researcher's unpublished work; and 'Grey' literature.

2.1.2. Existing Assessment Procedures used by Front Line Health

Professionals

In 2003, in Scotland, the Care Needs Assessment Package was initiated. The Package is an example of an established health and home assessment procedure, which looks at a limited set of qualified indoor variables.⁹⁹ Trained staff uses the procedure to assess the needs of vulnerable individuals (mainly with dementia), primarily in community settings. The protocol is mainly based on personal basic care such as hygiene, cooking, and general safety but provides an easy to follow table based 'tick chart'. The Package does not address indoor environmental issues.

In 2001, the charity - 'Foundation of Nursing Studies' piloted the 'Family Health Assessment Tool',¹⁰⁰ as a standardised holistic method for health visitors to be able to evaluate their clients' health needs. The assessment tool does not emphasise the indoor environment. In 2001, the Department of Health outlined a similar approach in the 'Health Visitor Practice Development Resource Pack'.¹⁰¹ The pack only mentions 'housing' and 'environmental health' in the sense of promoting 'safe' housing in connection with the development of a family health plan. The resource pack does not indicate how health visitors

might approach the subjects of housing and environmental health, although it does mention housing when suggesting a holistic needs-based assessment for care tailored to each family, seemingly acknowledging the importance of each client's housing conditions. The Department of Health resource pack suggests that health visitors should liaise with 'housing' (officers or landlords) on issues they believe relate to housing.¹⁰¹

Some Primary Care Trusts (PCTs) regularly monitor the conditions in health visitors' clients' homes. For example, the Plymouth Teaching PCT* (England) regularly monitors health visitors' activities by asking them to record 32 health needs factors for each family on their caseload.¹⁰² Two of the factors, poor housing and parental smoking, have a direct effect on an indoor environment. In Plymouth, health visitors use the 'Framework for Assessment' and the 'Child Concern Model'¹⁰³ to assess child vulnerability in a family (personal correspondence, Plymouth Teaching PCT).

2.1.3. Existing Home Environment Education Projects

There are a limited number of studies looking at health visitors and how they can influence the quality of the indoor environment in their clients' homes. The dearth of research on how health visitors understand indoor environmental issues was highlighted in a review in the year 2000, which indicated that health visitors could have an impact on improving indoor environmental quality in their clients' homes.⁸⁹

In the drive to promote energy efficiency, front line health professionals and

* Teaching PCTs were set up mainly in areas with health inequalities and deprivation to target resources and increase research, education, and staff retention (Mary McClarey, Correspondence in article in NHS Healthwise 5 May 2003)

others who engage with hard-to-reach client groups have been encouraged to promote energy efficiency grants. In 2002, in Portsmouth, UK, the local PCT and National Energy Action initiated a study, where they seconded a General Practitioner as an 'Energy Champion' to raise awareness, influence policy, establish partnerships, and deliver practical action to tackle cold-related illness associated with vulnerable households living in fuel poverty.¹⁰⁴ A family is thought to be in fuel poverty if, to maintain a satisfactory heating regime, they spend more than 10% of the family's net income on all household fuel use.¹⁰⁵ The study qualified the importance of using front-line professionals that enter people's homes to directly identify households living in cold, damp homes. Further, the study highlighted that few staff working in social services or health care were aware of the health problems linked with cold, damp homes. It found that PCTs are able to play an active part in improving health through reducing the number of cold homes. The study did not look at the overall quality of the indoor environment, but was a good example of an attempt to engage the health sector and other agencies to promote health awareness based not only on direct medical issues.

In 2005, the charity, Energy Action Scotland, completed a training programme for 300 front line health professionals in Glasgow to raise awareness of health problems caused primarily by poor housing and fuel poverty.¹⁰⁶ Energy Action Scotland aims to eliminate fuel poverty by raising awareness of the issue, as a high priority and working towards affordable warmth for all. The Energy Action Scotland programme was in principle similar to the outcome measures sought from the Portsmouth programme and highlights the increasing use of front line health professionals to promote prophylactic measures in the home to reduce

health problems. Crucially the Energy Action Scotland programme did not tackle the issues surrounding the indoor environment as suggested in this research.

The Plymouth Healthy Homes scheme, launched in 2001, has been promoting the take-up of Warm Front^{*} and local grants to reduce health problems caused by cold and damp homes.¹⁰⁷ In 2004, part of this scheme involved the training of 107 health professionals to be able to identify people living in fuel poverty and how to refer people to grant schemes together with the Plymouth Public Health Development Unit. The scheme has helped to promote the availability of grant schemes to district nurses, community staff nurses, and health visitors in Plymouth, resulting in a small increase in referrals to grant schemes from the health sector. The results from the training scheme highlighted important lessons for future similar projects:¹⁰⁷

- The training should focus on the available grants and what they offer and contain less background information
- Health workers are extremely busy and therefore training sessions should be no longer than one hour and held early in the day
- The support of Health Professional Team Leaders is important to encourage front line health professionals to attend training

The presentations highlighted some of the knock-on effects of poorly insulated homes such as damp, mould, and the proliferation of house dust mites. The results from the training tended to be short term, with the number of referrals

^{*} Warm Front is a UK government scheme, which aims to improve energy efficiency for vulnerable households in fuel poverty in the private rented and owner-occupier sectors.

reducing after time.

Liverpool City Council's Environmental Health and Trading Standards department initiated a project to address poor indoor air quality and respiratory health within particular wards - the 'HEAL 8' project.¹⁰⁸ HEAL 8 focused on children with asthma and patients with chronic obstructive pulmonary disease and included the monitoring of nitrogen dioxide, total volatile organic compounds, and carbon monoxide within homes. A household would get a joint visit by a nurse and an environmental health officer. Protocols were to be developed for environmental triggers, pollutants, housing unfitness, and disrepair, to provide a consistent approach to housing inspections.

In England, the 'Healthier Homes Healthier Lives' initiative is being carried out by Care & Repair England.¹⁰⁹ The project aims to provide materials and resources, including a practitioner's checklist,¹¹⁰ to raise awareness of the impact of poor or unsuitable housing on health. Part of the project involves training front line health professionals and social service workers to identify problems in homes such as cold, damp, hazards, and security and where to find organisations that can help with remedial actions. The initiative provides information for individuals to check their own home environment and is primarily concerned about health and safety issues for disabled and elderly people.

An extensive booklet for front line health professionals produced by the United States of America Environmental Protection Agency, demonstrates an approach linking medical symptoms with factors in a patient's home and work environment.¹¹¹ The booklet offers front line health professionals diagnostic

leads, in the form of questions linked specifically to sources such as pet dander and mould. This is a good, simple approach as it avoids the expense of extensive environmental research to detect a problem in a patient's environment, but still relies on a certain level of expertise and independent assessment methodology from front line health professionals. Other organisations have also developed home environment education systems for nurses and other health professionals in the United States of America.¹¹²

In the United States of America, experiments have been conducted to determine if low or high intensity visiting and educational strategies reduce the risk of families encountering (asthma) triggers in the home. The Master Home Environmentalist Programme (Seattle, Washington, United States of America) educated the public on home environmental issues. Volunteer non-specialist trained coaches were recruited to work directly with families.⁸⁶ A standardised survey tool – the Home Environmental Assessment List, assessed changes made by residents working with volunteer coaches. The Programme was effective in influencing the behaviour of residents and increasing their understanding about their indoor environment. The Programme was one of the precursors to the Healthy Homes Model in the United States of America, which aimed 'to holistically address all aspects of housing that effect health'.¹¹³ The United States of America Centre for Disease Control and Prevention together with the Department of Housing and Urban Development joined to sponsor the National Healthy Homes Training Centre and Network, operated by the non-profit National Centre for Healthy Housing "to change how city and state governments conduct public health activities related to housing". In essence, one health oriented and one housing oriented department realised that

representatives from both departments were visiting the same homes separately and had not coordinated their responses to a household's problem. Efforts were made to gather all information from home visits in an electronic database holding research information, assessment tools, and typical treatment proposals. The concept was demonstrated in the Seattle-King County Healthy Homes Project, United States of America,¹¹³ where community health workers implemented advice on the home environment. The concept is nearly identical to the methods suggested in this research. The project was discontinued in Seattle-King county because of a lack of funding (personal correspondence, James Krieger, February 2009). There were positive measurable outcomes including the reduction in days children (four to twelve year olds) suffered asthma symptoms, and reduced emergency health service visits. The intervention included education about asthma management, social support, and interventions (allergy control pillow and mattress encasements, low-emission vacuum cleaners, commercial quality door mats, cleaning kits, referral to smoking cessation counselling, cockroach bait, rodent traps). The approach recognised that using existing infrastructure stands a better chance of success than training a new service. High intensity dedicated visiting resulted in lesser (medical) costs for the state and better quality of life for the families. Although the studies in the United States of America became known after the inception of this research, the approach underlines the belief that housing and health conditions are inter-related and that training health staff to look at indoor environmental aspects can substantially contribute to good public health care.

In Sweden, occupational therapists have been trained to monitor the indoor environment in asthmatics' homes and advise on measures to promote allergen

avoidance. The occupational therapists measured temperature, relative humidity, carbon dioxide, volatile organic compounds, formaldehyde, airborne dust, and took dust samples for dust mite allergen concentrations. They also looked for the presence of mould, existence, and type of heating, and pets. Although the study was small (21 households), there were indications that indoor air quality improved, as did lung function of the participants.⁹⁰

In 2008, in the UK a basic tool kit for environmental health was produced.¹¹⁴ The tool kit is designed to help practitioners use the Housing Health and Safety Rating System⁷⁰ and to understand relationships between housing, health, and health care costs.¹¹⁴

Another approach is through online education, for example HealthHouse¹¹⁵ run by the Healthy Child Healthy World organisation. One of the main goals of the organisation is to expand the awareness and understanding of environmental hazards. The programme identifies the problems found in the indoor environment in American homes and encourages people to take up solutions to improve their indoor environment. Advice is provided in a simple, mainly pictorial format.

In the UK government's document 'Facing the Future: a Review of the Role of Health Visitors', the Department of Health confirms that they have authorised 10 full scale trials to test if the United States of America Nurse Family Partnership can be implemented in the UK.¹¹⁶ The programme, developed over 30 years by Professor David Olds, 'an early intervention expert' at the University of Colorado, United States of America, is described as an evidence-based high

intensity, home visiting support for young mothers over a two year period by specially trained family nurses drawn from the health visiting or midwifery background. In the UK, the programme focuses on achieving improved outcomes across three areas:

- Improving antenatal health
- Enhancing child development and school readiness
- Linking the family to wider social networks and employment

The family nurses, each with a caseload of 25 families, receive training to deliver the licensed programme and are linked to Sure Start Children's Centres. In 2008, the scheme was extended to a further 20 sites¹¹⁷ with plans to extend the scheme further.¹¹⁸ The government wants to create 3,500 children's centres by 2010, where health visitors are encouraged to provide more support at the centres than to individual families at home.¹¹⁹

In the UK, Action Against Asthma is a programme promoting joint home visits by an asthma nurse and an environmental health officer.¹²⁰ A specialist health visitor gives 'intensive education' about the causal factors of asthma and follows up each visit. This project resulted in substantial improvements in quantifiable health effects, including reductions in visits to hospital and doctor's surgeries.

The UK 'Framework for the Assessment of Children in Need and their Families'¹²¹ includes a measure of environmental conditions in the form of the Home Conditions Scale,¹²¹ based on the Family Cleanliness Scale.¹²² The total score has been found to correlate highly with indices of the development of

children. The scale is listed below and is based on a score of zero or one.

Home Conditions Scale

- 1) Smell (e.g. stale cigarette smoke, rotting food)
- 2) Kitchen floor soiled, covered in bits, crumbs etc
- 3) Floor covering in any other room soiled as above
- 4) General decorative order poor – obviously in need of attention (e.g. badly stained wall paper, broken windows)
- 5) Kitchen sink, draining board, work surfaces or cupboard door have not been washed for a considerable period of time
- 6) Other surfaces in the house have not been dusted for a considerable period
- 7) Cooking implements, cutlery or crockery showing ingrained dirt and or these items remain unwashed until they are needed again
- 8) Lavatory, bath or basin showing ingrained dirt
- 9) Furnishings or furniture soiled
- 10) Informant's or children's, clothing clearly unwashed, or hair matted and unbrushed
- 11) Garden or yard uncared for and strewn with rubbish

The Department of Health highlight that the Family Cleanliness Scale is a tool for highlighting a problem but does not point out why there is a problem or what to do to resolve it. The 'Framework for the Assessment of Children in Need and their Families' is based on the Home Observation for Measurement of the Environment concept first introduced in the 1960's by Caldwell.¹²³ This system has been used in a number of countries and assesses the caring environment in which a child is raised.¹²⁴ The Home Observation for Measurement of the

Environment only touches briefly on the physical indoor environment in terms of hazard assessment but the Department of Health version includes the Home Conditions Scale.¹²¹

2.1.4. Additional Related Research

The search of the NHS National Research Register Archive¹²⁵ revealed four projects, three of which were part of the Torbay Healthy Housing Project. This project was a three-year study of the Watcombe Estate, Torbay, UK in three to four bedroom, single-family unit, social-rented sector houses. The project was designed to assess the effect of installing wet central heating, on demand ventilation, double-glazed doors, cavity wall insulation, and roof and loft insulation on the health of the occupants and the indoor environment.^{126,127,81}

The housing upgrades increased bedroom temperatures in all houses but indoor environmental variables did not change.⁸¹

“Quantitatively measured health benefits are small, but as health benefits were measured over a short time scale, there may have been insufficient time for measurable improvements in general and disease-specific health to become apparent.”¹²⁸

The Avon Longitudinal Study of Parents and Children¹²⁹ (the Avon study) tracks social and health outcomes throughout a child's early life, including parental smoking, pets, damp and mould, heating, ventilation, and structural problems. However, the study is questionnaire based and although clinical data is available for health, there is no quantification of environmental variables. Whilst the Avon study is very detailed and conducted over a long period it does not address the variables thought important for this research.

In 2003, the Swedish Board of Health and Welfare (environmental health), implemented a national postal survey of 40,000 children's guardians.¹³⁰ At the time this was probably the largest such survey conducted anywhere in the world and the first such survey in Sweden.¹³⁰ The questionnaire covered about 100 subjects including descriptions about a child's exposure to pets, smoking, mould, noise, air pollutants, and toxic substances. Presence of allergies, asthma, other respiratory problems, hearing difficulties, and annoyances were used as health status outcomes.

Health visitors in Telford and Wrekin PCT, UK, worked on collectively raising the awareness of a number of health issues among young mothers.¹³¹ A multi-professional group (employed by health authorities and local authorities) formed a club for under-one year olds, working close to mothers and young children. The group did not extend their remit to indoor environmental conditions. By July 2006, the project closed because of lack of funds and a long-term illness of one of the organising health visitors.

In 2004 in Salford PCT, UK, a group of health visitors launched the concept of employing Health Improvement Programme officers to work with a population of approximately 15,000 people, throughout deprived areas. The PCT, local volunteers, council managers, and specialist service providers supported the project (personal communication, Janice Lowndes, Health Improvement Manager St James's House, Salford, M6 5FW). No results were available although implementation was still ongoing. The plan was that in 2008 the Health Improvement Programmes officers would coordinate community health programmes.

A project in Sedgefield, UK, is using integrated teams of district nurses, social workers and social work assistants, housing support officers, business support officers, and occupational therapists who aim to give a coherent response to public services. An example given of their work is liaising over housing options to ensure that people being discharged from hospital are not put into unsuitable accommodation. Local people helped to design the project.¹³²

2.2. Research Methods

2.2.1. Literature Search Methods

Similar methods were used to those described in 2.1.1. Searches were carried out using the following keywords in the singular, plural or in combination: qualitative; quantitative; systems; research methods.

A number of key publications were recommended by the researcher's supervisors, which are cited throughout this section. A method was required for this research to allow a study to take place within the complex structure of the NHS and the local support systems in place for front line health professionals. A review by Iles and Sutherland looked at specific methods for investigating the structure of an organisation and methods for implementing change.¹³³ Although the aim of this research was not to fully implement a change but investigate the feasibility of an intervention, the methods needed elements of understanding organisations and implementation of a research study in a local setting. Iles and Sutherland showed that the methods with the most evidence of use in the

NHS for investigating organisational structures was Soft Systems Methodology and Action Research for investigating the implementation of change.

2.2.2. Research Methodology

2.2.2.1. Investigating Systems

A common way to understand a complex system is to analyse 'the system' (to make sense of the system by breaking it apart). However, analysis focuses on the elements of a system in isolation risking losing connections between the parts. There are two main systems approaches within systems methods, defined as hard and soft systems. In hard systems thinking, parts of the world are taken to be 'systems' which can be 'engineered', and soft systems thinking focuses on making sure the process of inquiry into real-world complexity is itself a system for learning.¹³⁴ Hard systems approaches normally mean that researchers stand outside the systems, where well-defined problems are addressed. In soft systems, the researcher is part of the organisation in focus and the approach addresses messy or ill structured problems.^{133,135} Checkland stated that the fundamental difference between the two approaches is that with the hard systems approach a situation contains a system, whereas a soft systems approach would define the *process* of inquiry as a system.¹³⁵

Systems thinking aims to create a better understanding of the combination and interaction of constituent parts to look at the *system* as a whole.¹³³ The essence of systems thinking lies in uncovering inter-relationships rather than linear cause-and-effect chains and in seeing processes of change rather than single actions in organisations.¹³⁶ In defining systems thinking, Checkland stated:

*"The core systems idea or concept is that of an adaptive whole (a 'system') which can survive through time by adapting to changes in its environment."*¹³⁷

Checkland¹³⁸ defined a system as a set of elements, connected together, which forms a whole, developing properties, which are properties of the whole rather than of the systems' component parts. Systems can be classified as 'open' or 'closed'. There are four fundamental types of systems:¹³⁸

- 1) Natural
- 2) Designed physical
- 3) Designed abstract
- 4) Human activity

The last system type, 'human activity', is seen as crucially different from the previous three in that, while the first three systems can be described objectively and "*can be no other than [what] they are*", human activity systems are understood differently by the various human actors involved in them, who attribute different meanings to what they perceive.¹³⁸ All the people involved in a system will perceive it differently and these differences need to be understood before changes can be designed.

2.2.2.2. Action Research

Action Research involves a researcher being engaged with a change process, where participants understand the situations and take action themselves to achieve the objectives of the research.¹³³ Action Research was first discussed in 1944 by Lewin and can be described as a series of steps to plan, do, study,

and act.^{139,140} This research methodology is designed to simultaneously bring about change whilst learning from the process of bringing about change.¹⁴¹ Checkland, thought that Action Research was limited to the field of social interactions and Soft Systems Methodology was partly developed to address this limitation.¹³⁷

2.2.2.3. Soft Systems Methodology

Checkland and his colleagues at Lancaster University developed Soft Systems Methodology in the 1970s.¹³⁸ Checkland perceived a gap existed between the traditional 'hard' system and its application, to situations involving complexity and developed a systematic process of inquiry.¹³⁵ Checkland suggested using loose structures and methods when conducting research, building 'Rich Pictures' or 'vivid descriptions' of a system.^{142,143,144}

Checkland suggested that the primary use of Soft Systems Methodology would be in the analysis of complex situations where there are divergent views about the definition of a problem, defined as soft problems, for example, how to improve the delivery of health services. In its classic form, Soft Systems Methodology consists of seven steps, with initial appreciation of the problem situation leading to the modelling of several human activity systems that might be relevant to the identified situation. A later, four stage Soft Systems Methodology gave a more loose structure in which to pursue an analysis of a situation:

1. Finding out about the initial situation which is seen as problematical

The first stage of the analysis cycle concerns itself with finding out about the situation being investigated and the second stage is creating a Rich Picture of the situation based on the views of different stakeholders.^{142,143} This step is concerned with finding out about the culture within the organisation and the social and political culture and identifying people in the key roles; 'client', 'practitioner' and 'owner of the issue(s) to be addressed', observations relating to these are recorded in a reflective log.

2. Developing purposeful activity models

This is a modelling stage aimed at capturing the issues, ideas, and worldviews expressed during stage 1.

3. Structured discussion about change

The models built in stage 2 are used to invoke a structured discussion – the dialogue stage. At this stage in the cycle, the researcher is looking for 'accommodation' or broad acceptability, not total consensus for the intervention, which may be impossible to achieve because of participants differing perspectives.¹⁴²

4. Action to improve

Development of the (revised) change model into a concrete plan, and taking action to implement it.

There are known strengths and weaknesses of the Soft Systems Methodology.¹⁴⁵

Strengths

- Soft Systems Methodology gives structure to complex organisational and political problem situations, and it can allow them to be dealt with in an organised manner
- It forces the user to look for a solution that is more than technical
- It is a rigorous tool to use for messy problems
- It has specific techniques

Limitations

- Soft Systems Methodology requires participants to adapt to the overall approach
- There is a risk of narrowing the scope of the investigation too early
- It is difficult to assemble the richest picture, without imposing a particular structure and solution on the problem
- People have difficulties to interpret the world in a loose way. They often show an over-urgent desire for action

Assumptions

Soft Systems Methodology assumes that most management and organisational problems cannot be seen as pure 'systems problems' as the system is far too complex to analyse. Proponents of Soft Systems Methodology argue that the initial situation being viewed will be changed by the very use of this methodology. In Soft Systems Methodology, the role of any external agent (in this case the researcher) is to facilitate the understanding of players within the system so that they design and implement changes themselves.¹³³

2.2.3. Study Methods

2.2.3.1. General

Within the framework of the research, specific methods were needed to meet the objectives of the study. There should be a balanced set of process, outcome, and cost measures, using both qualitative and quantitative measures, with small representative samples.¹⁴⁶ Several 'layers' of different methods were required for the study, including a method to:

- Diffuse the concept and the research to the health visitors and for them in turn to diffuse the information about the research and the subject matter to their clients
- Understand and implement an indoor environmental assessment procedure tailored specifically for health visitors
- Assess the feasibility of health visitors quantifying their clients' indoor environments and give bespoke advice
- Assess acceptability of the concept for health visitors

2.2.3.2. Providing Evidence

A proof of concept study is a trial used in many fields to demonstrate clinical or technical efficacy with a small number of strictly selected participants.

"Proof of concept is a short and/ or incomplete realization (or synopsis) of a certain method or idea(s) to demonstrate its feasibility, or a demonstration in principle, whose purpose is to verify that some concept or theory is probably capable of exploitation in a useful manner."¹⁴⁷

2.2.3.3. Qualitative Methods

Creswell¹⁴⁸ described eight reasons to undertake a qualitative study:

- 1) If the research question often starts with 'how' or 'what' to describe what is going on
- 2) If the topic needs to be explored
- 3) There is a need to present a detailed view of the topic
- 4) There is a need to study individuals in their natural setting
- 5) There is a wish to engage in story telling
- 6) There is sufficient time and resources available to engage in data collection in the field and a detailed analysis of text
- 7) There is a receptive audience to qualitative research
- 8) The researcher wishes to be an active learner to tell the story from the participants' viewpoint

Qualitative interpretation tends to be based on interpretative philosophy; the researcher needs to take a holistic view of the subject under investigation.¹⁴⁹ Many methods have been developed to collect the subjective opinions of research participants in general. Questionnaires, focus groups, and interviews are commonly used.

2.2.3.4. Interviews

The task of a qualitative evaluator is to provide a framework for the interviewee to respond to questions in a way that accurately represents their point of view.¹⁵⁰ A common framework for gathering perceptions about an idea is to use standardised, open-ended, face-to-face interviews. Such interviews are

advantageous for data collection to gather richness of data and depth of focus.¹⁵¹ Semi-structured, face-to-face interviews can be specifically chosen to provide a structure, so that key topics can be covered and important information gathered.^{152,153} An interview-based exploration of participants' opinions is normally preferred because an interview has the potential to collect larger amounts, more detailed and more complex information than a self-completed questionnaire¹⁵⁴ or focus groups.¹⁵¹

When designing texts for interviews, opportunity should be taken to pursue issues unobtainable by the researcher through other outcome measures.¹⁵⁵ The disadvantage of using an interview script is that there is reduced flexibility for the interviewee to respond compared to not having a script at all and script statements may not be the right ones for the interviewee.¹⁵⁶ Perceived restrictions can be mitigated by adding 'free' topics at the end of an interview where an interviewee is invited to voice any topic.

2.2.3.5. Questionnaires

Questionnaires can be used to collect perceptions quantitatively and qualitatively. For instance questionnaires containing Likert scales collect a set of answers to 'declarative statements', which can be given a ordinal value from which statistics can be derived, such as descriptive statistics.^{157,158} Responses to open-ended questions enable freely made comments, giving the raw data needed to meet the objectives of a qualitative study through providing direct quotations, essential in qualitative evaluations.¹⁵⁶ Structured quantitative questionnaires are not always appropriate when dealing with small sample

sizes and where there is the need to collect subjective views about the concept, not just numbers.¹⁵⁹

2.2.3.6. Observational Studies

Observation studies involve the systematic watching of behaviour and discourse in an actual setting. There are different roles in observational research:¹⁶⁰

- Complete participation that involves complete covert observation unknown to the people being observed
- Participant as observer, where the observer takes part in the activities being observed overtly observing people
- Observer as participant, where the observer interviews participants
- Complete observer, where the researcher has no participation in the study

Covert observations have many ethical issues, which are avoided in participant observation studies, although there is an issue with the observer influencing and modifying the behaviour of participants.¹⁶¹ In a participant observer study, the researcher becomes part of the routine of the people being observed and makes overt observations.^{161,162} Jorgensen has defined the main features of participant observation studies.¹⁶³ When getting access into a social setting or organisation, the researcher has to be aware of power relations, for example management-worker relations.¹⁶² The research method demands that researchers spend time with relatively small groups of people to understand fully the social environment that they inhabit. The research method does not lend itself to dealing with large-scale issues involving large organisations or national economies.¹⁶²

2.2.3.7. Interpretation of Qualitative Data

In terms of interpretation of qualitative data, there are several common methods. Kvale defined methods for interpreting data from interviews.¹⁶⁴

Åkermark further interpreted and described Kvale's five methods.

1. *Meaning condensation entails an abridgement of the meanings expressed by the interviewees into shorter formulations, and reduction of large interview texts into briefer, more succinct formulations*
2. *Meaning categorisation implies that the interview is coded into categories. By categorisation, a large text can be reduced and structured into a few tables and figures*
3. *Narrative structuring entails the temporal and social organisation of a text to bring out its meaning*
4. *Meaning interpretation goes beyond a structuring of manifest meanings of a text to deeper and more or less speculative interpretations of the text*
5. *Generating meaning through ad hoc methods is an eclectic approach. A variety of commonsense approaches to the interview text, as well as sophisticated textual or quantitative methods, can be used to generate the meaning in words, numbers, figures and flow charts, or some combination of these media"¹⁶⁵*

Interpretation says this is what I believe the person or text is getting at.¹⁶⁶ The coding of responses in this way is known as content analysis, which can be defined as identifying, coding, and categorising primary patterns in data.¹⁵³

2.2.3.8. Reflexivity

Reflexivity is an important aspect of research, where the researcher is considered inclusive of the study and the system being studied. When using qualitative methods, 'reflexivity' (self-awareness and critical examination of the researcher's assumptions) is an important factor to ensure validity and trustworthiness.^{152,153,167}

"Reflexivity means sensitivity to the ways to which the researcher and the research process have shaped the collected data, including the role of prior

*assumptions and experience, which can influence even the most avidly inductive inquiries.*¹⁶⁷

The need for reflexivity results from the fact that no qualitative researcher can be totally objective¹⁶⁸ and there is no such thing as observer free research.¹⁶⁹ Reflexivity is needed to highlight objects, people or circumstances that are disturbed by the very attempt to observe them,¹⁶⁹ similar to the Heisenberg uncertainty principle in physical sciences, where sub-atomic particles cannot be observed in their 'system' without altering their behaviour.¹⁷⁰ A wider approach to reflexivity is for the researcher to look at the effect of their own background, social class, gender, ethnicity, and beliefs and what effect they may have on their research.¹⁷¹

2.2.3.9. Analysis of Quantitative Data

Descriptions of the statistical analysis used for the quantitative data are given in Chapter 5.

2.2.3.10. Integration of Quantitative and Qualitative Data

Qualitative methods have been portrayed as the antithesis to quantification, with qualitative research characterised as hypothesis-generating and quantitative research as hypothesis-testing.¹⁷² It is suggested that quantitative researchers work with a few variables and many cases, whereas, qualitative researchers rely on a few cases and many variables.¹⁷³ A simplified dichotomy between the two methods is shown in Figure 3.¹⁷⁴

Researching social phenomena can require both an inductive and deductive approach.¹⁴⁹ Induction involves producing a generalised statement from a

particular set of observations.¹⁴⁹ Qualitative and quantitative research methods can complement each other^{175,176,177} despite developing from different origins and traditions.¹⁷⁸ The choice of the type of method should be based on the appropriateness of the method to the research question¹⁷⁹ and different evaluation methods can add to the rigour, breadth, and depth for any research.¹⁸⁰ There are some inconsistencies and contradictions between using qualitative and quantitative methods but this does not mean that a mixture of methods should not be used when appropriate.¹⁵⁵ Quantitative research draws conclusions from facts whilst qualitative research stresses the importance to understand phenomena as experienced by the individual and in the context in which they happen.¹⁸¹

The combination of two or more types of methods to improve validation is known as triangulation.^{179,182} The triangulation of methods provides evidence from different sources.¹⁴⁸

2.3. Managing Health-determining Aspects of the Indoor Environment

2.3.1. Literature Search Methods

A worldwide literature review was undertaken at the outset of this research to establish the current understanding concerning the relationship between the indoor environment and health, especially respiratory illnesses. Preliminary searches indicated that the United States of America National Academy of Sciences Institute of Medicine had undertaken the latest published comprehensive review in 2000.²¹ The aim of the Institute of Medicine review was to make recommendations on how to reduce morbidity and mortality linked

to asthma. Similar review research strategies have been pursued in other countries for example, Sweden, Finland, and Germany.²⁶ The aim of the literature search process was altered to find current experimental evidence about indoor environmental variables suggested by the Institute of Medicine (Figure 4).²¹ Similar methods were used to those described in 2.1.1.

The search process was further used to find evidence for practical, preventative measures and remedial actions, which have either been shown to reduce the environmental variable in question and or improve clinical health outcomes. Searches were carried out using the following keywords in the singular, plural or in combination:

Respiratory illness; asthma; indoor air quality; allergen avoidance; asthma prevention; remedial action; environmental control; indoor environment; damp; mould; cat; dog; pets; allergen; house dust mites; *Der p 1* (house dust mite allergen); systematic review; meta analysis.

Many of the indoor variables, which were not included in the review, may be important health risk factors, however the review was based on current evidence as to the most important respiratory, and allergy health risk factors found in the indoor environment. To ensure that the literature review provided current, easy-to-understand, verified connections between technical and medical outcomes, and could be used by health professionals, it was condensed into a format suitable for publication, submitted and published in the *Journal of Advanced Nursing* (Paper 1).

2.3.2. The Indoor Environment and Remedial Actions

A basic summary of the indoor pollutants associated with human health effects is given in Table 1 (adapted from various sources for example^{5,47,183}). The most commonly highlighted triggers in the home environment were in order of importance: house dust mite allergens; environmental tobacco smoke; pet allergens (particularly from cats), and mould. The variables listed by the Institute of Medicine (Figure 4) correlated somewhat with those suggested for inclusion in any assessment, including general indoor air quality, house dust mite allergens, dampness, and hygrothermal conditions.¹⁸⁴ These suggestions for environmental management are also relevant to rhinitis and other environmentally triggered allergies.¹⁸⁵

The UK Institute for Environment and Health produced an extensive report on the effects of the indoor environment on health in general.⁴⁷ Although the report highlighted the problem of the lack of detailed and reliable research on the indoor environment, it concluded that tobacco smoke, carbon monoxide and allergens are of particular importance to health. Exposure to nitrogen dioxide, volatile organic compounds, and formaldehyde only constitute a low risk to health in the concentrations found in homes. Some chemicals have a low but significant relationship (either on their own or in combination) with health. The report from the Institute for Environment and Health states that health risks from pesticides, polycyclic aromatic hydrocarbons, moulds, and endotoxins have not been determined. The Institute's conclusions are based on general health effects and in particular, cancer risks.

Bacteria present a risk indoors partly from the risk of increased infections but also from the toxic and inflammatory effects of endotoxins; there is little evidence of a link between endotoxins and health. There is some opposing evidence to suggest that exposure to low levels of endotoxin may initiate a protective immune response. A study of 61 infants concluded that there is evidence that indoor endotoxin exposure early in life may protect against other allergen sensitisation.^{7,186}

The fact that the health risk from pesticides, polycyclic aromatic hydrocarbons, moulds and bacteria have not been determined does not mean that measures to prevent exposure to these pollutants should not be taken. The United States of America Environmental Protection Agency, in conjunction with their Childhood Asthma Campaign, also offer a list of asthma triggers found indoors. The triggers are given in order of priority as: environmental tobacco smoke, house dust mite allergen, pets, and moulds.¹¹¹

The triggers (and methods for reducing them in the home environment) shown in Table 1 and Figure 4 have been described in Paper 1. The results are summarised in the following sections.

House dust mite allergens

Any intervention to remove mites must also address the long-term removal of existing allergen reservoirs and reduce the further production of allergen in a home to redress mite related asthma symptoms. The review in Paper 1 highlighted that there was reasonable evidence that recommendations could be

⁷ Homes of allergen-sensitised 15-month-old children contained 468 endotoxin units per millilitre whereas homes of non-sensitised children contained 1035 endotoxin units per millilitre

given to householders on how to cope with house dust mite allergens. The term 'house dust mites' covers a number of dust mite species. In this research, the mite *Dermatophagoides pteronyssinus* is the only one discussed in detail. The mite produces an allergen designated as *Der p 1*^{*}, which is the allergen most commonly linked to allergies and asthma. Reliable evidence suggests that the most beneficial intervention to reduce exposure to *Der p 1* and the mites themselves is the use of occlusive covers on mattresses, pillows and duvets combined with hot washing (60°C and over, will kill mites¹⁸⁷) of sheets and other bedding. This would be beneficial both for asthmatics and to reduce the risk of sensitisation to house dust mites in non-asthmatics. It is possible to conclude that because children spend a substantial part of their early life in bed the degree of cleanliness (measured in terms of allergenic load) of their beds should be paramount. Dust samples collected from 88 asthmatic children's beds in houses in the southwest of England had an average 4.37 µg g⁻¹ of *Der p 1* present (researcher's own unpublished data, 2000). These values indicated that not enough care and attention was taken by the responsible householders to reduce the reservoir of allergenic material. The World Health Organisation recommends that *Der p 1* concentrations should be limited to 2.0 µg g⁻¹ and under.¹⁸⁸

Pet allergens

There are only a limited number of measures that householders can undertake to avoid cat (*Felis catus*) allergen (*Fel d 1*) and other pet allergens indoors:

^{*} Amount of *Der p 1* is measured as µg of allergen per g of house dust.

- Remove the cat and other furred and feathered pets
- Keep the pet and install high efficiency particulate arrest air filtration units in both the living room and bedroom. The air cleaning equipment will be required to run continuously at a high number of air changes per hour
- 'Deep' clean strategies will only permanently reduce the allergen load indoors if the animal is removed as well

The concept of a non-allergenic cat is in a part a myth because although the production of *Fel d 1* can be reduced, other proteins are still produced which some people are still going to be allergic to.¹⁸⁹ Feather filled pillows retain less *Fel d 1* compared to synthetic pillows.¹⁹⁰ Synthetic bedding materials have been associated with increased wheezing in children.¹⁹¹ This phenomenon is due to a fine weave for the 'tick' of feather pillows, required to keep the feathers encased.

There are no known safe levels indoors for the allergen *Fel d 1*. No studies to date have established any method whereby asthma symptoms are reduced for individuals with cat-allergic asthma through any practical and physical interventions barring the removal of the animal. The subject is made more complicated in that in many environments where people meet and work, there can be high levels of cat allergen with no animals in sight, because *Fel d 1* is a sticky protein that can be transported long distances on cat dander,¹ causing the transfer of *Fel d 1* to homes and buildings without cats.^{6,192}

Environmental tobacco smoke

Environmental tobacco smoke will not be discussed in detail in this review since it is widely appreciated that smoking tobacco and other materials, with associated passive smoking indoors, is detrimental to health. Cook and Strachan concluded that:

*“Overall there is a very consistent picture with odds ratios for respiratory illnesses and symptoms and middle ear disease of between 1.2 and 1.6 for either parent smoking, the odds usually being higher in pre-school than school children and higher for maternal smoking than for paternal smoking.”*¹⁹³

Exposure to environmental tobacco smoke during childhood is associated with an increased prevalence of asthma in adults.¹⁹⁴ From the researcher's personal experience in 225 homes in the southwest of England during discussions on the detrimental effect of smoking indoors for children, it is clear that the message that smoking damages both their children's and their own health has got through to parents and guardians. However, what is quite unclear to these householders is that smoking anywhere indoors is practically as bad as smoking in the presence of children.^{195,196}

Mould

There is no current [health] scientific evidence on which to base recommendations for mould remediation.⁷² Airborne mould can be quantified by measuring the number of colony forming units per volume of air (cfu m⁻³) or as a number of spores in the air (a high figure is regarded to be more than 1000 spores m⁻³ of air), however, not many studies quantify mould and rely on subjective measurements (visible mould and mould odour). The National Allergy Bureau of the American Academy of Allergy, Asthma and

Immunology¹⁹⁷ have a website that gives indicative values for mould levels in outdoor air that might cause sensitivity to individuals. No values are suggested for indoor concentrations.

However, recommendations based on remedial actions normally taken to reduce mould for cosmetic or structural reasons should be observed in the hope that they might reduce the severity of asthmatic symptoms. Although there is a lack of evidence, there is biological plausibility that mould in the indoor environment due to its toxic and allergenic nature will have an impact on health.

The mere existence of mould can be used as an indicator of a high humidity content in a house despite the fact that any discrete relative humidity measurement taken during an investigation might suggest otherwise. Although visible mould patches are obvious and easy to record, research suggests that airborne mould levels need to be quantified and qualified to prevent biased reporting and to prevent possible misdiagnosis of a visible mould problem.¹⁹⁸ This is because non-visible mould growth exists in most households. Not all mould genera found indoors are toxic or give off toxic by-products, therefore eradicating mould might not lead to reduced symptoms.

Humidity and dampness

Relative humidity is the most common measure of humidity and is defined as the percent of water that a given atmosphere holds relative to the maximum amount of water the same atmosphere could hold before physical water droplets form in the air. Absolute humidity is a weight measurement of the amount of water in a given volume of air. Raised relative humidity indoors can

create dampness on surfaces (in the form of condensation), which will provide an ideal habitat for omnipresent mould spores to colonise. In addition, humidity is an important factor in the ecology of house dust mites.

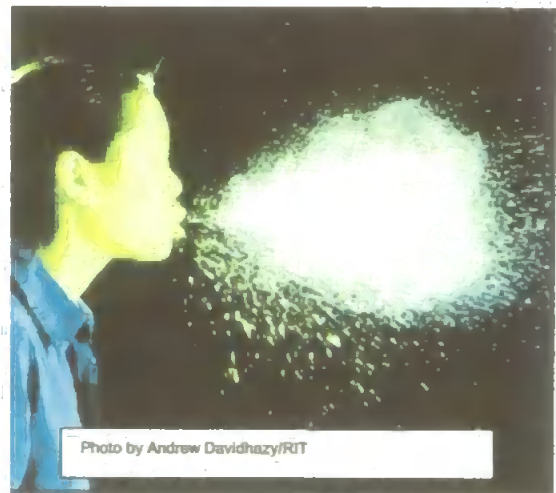
Dampness can be caused by a structural problem in a building that has allowed water to penetrate indoors. There is no strong research evidence that limiting humidity indoors and reducing structural dampness will result in a clinical improvement in asthma. However, there would seem to be an association between damp conditions and respiratory symptoms,¹⁹⁹ therefore control measures should be sought to try to reduce problems from damp. Accommodation that is damp, infested with pests and overcrowded has been found to contribute to low birth weights, an infant's failure to thrive, and chronic ear, nose, and chest problems.²⁰⁰ Providing mechanical ventilation may be an answer, however balanced whole house mechanical ventilation with heat recovery systems are expensive to install (£2,000 to £3,000 per household) and will add to electricity costs. If no structural problems are reported in a home then any raised humidity levels and or damp areas are a result of lifestyle choices resulting in inadequate ventilation, excess generation of moisture, overcrowding or a sign of an 'airtight' house.

Both humidity and structural dampness need to be physically quantified to prevent biased reporting of indoor conditions. Measuring humidity in one spot in a room does not determine if there are other areas in the building with higher values and high relative humidity does not necessarily relate to high wall dampness. Observation of dampness may still be required as a tool for locating damp areas.

Particulate matter.

Epidemiological studies have made connections between airborne particulate matter, morbidity, and mortality.²⁰¹ Although, this link has not been proven for causality,²⁰² it has still been put forward as one of the main causes for an increase in respiratory problems. Particulate airborne pollution indoors has often been linked with an increase of various symptoms known collectively as sick building syndrome.⁶ Airborne particles include a wide variety of indoor contaminants including biological (disintegrated mite faeces, allergens, bacteria, viruses) and inert (environmental tobacco smoke, diesel fumes) particles.

The photo opposite shows a person sneezing, illustrating the release of biological particles indoors. Most of these particles have a settling speed of 3 –5 cm per day.²⁰³



The indoor environment provides the largest amount of personal exposure to particles. In the (theoretical) absence of indoor sources, indoor concentrations of fine particles (less than 2.5 μm in diameter) tend to follow outdoor concentrations with a slight time lag.²⁰⁴ In reality, relationships between indoor and outdoor fine particles vary with location, number of occupants, type of activities conducted and the type of building and provisions for ventilation. The exposure to fine particles in the home environment has been found in many cases to be greater than exposure in the work environment.²⁰⁵ In terms of

simple monitoring, measuring the number (number of particles per volume of air: particles L⁻¹) or mass (mass of particles per volume of air: µg L⁻¹) of airborne particles requires expensive high-tech instruments and some degree of expertise.

Coarse particles indoors (with a diameter larger than 2.5 µm) are mostly generated through human activities. They settle quickly and come mostly from abrasion of materials. These particles tend to affect health less than fine particles and are more easily understood by householders since they are observable with the naked eye as dust.

Temperature and energy efficiency

Temperature (and perception of warmth) was not highlighted by the Institute of Medicine as a risk factor for asthma, although in the UK it is often implicated in asthma morbidity. No science-based literature has been uncovered linking temperature with the causation of asthma. There is evidence of an indirect link between temperature and well-being.²⁰⁶ Cold homes are mostly a result of poor quality housing, often coupled with fuel poverty. Un-insulated cold surfaces in homes can lead to condensation problems and therefore health problems can be linked to temperature through dampness and mould growth. Aspect of a building is important in terms of solar energy gains and damp problems related to a north or east -facing walls that are never warmed by the sun. In 1997, the National Housing Federation estimated that the NHS could save £800 million per year if all damp and cold housing was remedied in the UK.²⁰⁷ Problems traditionally associated with cold, difficult to heat homes are being dealt with in the UK following the extensive housing modernisation programme presently

underway. Since the UK Government is committed to eradicate fuel poverty by the year 2016,²⁰⁸ in theory, the problem will disappear but so far, because of increasing fuel prices - fuel poverty is increasing.

New health problems may emerge in connection with 'airtight' energy efficient housing and poor air quality. There is evidence of a short-term improvement in the environment and general well-being and health after improving warmth in a home.^{126,127,209} A recent report from a large population study (approximately 3,000) in New Zealand highlighted that upgrading the physical properties of a house does lead to positive non-clinical health outcomes.²¹⁰

Some energy efficiency programmes such as England's Warm Front grant scheme have been running for a number of years. A report published in 2008 suggests that improving energy efficiency and making a home warmer reduces mould and has an impact on mental health,²¹¹ however, schemes like Warm Front are difficult to measure.²¹² Research outside the UK on 'airtight', warm houses and associated health outcomes suggests that people in the UK might experience more breathing related illness following the completion of the modernisation programme.^{213,214} International research confirms that the UK home environment might be moving from a state of 'cold and draughty', to a state of 'warm and humid without ventilation'. There are few systematic reports on the health effects of making houses more energy efficient.¹⁸⁴ However, it has been established that measures dictated by saving energy lead to fewer absences from school and fewer respiratory problems.¹⁸⁴ These findings need to be reconciled with the inexorable rise in reported cases of asthma, rather hinting that either there is little mitigating overall effect from the current

modernisation programme or the increase in cases of recorded asthma have overwhelmed any positive effect from the modernisation programme.

2.3.3. Interrelationships Between Variables

Figure 5 illustrates how the main variables identified by the literature review interrelate (roughly) and how they relate to associated topics.

The diagram shows variables related to the quality of indoor air that are simple to quantify. The major factor linking the variables is ventilation, which although not directly a 'problem' or 'pollutant', is a decisive factor for the concentration of many indoor environmental variables. Ventilation (or the lack of it) is often the underlying factor when homes have poor indoor air quality.

"There is general consensus that a link exists between ventilation rates in dwellings and respiratory hazards (for example house dust mites). There is also general consensus that a link exists between these respiratory hazards and respiratory problems."²¹⁵

Inadequate ventilation and high relative humidity levels in combination are often discernable through the odour of the air (often described as 'stale air') within the very first moments of entering a building. Voluntary and involuntary ventilation rates are measured as air changes per hour for a given building volume. Indoor to outdoor ventilation is expensive because of possible increased energy usage, and in the case of mechanical ventilation, replacement filters and servicing is required.²¹⁶ There are also psychological hurdles to overcome in convincing householders that ventilation is necessary. Visibly venting warm air out of a building to let cold outdoor air enter is generally recognised by occupants as an expensive habit. However, it is necessary to ventilate all buildings to reduce the

build-up of airborne substances, water vapour, coarse particles, odours, and environmental tobacco smoke. In theory, these airborne contaminants can be reduced or removed from indoor air without reverting to mechanical ventilation, by opening windows and reducing the source of the pollutant. The effect of ventilation is limited in that air movements only partially influence certain size particles. Ultra fine particles can remain suspended for a very long time and the slow air movement supplied by ventilation tends not to influence these particles.²¹⁷

A modern indoor environment relies on a sealed housing envelope, thereby reducing heat loss from involuntary ventilation, preferably with controllable, mechanical ventilation and where the fabric of the envelope is made from highly thermally insulated structures all in an effort to improve energy efficiency, quietness and a sense of security. The ideal building design has led to buildings that are virtually devoid of involuntary ventilation equipped with fully controllable forced ventilation systems. The driving force behind the need for energy efficient buildings has been the substantial increase in the cost of energy since the 1970's. As buildings become more airtight the relative importance of involuntary ventilation increases. In the UK, the drive for energy efficiency has culminated in part of the requirements for the Home Information Packs for house sales, part of which is an Energy Performance Certificate, which became mandatory in 2007.²¹⁸ This will increase the need for each home to be energy efficient to meet market requirements.

Due to the reduction of involuntary ventilation in homes, it was realised that anyone assessing or giving advice to someone in their home would have to

understand the different environmental problems encountered in modernised and un-modernised homes, which led to the development of Paper 2.

2.3.4. Conclusions

The search of literature published after the date of completion (taken to be January 2000) for the book has uncovered very few sources of information that have added to the evidence base. Clinical trials, intervention studies, and previous literature reviews have all been included in this literature search. Consideration was given to conducting a meta-analysis²¹⁹ in combination with a Jadad scoring system²²⁰ to evaluate the studies uncovered in this review. However, in September 2003 there were too few studies to be able to carry out a meaningful evaluation. A review in 2003 on housing and health, found four works dated later than 2000 partially covering the subject.²²¹ In addition, the use of other comprehensive literature reviews, particularly those from the Cochrane Institute, has helped to highlight research trends and confirm the reliability of trials, strengthening the conclusions made in this review.

Much of the research on possible remedial actions that could be taken to reduce risk factors for asthma will be applicable to other diseases associated with indoor air, such as rhinitis. There is currently not enough evidence to conclusively prove that reducing exposure to the most common indoor allergens and pollutants will reduce breathing related illnesses. There are only encouraging routes and suggestions of how to mitigate the detrimental effects from indoor allergens especially for sensitised individuals. A study from the

1. Was the study described as randomized (this includes the use of words such as randomly, random, and randomization)?; 2. Was the study described as double blind?; 3. Was there a description of withdrawals and dropouts?

United States of America has highlighted that guardians often try to reduce triggers but often are fighting the wrong triggers that might influence their child's asthma.²²² During the development of this research, the British Medical Journal published the editorial "Is a warm house a medical intervention".²²³ The editorial was an invitation to the medical profession to consider factors outside their sphere of expertise.

"You don't have to work very long taking care of poor people before you realise that the content on your medical bag of tricks are often insufficient to improve their health status. One key contributor to ill health is the environment around the patient."²²³

This literature study is partly deficient in that not enough attention has been given to other possible factors associated with asthma and breathing related health problems. For instance, poverty and other social factors are confounding factors in health and environment studies. Poor quality housing conditions are closely connected with breathing related illnesses for children.²²⁴ In considering the indoor environment as a risk factor to health, it is wrong to look at the home environment in isolation. The risk factors discussed herein are also relevant to occupational settings, school, and nursery environments.¹⁹² Inter-reactions between variables have been poorly covered and not evaluated against the degree of illness caused.

2.4. Health Visiting

2.4.1. Literature Search Methods

A literature search was conducted to review the history, current practices, and any similar work being conducted concerning health visiting. Similar methods were used to those described in 2.1.1. Searches were carried out using the following keywords in the singular, plural or in combination: health visitors; health visiting; home visits; history; practice. A further search was conducted in June 2008 of the NHS site <http://www.evidence.nhs.uk/>.

2.4.2. Health Visitor Facts

Health visitors are fully qualified nurses with an additional one-year taught course in health visiting, answerable to a local PCT with their own local management team. Health visitors have to register with the Nursing & Midwifery Council every three years to be able to work in the UK.²²⁵ They were historically based in General Practice surgeries but with the introduction of Sure Start Local Programmes, many are now based in Children's Centres.²²⁶ Health visiting is a government funded, health-promoting service, offered free of charge to all families with children under 5 years old.^{227,228} Health visitors are also qualified to work with clients who are elderly or have mental health issues.

In 2007, there were 9,309 full time equivalent health visitors in England (9,809 in 2005, 10,137 in 2004 and 16,960 in 2000),^{229,230} and approximately 912 in the southwest.²³¹ Health visitors are managed by 152 local PCTs (303 at the beginning of the research).²³² A study in 1998 showed that health visiting accounted for 50% of the total cost of Community Child Health Services, which

equated to around £215,840 per 10,000 children or £21.58 per child per year.²³³ During 2003 through to 2004, health visitors made approximately two million 'first contacts' with children aged less than five years old in England.²³⁴ First contacts are defined as the first time a client is seen in the financial year by a health visitor and subsequent contacts with different health visitors do not count.

2.4.3. Current Practices

Health visitors have traditionally been one of the few highly qualified and respected front line health professionals that routinely monitor clients up to five years. They are able to enter almost any client's home by invitation as a visitor.²³⁵ Health visitors work in a variety of settings; there is evidence to show that some settings such as the home may be more beneficial for some purposes of their work.²³⁶ Health visitors want to visit clients in their own homes.²³⁷ There is evidence to suggest that home visiting can produce positive effects on various dimensions of parenting.^{88,238} Appleton and Cowley listed at least 35 subjects that health visitors are likely to have in mind when conducting a client/ family health needs.

After the initial first contact, visits tend to follow at 10 to 21 days after birth, then 6 to 9 months, and final contact is made in the third year (personal correspondence, Plymouth based health visitor). A national survey has shown that in the majority of cases only one or two visits were made to each family (plus an invitation to a Well Baby Clinic).²³⁹ Some young families are followed more intensively than others because the health visitor has recognised social determinants of health that require more frequent visiting. This is often based on the neighbourhood that the family lives in, for example, if there is a high

prevalence of health risk factors, such as low income, smoking, poor education, and poor housing.^{240,241}

Health visitors generate family health plans with a family collaboratively in the home setting, allowing the health visitor to identify health needs as they see them.¹⁰¹ Making clients more aware of the advantages of improving the quality of life for themselves and how to achieve such goals is an important part of health visiting.¹⁰¹

All health visitors produce an output from a visit in the form of the 'hand held record', commonly known as the 'Red Book'. In some cases, clients hold the personal information in the Red Book. It is also common for health visitors to collect and report on demographic data, using standardised local recording systems for example, the Community Child Health Record – Health Visitor/ School Nurse Record, form COM 1A-E, used in the southwest to collect data.*

2.4.4. Health Visitors and the Indoor Environment

The concept of health visitors taking an active role in advising families on the quality of their indoor environment is not new. Such a *modus operandi* has been long established. The public health movement started in the mid 1800's, along with the appearance of the first women fulfilling a 'health visitor's role'. These women emphasised practical assistance for householders, focusing on a family's indoor and outdoor environment.^{242,243} Environmental health as a public health issue and health visiting developed in tandem. The history of health visiting has been studied extensively.^{241,244,245,246}

* In Plymouth, this is conducted by the Public Health Development Unit, Plymouth Teaching PCT

The formalising of the health visiting service in 1915, led to a more focused but restricted workforce, which began to move away from giving practical advice to mothers about a child's home environment. Health visiting was directed to monitoring and preventing high infant mortality and poor child health. Changes in health visiting practices have moved along with the changing public health movement, which abandoned the early emphasis on environmental change in favour of more individualistic approaches. It has been suggested that four distinct phases of public health (environmental control, personal preventive behaviour, therapeutic interventions and new public health) can be seen in the changes to health visiting.^{247,248}

The 'original' health visitors took an interest in the physical surroundings of a child and regularly inspected a child's sleeping quarters, giving advice to the children's guardians on how to provide the best possible sleeping arrangements. In some PCTs, health visitors do not go into a child's bedroom in the interest of expediency (despite the importance of the sleeping area for a child in terms of sudden infant death syndrome and other issues). Health visitors in Plymouth recall checking and advising on the sleeping arrangements of children and remember when directives were passed to health visitors in Plymouth not to visit children's bedrooms (personal correspondence, 2006).

Health visitors receive little information about the interaction between the indoor environment and health. Some policies mention the need for health visitors to take note of the indoor environment. Both the Nursing & Midwifery Council²⁴⁹ and Wanless^{73,250} suggested that health visitors should take note of their client's

indoor environment but did not give further advice on how to handle the information nor did they suggest any methodology to collect the information. Presently, health visitors do not receive any formal training in indoor environmental science issues or any other related information even though their formal training schedule mentions the subject. However, the potential effects of the home environment on biological pathways that lead to health problems in later life, is still used as a part justification for health visitors focussing on visiting young children at home.²⁴⁵

A Danish working group has recommended that health visitors should be trained in environmental health matters in relation to child health issues.²⁵¹ In the United States of America, there has been an integration of environmental training into nursing education following recommendations from the Institute of Medicine in 1995 that environmental health concepts should be incorporated into all levels of nursing education.^{252,253} The lack of training for health professionals has been highlighted in an American study which found that 66% of medical schools surveyed provided education on environmental and occupational medicine but only for four hours over four years of training. Associate degree nursing programmes generally neglected such content because of time constraints.^{252,254} The specialist community public health nurses' training suggest that one of the factors affecting health and well-being that needs to be addressed by a public health nurse is the environment, including housing, air quality, noise, pollution, exposure to contamination, emissions or infestations, potential contact with disease carriers, or noxious substances.²⁵⁵ However, there are no guidelines as to how health visitors should approach these factors. There is the added complication that some

health visitors are concerned with overlapping with the remit of social workers and environmental issues are put down as a social worker's problem. Health visiting has always sat uneasily between social work and nursing.²⁵⁶

2.4.5. Health Visitors' Changing Roles

The historical change in the emphasis of health visiting can be summed up as the adoption of a medical model over a social model – a move to a more medicalised approach.²³⁶

There is a growing risk that the declining health visitor numbers are preventing them from fulfilling their roles as envisaged in the original principles of health visiting.²⁴⁵ Suggestions have been made that the support given by professionals such as health visitors is a therapeutic intervention for a vulnerable group in society which can in itself produce positive health outcomes for clients.^{257,258} Clients have been shown to utilise advice given by their health visitors, being able to retain and recall between 33 and 50 % of the (mostly spoken) advice they were given.²⁵⁹

The Nursing and Midwifery Order of 2001 resulted in health visiting no longer existing as a profession in statute, yet the requirement for health visitors still exists. In 2007, the number of health visitors was at its lowest point for 12 years, with a 40% decrease in training places.²⁶⁰

Since 1999, there has been a push to change the role that health visitors play in front line health care, with a restored emphasis on public health. The UK Government suggested that health visitors were potentially well placed to fulfil a

public health role in the community.²⁶¹ Health visitors are fully aware that their work involves public health, where 88% of health visitors believe that health visiting, and public health was the same or similar service.²³⁹ However, there is much ambiguity about how health visitors interpret public health within their own working context. In a recent move to expand their health-visiting role, the government emphasised the importance of preventative healthcare, shifting the emphasis from treatment to a holistic health promotion in the community approach. In recent years there has been a quiet revolution in working conditions with team and cooperate responsibilities introduced.²⁶² The requirement to work in a team with combined caseloads was seen as a necessity to cover all cases at all times. The team effort requirement was brought about following a spate of high profile mishandled cases.²⁶³

The Wanless review forced the government to launch the concept of empowering the public to take responsibility for their health needs to reduce the financial burden on the NHS. The intent of the Wanless report and others was to have front line health professionals, like health visitors, perform more of a public health role, compared to their present participatory role.

The Nursing & Midwifery Council encouraged health visitors to enhance their knowledge base to fulfil their public health role.²⁴⁹

*"The rapidly changing nature of health care reflects a need for career-wide continuing professional development and the capacity not only to adapt to change but also to apply the principles of health visiting and initiate change. Health visitors must be prepared to work in partnership with other members of the health care team, as well as other agencies, to influence public health."*²⁴⁹

Health visitors were urged to take a lead role in reducing health inequalities through developing population focused health promotion programmes that were evidence-based in response to identified needs. In reality, health visitors were becoming 'organisational personnel' where their skills were used for arranging and delegating some of their previous tasks to lower paid workers, such as health visitors' assistants and Sure Start groups. The Hall report 'Health for all Children'²⁶⁴ presented results from the assessment of the work being conducted by health visitors and other professionals in terms of health and financial benefits. This report no longer recommended some of the work conducted by health visitors, such as some of their screening procedures and the child reviews made after they were four months old because they were not financially viable. The government advocated a new 'family-centred public health' role for health visitors, encouraging them to work in new ways focusing on whole communities as well as families and individuals, responding to local health needs, and addressing national priorities.¹⁰¹ The family-centred public health role was seen as an opportunity for health visitors to "reclaim their public health roots" yet at the same time provide a framework to improve family-based work.¹⁰¹ The Health Visitor Practice Development Resource Pack¹⁰¹ favoured targeted approaches, limiting the delivery of universal health visiting.²⁶⁵ Houston and Cowley pointed out that the suggested 'new' policy had been practised before and the public health role was not a new idea, but a return to a lost path.²⁶⁵ The document 'Liberating the Talents' identified that public health issues are one of three core issues for health visitors.²⁶⁶ The desire to 'modernise' the roles of these disciplines came from an explicit attempt to enable them to respond effectively to the challenge of the government's new policies first mooted by the Department of Health.²⁶⁷ The policy history on their

role up until 2002 was summarised by Goodman-Brown and Appleton²⁶⁸. The legislative framework and related documents summarised in Figure 6²⁶⁹ and below:

1998: Making a Difference.²⁷⁰ Health visitors were envisaged as members of teams delivering Health Improvement Programmes.

2001: Health Visitor and School Nurse Practice Development Resource pack.¹⁰¹ Health visitors encouraged to discuss what changes might be pursued within their practice with PCT colleagues to be able to implement change. Health visitors are encouraged to broaden their field of activity.

2002: Requirements for Pre-registration Health Visitor Programmes.²⁴⁹ Health visitors should pursue a lifelong learning attitude. Requirement to work with other organisations within the community to enhance public health.

2003: Liberating the Public Health Talents of Community Practitioners and Health Visitors.²⁶⁶ Follow on from earlier document.²⁷¹ Outlines envisaged function as:

- First contact care: acute assessment, diagnosis, care, treatment, and referral
- Chronic disease management, continuing care, and rehabilitation
- Public health, health protection and promotion programmes

2004: Children Act (and the Children Act 1989).²⁷² Children are entitled to a reasonable standard of health or development.

2004: National Service Framework for Children, Young People, and Maternity Services.²⁷³ Ensures 'age appropriate' interventions to improve health care.

2004: Review of the Nursing, Midwifery and Health Visiting Contribution to Vulnerable Children and Young People.²⁷⁴ Sets out changes needed to improve the health and well-being of vulnerable children.

Although there has been a push throughout the last ten years towards public health roles for health visitors, there is very little guidance offered on how to fulfil this role:

"...there is very little prescriptive guidance available. Both the Department of Health and Nursing & Midwifery Council existing guidance is tailored to enable individuals to be as creative as possible to meet public health need as determined by each locality." (Personal correspondence, Plastow L. Professional Adviser, Specialist Community Public Health Nursing Standards and Registration Directorate, Nursing & Midwifery Council, 2005).

In 1998, it was highlighted that even ten years after the government first raised the subject of 'public health nursing' in 1987, no definition existed as to how to understand the concept and how the terminology was related to health visitors.²⁴² In 2004, the situation was not any clearer.²⁷⁵ The situation facing health visitors at the time has been described as chaos, confusion, contradiction, and complexity.²⁷⁶ Yet, all professional services experience some or all of the listed 'C' words sometime in their history and the health visiting service certainly has endured, assimilated, changed with the times, and accepted instructions from successive governments during more than 140 years of existence.

A study of health visitors' use of the formal guidelines that were in place to identify health needs and prioritise families requiring extra health visiting

support found that more often than not these guidelines were not followed.²²⁷ Further, different PCTs had differing guidelines.

In 2008, the Conservative party produced a document summing up the major problems that the health visiting service faced.²²⁶

- Under funding, lack of structured career pathway and lack of government commitment²⁷⁷
- Increasing caseloads (due to reduced health visitor numbers and high birth rates)
- Low workforce morale
- Lack of health visitors in deprived areas
- Lack of continuity of service (variation in the number of hours individual parents get with their health visitor)
- Lack of clarity about their role
- A retreat from universal health visiting (where the new progressive universalism actually has more emphasis on specific families)²⁷⁸
- Inadequacy of Sure Start outreach (due to non specified roles and training)⁹⁷

Health visiting is a form of surveillance²⁷⁹ and therefore provides an excellent opportunity of assessing all the problems associated with a poor indoor environment as suggested with this research. Health visitors offer a broad and holistic view of health at the ground level, providing vital information for the new 'health intelligence' service developed by the Department of Health.²⁸⁰ In 2007, the report 'Aiming High for Children' suggested that health visitors and midwives should still be a key part of the personalised service for children but primarily through children's centres.²⁸¹ The report pointed out that there is a shortage of

midwives and health visitors, which causes the service difficulties. In the paper 'Health visitors – an endangered species' the Family and Parenting Institute campaigned for a well-funded, universal health visiting service, offering equal quality across the country to all parents of children under five years old.²²⁹ The Institute pointed out that whilst on the one hand many PCTs are cutting back the number of health visitors, on the other hand, in 'Aiming High for Children'²⁸¹ the government points out that midwives and health visitors will henceforth play a crucial role in promoting children's services. The Commission for Health Care Audit and Inspection has also suggested extending the role and capacity of health visitors to work with children and young people in community settings.²⁶⁹ The latest child health strategy proposes that the number of health visitors should be increased.¹¹⁸

A systematic review in 2001 of the effectiveness of domiciliary health visiting showed that there was a lack of evidence that linked what they did with families to their health outcomes.²³⁶

- *"There was a potential for using para-professional members of the community in extending the role of health visitors*
- *Health visitors were good at working in inter-disciplinary and inter agency ways*
- *Health visitors were most successful when functioning in a non-directive, supportive way, encouraging their clients to set their individual health agendas"*²³⁶

The review also suggested that the reduction in health visitor numbers could have left some families unsupported during the 'normal' crises that occur in family life. In 2007, there were concerns that the reduction in the number of health visitors and increasing workloads were increasing the risk of child abuse.²⁸² A child neglect case in 2009 has highlighted the problem that if no

one visits a home, authorities cannot see the conditions a child lives in. The case occurred under the jurisdiction of York City Council, where the councillor for children's services in York indicated the gap monitoring children in the UK.

*"We're all concerned about the gap between when the health services go into the home, like health visitors when the children are younger, and when the children go to school and there's a gap if they don't go to any pre-school provision... if the children are at home and nobody's visiting them regularly and they're not going out of the home regularly then there's clearly a gap."*²⁸³

2.4.6. Health Visitor Training

A health visitor is a qualified, registered nurse or midwife who has undertaken post registration training to become a health visitor.²²⁶ The Department of Health and the Nursing & Midwifery Council used evidence-based teaching models coupled with complex stated written goals in the form of 'competencies' that a health visitor must meet to become qualified.^{101,255} In 2004, there was a national programme for training new health visitors in the UK, which only varies due to local interpretation of the requirements. To qualify to be a health visitor requires enrolment on a 45-week programmed course, based on the 'Standards of Proficiency for Specialist Community Public Health Nurses'²⁵⁵ (which is to be reviewed in 2009 (personal correspondence, Marie Saldanha, Assistant Consultation and Public Involvement Officer, Nursing & Midwifery Council, 2009)). This standard has been in use since the end of the Requirements for Pre-registration Health Visitor Programmes.²⁴⁹ Before this, teaching was based on ensuring that health visitors understood the four principles of health visiting developed in 1977.²⁸⁴ The current course is evenly split between classroom teaching (theory) and practical training. At the end of the course, there is a 10-week consolidating practice placement period to ensure the health visitors are adequately trained.

The Health Visitor Practice Development Resource Pack highlights the importance of continual learning after health visitors have qualified, suggesting that one of the most effective ways to improve knowledge is to 'learn by doing'.

Learning activities should include:

- *Shadowing others*
- *Regular discussion groups to explore critical incidents and share experiences of new ways of working*
- *Reading*
- *Visiting other projects*
- *Using informal contacts with colleagues to talk through ideas*
- *Running workshops*
- *Journal clubs*
- *Learning sets*
- *Attending courses*¹⁰¹

Health visitors are actively encouraged to take part in continuing professional development to allow them to re-register on the Nursing Midwifery Council register (albeit as Specialist Community Public Health Nurses). The Post-Registration Education and Practice handbook gives guidance on the sort of activities that are required to show a commitment to professional development.²²⁵

Health care trainers often use problem based learning, which is a teaching concept used to enhance multidisciplinary skills to resolve problems whilst at the same time acquiring basic knowledge. The concept was introduced in the 1960s at McMaster University in Canada. Problem based learning uses a problem or scenario as a basis for teaching. The principal aims of problem based learning are:

- *“To integrate knowledge and skills from a range of multidisciplinary sources*
- *To acquire knowledge through self-study*
- *To pass on/ share knowledge*
- *To develop problem solving skills*
- *To encourage self motivation, curiosity and thinking”*²⁸⁵

Some research has suggested that a full curriculum of problem based learning can be frustrating for students and cause conflict with the teacher, although the same research does suggest that slightly higher achievement can be gained from problem based learning versus alternative methods.²⁸⁶ However, students have been shown to perform less well in exams on basic scientific knowledge.²⁸⁷

The Nursing & Midwifery Council suggested that a curricula should reflect contemporary knowledge and enable the development of evidence-based practice.²⁵⁵ The emphasis on evidence-based practice should be taken into consideration when developing any training for health visitors since both the NHS and National Institute for Health and Clinical Excellence are committed to such practices.

2.4.7. Evidence-Based Practice

2.4.7.1. Definition of Evidence-Based Practice and National Policy

Diffusion of innovations, policymaking, and guidelines such as those produced by National Institute for Health and Clinical Excellence tend to be based on robust scientific evidence and evidence of best practice.^{288,289,290} Local policymaking is influenced by top down instructions but also by evidence-based practices, where what works locally is adopted locally. Evidence comes from four sources: research; clinical experience; patients, clients, and carers; and

local context.²⁹¹ However, evidence-based practice can mean different things to different people because of different interpretations of what constitutes evidence.²⁹² One definition is that it is the integration of best research evidence with clinical expertise and patient values.²⁹³ For example, evidence-based nursing is based on evidence-based medicine but takes into consideration the needs of nursing, allowing less reliance on pure research evidence and giving credence to the nurses' own experience and the local context.

Wanless highlighted that non-research based evidence should be incorporated in an evidence base and cited a World Health Organisation report which supported the idea that evidence including self-reporting of health should be accepted.⁷³

Evidence-based practice does not have an easy historical time line to follow and has not evolved or progressed in the same sense as other sciences.²⁹² Many authors suggest that the emphasis for making an evidence base for health interventions has moved from anecdotal evidence to a reliance on epidemiological research.²⁹⁴

2.4.7.2. Evidence-Based Practice in Health Visiting

Building an evidence base and looking at the traditional types of evidence used by health visitors is important.²⁹¹

The modern health visiting service is based on hierarchical evidence-based practice, with an emphasis on research evidence imparted through training, rather than the traditional practice of relying on personal experience and

common sense. Although there are few studies on what type of knowledge health visitors mainly use when practising, one study has shown that health visitors use a wide evidence base and use different types of knowledge.²³⁵ They are informed by own experiences, the evidence presented during training, recently read research and grey literature.²⁹⁵ The types of knowledge used in health visiting practice can be further defined as:

- Propositional knowledge based on empirical evidence^{*}
- Nonpropositional knowledge including:
 - o Practical knowledge – practical skills and expertise
 - o Intuitive/ tacit knowledge – a sense of knowing
 - o Personal knowledge
 - o Experiential knowledge – gained through an encounter with a subject, person or thing²³⁵

Propositional knowledge consists of discipline-based theories and concepts; generalisations and practical principles; and specific propositions about particular cases.²⁹⁶ It is probable that perceived difficulties with housing are addressed using 'experiential knowledge'.²⁹⁷

The health visitors' implementation of evidence-bases is complex and varied.²⁹⁸ A 'rhizomatic' format has been used to describe the different ways in which evidence-based practice is understood in the literature – and how individuals collect and interpret their own evidence sources.²⁹² Rhizomes are used to describe practices that allows for multiple, non-hierarchical structures,²⁹⁹

^{*} Where propositional knowledge is defined as; knowledge of something that can be asserted as true or false

implying that information can come from sources other than clinical trials. Discussions with health visitors practising in Plymouth revealed that their view of their working practices was in line with the rhizomatic knowledge organisational structure and that their work was not just dictated by research evidence presented by the Department of Health. They saw their workload as shouldering an infinite number of demands from known and unknown directions in constant flux.

2.4.7.3. The Evidence Base behind this Research

The research had two separate foci that there was evidence that the indoor environment impacted on health and that health visitors were suitable candidates to help a segment of the public improve their indoor environment.

There was enough scientific evidence about indoor environmental pollutants and a historical sociological context about how the indoor environment interacts with health outcomes available to consider the epidemiology robust enough to pursue this research. Although, where possible, the link between the indoor environment and health was based on clinical research there is no hierarchy given to this evidence. Due to the substantive evidence linking the indoor environment and health, it was assumed that it is biologically plausible that there will be health effects from altering someone's home environment.

However, it was realised that after the initial exploratory research there would be a need to build an evidence base of the impact of health visitors adopting the concept. Therefore, one part of the initial proposal for this research included

the outline for a randomised control trial that could be developed to determine the health benefits from the concept.

2.5. Diffusion and the Implementation of Change

2.5.1. Literature Search Methods

A literature search was conducted to review current research on the implementation of an innovation in the health service. Similar methods were used to those described in 2.1.1. Searches were carried out using the following keywords in the singular, plural or in combination: implementation of change; diffusion; health visitors; health visiting; home visits.

2.5.2. Definition of Diffusion

Rogers and others define the initiation and uptake of a new idea by an individual or organisation over time as diffusion.⁹⁴ This research and the concept it tested were both innovations. The word 'research' is used henceforth to represent the project described in this research (practical). The word 'concept' is used henceforth to represent the 'idea' behind the research (theoretical). The researcher was the original innovator, supplying both the concept and the research method.

The concept was an innovation for health visitors who no longer considered the indoor environment, did not use indoor environmental monitoring equipment, and had limited knowledge about the indoor environment. The concept was also new to all organisational levels managing the health visiting service in Plymouth, where the research was based. The concept and research proposed

was new to the health visiting system as per the definition that an innovation is an idea or behaviour that is new to the organisation adopting it.³⁰⁰ The diffusion of innovations is an important process to introduce a new product or concept to individuals and organisations and instigate change.

*"It is a lack of understanding of the diffusion process which is largely responsible for the failure of many new products, not only because of unreliable forecasting but also because of the use of inappropriate marketing strategies."*³⁰¹

Three key factors can have a positive or negative effect on the development of new practices.³⁰²

- The context in which the practice is to be developed
- The structure of the organisation
- The influence of the individual

When implementing change in nursing, planned change is the most effective method according to Lancaster³⁰³. Any planned change is a process whereby new ideas are created or developed (invention), communicated to all parties (diffusion), and either adopted or rejected with or without consequences.

There is a risk when introducing a new science into the health care industry such as indoor environmental sciences, that the subject might be rejected out of hand as being too unusual or just 'common sense'. Experience from Sweden suggests that the most vulnerable members of society will gain from their health organisation being able to cope with implementing change.³⁰⁴ Allowing evidence-based change to take place in a structured and at times taught format

within the social services' (system) legitimises changes and can raise the morale of staff. Further, relying on evidence-based knowledge is considered a 'safe' approach, whether or not a change is implemented.³⁰⁴

In 2007, the National Institute for Health and Clinical Excellence issued guidance to help health care workers implement changes in practice.³⁰⁵ The first important issue highlighted by the guidance is that the barriers to change, such as awareness, knowledge and acceptance must be understood. The Institute suggested that these barriers could be identified through qualitative methods, such as observing clinical practice in action, focus groups, and questionnaires. The identified barriers can then be overcome by raising awareness and diffusing the change through educational materials, meetings, and outreach visits.

It is important to take a 'cultural perspective' of the organisation to understand the behaviour and practices within an organisation and that a failure to take into account cultural forces can render organisational changes ineffective.³⁰⁶ However, it has been argued that 'culture' is an under-defined concept which is used to encompass organisational elements that have no formal label and that an over emphasis is placed upon the study of organisational culture.³⁰⁷

2.5.3. Diffusion to the Health Visiting System

Local health visiting systems comprise three parts: the health visitors; their management organisation including commissioning agents; and support organisations. To diffuse research, two spheres of influence have to be

³⁰⁴ The department for social services in Sweden covers a much broader remit than in the UK

recognised: individual and organisational. Figure 7 shows the main organisations in the national health visiting system. Local health visitors, Health Visitor Leads, and indirectly clients are the individuals in the diffusion process. On an organisational level, PCT research managers, health visitor management teams, research governance and ethics committees need to be convinced that any research is valid.

The adoption of an innovation by organisations is much more complex than an individual's adoption as there are many more 'layers' of people involved in the innovation-decision making process.⁹⁴ Rogers distinguishes the types of innovation-decisions based on where in a system a decision to adopt is made.⁹⁴

- *Optional innovation designs – adoption is decided by individuals independently of other members of the system*
- *Collective innovation decisions – the decision to adopt is made by consensus by members of the system. For example, the collective innovation decision made by members of an ethics committee to allow research to be adopted*
- *Authority innovation-decisions – the decision to adopt the innovation is made by a few individuals in a system that have power, status or technical expertise*

In terms of adopting a new concept, the types of innovation-decisions that a local PCT would make are normally contingent innovation-decisions. In other words, the Department of Health made authoritative innovation-decisions about a new health care practice and then the PCT make a decision to adopt or reject the recommendations. In such cases, PCTs make their decisions based on statutory requirements, available finances, and whether an innovation was compatible with their current skills and client population. An authoritative innovation-decision can reduce the efficiency of implementation of an innovation

in the health service, for example the implementation of information technology, like the NHS Care Records Service.³⁰⁸

Within an organisation, diffusion of innovation processes normally follow five stages and this would be applicable within health care systems.⁹⁴

- 1) Agenda setting occurs when the organisation identifies and prioritises a problem that needs an innovation
- 2) Matching involves the synchronisation of the identified problem and an innovation. This is a crucial stage at which the organisation decides to reject or adopt the innovation
- 3) Re-defining and re-structuring then occurs, where the innovation is reinvented to accommodate the organisation's needs and the organisation is modified to fit the innovation
- 4) Clarifying occurs when the use of the innovation becomes more widespread and the idea becomes clearer to more people
- 5) Finally, the innovation is routinised and incorporated into the regular activities of the organisation. The innovation is no longer thought of as a new idea

The decentralised health visiting system, coupled with the origins of health visiting and the informal nature of the roles of a health visitor meant that the research innovation process would be easily initiated according to Rogers.⁹⁴ Unfortunately, this also meant that it might be difficult for the organisations governing health visitors to implement the innovation given good results.

Rates of adoption are dependent on the complexity of the innovation, particularly for the introduction of new equipment for health care. A study of the variability in rates of adoption of medical technology innovations indicated that socio-political, historical, and cultural differences influenced the rate of adoption of new ideas.³⁰⁹ Examples of the attributes of a technology needed to increase adoption rates have been described in a 'characteristics of innovations' scale for adoption of information and communications technology:³¹⁰

- Compatibility (with existing practices)
- Ease of use (free of effort)
- Image (adding to the user's social approval)
- Relative advantage (is this better than previous practice and how useful is it)
- Result demonstrability (is it easy to demonstrate the innovation)
- Trialability (can it be tried out on a limited basis)
- Visibility (are others visibly using the innovation)
- Voluntariness (degree to which innovation is controlled by the users free will)

Previous studies have shown how spontaneous, self-organisation type systems react under the situation the health visiting service found itself in during the period of this research.³¹¹ Individuals and fractions within an organisation behave to basic sets of rules, at times subjected to random events that might result in novel organisational patterns and relationships. Spontaneous self-organisation, fed by internal and external pressures has been observed to occur in healthcare type organisations.³¹² Under these conditions, the suggested research had every chance to survive and thrive. For diffusion of the concept into the local management system the third point above was the most salient to

overcome since the service had no funds to cover extra time required by health visitors to participate in research.

2.5.4. Diffusion to Governing Bodies

To promote the concept in the future and have it recognised by the whole health visiting system (given its present structure) it would be necessary to diffuse the concept to the authoritative innovation-decision makers in the NHS. To get the Department of Health (managers of the NHS) to adopt an innovation there is a need to explore the nature of the organisation and understand how it functions, as a prerequisite to understanding organisational change.³¹³

Bearing in mind that the NHS is entirely funded by the Treasury through the Department of Health, the operation of the NHS cannot be compared with the running of a similar sized commercial organisation. The NHS does however, recognise the idea of 'cost benefit' and following the various inputs from Wanless (2002 to 2007) is trying to reduce direct costs through providing decentralised care.³¹⁴ The NHS is however just an administrative body of the Department of Health, from which the NHS takes information and makes decisions, which it carries out. Organisations like the Department of Health, where the command structure is over centralised and virtually inaccessible for front line staff at the local level, become resistant to change by default and thus hinder grass-root ideas influencing managerial changes.⁹⁴

It might be argued that the Department of Health can only progress by reacting to requirements for change as indicated by information fed upwards in the organisation or directly parachuted in from intergovernmental information

sources, evaluating and if accepting the suggested changes, turn the new information into new directions. To determine the type of innovations that were circulating in the health community, in June 2006, the Department of Health launched the Best Research for Best Health – a new national health research strategy.³¹⁵ Over 500 suggestions for research were presented through the consultation request. It has been suggested that the present organisational structure of the NHS does not promote innovation coming from practitioners within the organization.³¹⁶ In 2008, Lord Darzi suggested that the NHS as an organisation should focus on innovation.³¹⁷ To encourage innovative practice, the Health Innovation Unit was initiated to ensure the NHS develops and deploys hi-tech health care such as medical devices and diagnostics. However, the unit is not entirely new, in that it succeeded the NHS Institute for Innovation and Improvement, which in turn had succeeded the Modernisation Agency.³¹⁶

2.5.5. Diffusion to Individuals

2.5.5.1. Adoption by Health Visitors

Managers within organisations wanting to forward ideas for change should act on assumptions based on their personal psyche and the cultures that they influence and are influenced by.³¹⁸ Managers behave in terms of their theories-in-use and, in many cases, without hesitation and without thinking about the underlying reasons for their actions.³¹⁹

Lancaster listed questions to assess the potential for resistance to change from individuals, concentrating on personal perceptions of an innovation looking at emotions, threats, involvement, personal feelings towards the change agent and finances.³⁰³ Involvement with potential adopters is positively related to

adoption, implementation, and the sustainability of a change.³²⁰ Analysing an individual's resistance to change, using criteria such as Lancaster's, enables a better understanding of the proposed change itself and possible required modification(s) to the invention to better suit individual perceptions. Potential resistance to change when piloting an innovation can be understood as a positive outcome, since such a reaction would identify what it is about the proposed change that reduces its acceptability.

The process of policy and strategic development and eventual implementation of an innovation within the health care system is increasingly following the principles of social marketing.³²¹ Rogers suggested that commercial marketing skills should be employed to 'sell' into society notions of better health.⁹⁴ The National (UK) Social Marketing Centre for Excellence defines Social Marketing as the systematic application of marketing concepts and techniques to achieve specific behavioural goals relevant to a social good.³²¹ Social marketing principles ensure that an understanding of the 'customer' is considered when attempting to diffuse a new idea. Social marketing is centred on understanding the customer and relies on marketing exercises such as scoping, goal setting, systematic planning, stakeholder involvement, budgeting, and monitoring.

When practicing social marketing principles, healthcare professionals and their clients can be looked upon as if they are the first and second line 'customers' when considering 'change' as a product. When treating the diffusion of an innovation as a 'sale', the salesperson needs clear, understandable, and achievable goals.

2.5.5.2. Adoption by the Health Visitors' Clients

Chapter 1 described the difficulties in teaching the public about the importance of a high quality indoor environment and the rationale for needing someone to disseminate the information to the public. For many people, the idea of managing their home to make it healthy for them to live in is innovative; they have not had the necessary experiential knowledge passed to them from their families or friends. Similarly, the idea of health visitors coming into homes and providing information and advice about indoor environments is new.

Householders will only follow advice when it fits into their daily routines and activities and when they, their family and friends can 'see' how the advice affects their well-being.³²² Therefore, it is important for the health visitors to understand a client's routines, preferences, and restrictions and positively build on these when giving advice.

Eraut has developed a typology for methods as shown in (Figure 8), which considers communication.³²² This typology is quoted as an alternative to Buchler's typology of method, which ranged from a description of methodical training to responsiveness and invention.³²³ Although Buchler's typology correctly described the different types of method, Eraut made a distinct category for communication, highlighting its importance when developing methods.

Chapter 3. Overall Methods

The central component of this study was a proof of concept, participant observer, feasibility study. The purpose of the study conducted in Plymouth, England was to meet the objectives given under Chapter 1.2.2 before embarking on a large-scale trial.

Whilst other frameworks were considered as models on which to base the change process, Soft Systems Methodology was the most appropriate. The Soft Systems Methodology cycle served as a framework and allowed adaptations as and when new problems or aspects arose during the research. The research followed the Soft Systems Methodology four stage learning cycle. Figure 9 shows the four stages (in dashed line boxes) and where the relevant chapter discussing the stages is given in brackets.

Stage 1: finding out about the initial situation, which is seen as problematical.

- Explore the demographics of the research setting in Plymouth
- Explore the health visiting system, look at health visitors' current situation, and match problems in their practice with housing and the indoor environment
- Approach key stakeholders within the health visiting system. Investigate the method of implementation of new information and ideas. Part of the first stage of this study was to understand the (changing) role of health visitors working for Plymouth Teaching PCT, how the organisation surrounding them operated (especially in relation to Plymouth City Council and others

concerned with housing), and to gain support from relevant stakeholders and ethical permission for a Feasibility Study

- Conduct a Pilot Study

Stage 2: developing purposeful activity models.

The findings from Stage 1 were used to develop the methods for the Feasibility Study, incorporating the needs of participants and addressing issues identified.

Stage 3: structured discussion about change.

Discussions with the health visitors' management resulted in permission to implement the Feasibility Study, and the realisation of the concept in practice.

Stage 4: action to improve.

The main action of the research was the implementation of the Feasibility Study. The completion of the Feasibility Study ended one cycle in the Soft Systems Methodology framework leading to discussions with key stakeholders about the outcomes of the study. This led to recommendations on whether to take the concept forward into a randomised control trial or not.

The research methods were compared with Eraut's typology of method³²²

(Figure 8):

- **Case complexity:** the research was based on a well-defined problem. The methods had to address teaching a defined group to advise and follow-up a specific topic (the indoor environment) in the locations of a classroom and a client's home. There were clear parameters within the study design
- **Type of response:** although there was a plan for the study and for diffusion of the innovation, there needed to be room for continuous development of the methods
- **Level of support:** the health visitors' clients would need ongoing support since at each interaction with the clients, the subject of the clients' indoor environments might be brought up.
- **Communication with clients:** based on the health visitors' and the researcher's experiences of teaching students and clients respectively. The level at which the researcher and the health visitors disseminated evidence-informed messages was different, with the researcher trying to avoid addressing the health visitors' clients directly

The acceptability and feasibility of health visitors conducting indoor environment assessments was an issue that needed an adaptive approach to be resolved as lessons were learnt from experience and ongoing interpretation throughout the Soft Systems Methodology cycle. For the Feasibility Study, the researcher needed to observe and assess physical factors such as how the health visitors handled the suggested measuring equipment. Other factors needed to be assessed such as the weight of the measuring equipment and the time it took to carry out required measurements. The health visitors' opinions of the concept needed to be explored to gauge its acceptability.

Chapter 4. Exploring the Initial Situation

(Soft Systems Methodology Stage 1)

4.1. Local Setting

A search of Internet based demographic data was used to explore the research setting of Plymouth (a Unitary Authority³²⁴). Searches were conducted using the following sites:

Internet Sites: Department of Health (<http://www.dh.gov.uk>); Department for Communities and Local Government (<http://www.communities.gov.uk>); Plymouth Teaching PCT (<http://www.plymouthpct.nhs.uk/>); Plymouth City Council (<http://www.plymouth.gov.uk>); South West Public Health Observatory (<http://www.swpho.nhs.uk/>)

All searches were carried out using the following keywords in any combinations with the word 'Plymouth': demographics; population; health profile; deprivation indices; and housing. A preliminary search of the search engine Google (<http://www.google.co.uk/>) was conducted for information related to indoor air quality in homes in Plymouth. No data was available. However, because there are known links between the quality of the outdoor and the indoor environment^{325,326,327} a web-based search was conducted for data on outdoor air quality in Plymouth.

Plymouth is a coastal city on the English Channel with no major sources of industrial pollution, with an average daily particulate matter (PM₁₀)^{*,204}

* PM₁₀ is defined as particulate matter with an aerodynamic diameter of less than 10 µm

concentration of $14 \mu\text{g m}^{-3}$, which is lower than the English average of $21.6 \mu\text{g m}^{-3}$ (39 cities). Similarly, the nitrogen dioxide level of $21 \mu\text{g m}^{-3}$ (main source traffic) is lower than the English average of $39.5 \mu\text{g m}^{-3}$.³²⁸ In 2004, Plymouth met the UK National Air Quality Strategy objectives.³²⁹

The population in Plymouth (approximately 250,000) has a low quality health profile compared to the rest of England.⁶⁸ There are major health inequalities across the city.³³⁰ Nine neighbourhoods in Plymouth contain 'pockets' in the top 10% most deprived in England (in terms of the Index of Deprivation; 2004) and five of these are within the top 3% (Stonehouse, Devonport, City Centre, North Prospect, and Barne Barton).³³¹ For a map of Plymouth neighbourhoods, see Figure 10. Within the city, approximately 70,000 people live in areas defined as deprived by the Plymouth 2020 Partnership Neighbourhood Index of Deprivation.³³²

In 2004, of all dwellings in Plymouth, 33% (social sector 42%³³² and private sector 32%³³³) were classed as non-decent (defined by the Department of Communities and Local Government⁶⁵). In comparison, the English House Condition Survey of 2004 indicated that the English average for non-decent social housing was 29% and for private housing 31%.³³⁴

Plymouth health visitors have reported undefined poor housing conditions (thought to be detrimental to health) in approximately 7% of the homes they visited in 2006.¹⁰² Plymouth neighbourhoods with the highest prevalence of poor housing are listed in Figure 11.¹⁰² Overall, in 2006, out of the families

⁶⁵ A decent home is one which is wind and weather tight, warm and has modern facilities

receiving health visitor support, 29% had one or more smokers (compared to the English average of 25%³³⁵), 28% had a low income or were dependent on benefits, and for 15% of families the major (potential) wage earner was unemployed.¹⁰²

The Audit Commission, as part of their Corporate Assessment of Plymouth, rated Plymouth's 'Children's Care Services' as poor up to 2003 and as 'adequate' by 2006.³³⁶

In 2003, there were 51 full time equivalent health visitors in Plymouth Teaching PCT (this reduced to 47.27 in 2008^{*}).²²⁹ The 51 health visitors were based in 30 clinics or health care centres. The ratio of children under 5 years old to a health visitor in Plymouth was 264 to 1, in comparison to an English average of 357 (range Doncaster PCT 160 to Redbridge PCT of 1142).²²⁹

4.2. Exploration and Review of the Health Visiting System

The aim of this stage of the research was to determine the current environment in which health visitors worked and to match current problems in their practice dealing with housing and the indoor environment with the research concept. The health visitors' system was investigated to determine time management and practices and how new practices were introduced before and during the development of the methods.³³⁷ This work resulted in a literature review, which has been presented in Chapter 2. In addition, a small observational study was carried out to understand how health visitors were trained locally and to develop an educational model for health visitors that might participate in this research.

^{*} Personal Correspondence, Freedom of Information Officer, Plymouth Teaching PCT, 31 March 2008

The researcher acted as a participant observer for a day of health visitor training at the University of Plymouth (17 March 2003) to observe local methods, the speed with which information was presented, the complexity of the language used, the type of classroom atmosphere, and the opportunity for interaction. The teaching method was lecture based with some interaction between the lecturers and students. Course handouts and note taking on white boards aided teaching. The post-registration education program used in Plymouth to prepare registered nurses to be specialist community public health nurses (health visitors) did not include any detailed training on housing issues (personal correspondence, Lecturer in Public Health, University of Plymouth, 2007).

The researcher's previous experience when mentoring students and colleagues to conduct indoor environmental assessments indicated that lecture type teaching with restricted interaction was not appropriate for teaching the health visitors. 'Hands on' teaching was found to be more appropriate for learning about equipment and conducting an assessment. The resulting training method is given in Chapter 5.

The types of innovation decisions⁹⁴ taken in the local health visiting system to allow the research to take place are shown in Figure 12. Some of the main (organisational) problems that were considered important to the diffusion of this research in Plymouth Teaching PCT were:

- Recent changes to the health visiting role might limit the adoption of more new working practices
- The Department of Health and the Nursing & Midwifery Council were ambivalent and ambiguous in their management directives and definitions for the health visiting service
- The local health visitor structure was overstretched and under funded (according to the Plymouth Teaching PCT research management)

These possible disruptors and their backgrounds had to be understood, contained, and appreciated, to be able to conduct the research as originally intended.

4.3. Engaging with Stakeholders

Although some meetings and presentations were made, there were also many e-mails, postal, telephone contacts and correspondence with all stakeholders throughout the research that are too numerous to list. Some of the key data about implementation and changing roles have been discussed in Chapter 2.

The Department of Health and National Institute for Health and Clinical Evidence were not engaged in the research, since it was not necessary for the study to commence.

4.3.1. Plymouth Health Visiting Service

The following local people and service departments were involved in the research:

- Health Visitor Lead (two different Leads have been involved (changeover in October 2004. In 2007, the title Health Visitor Lead changed to Health Visitor Manager.)
- Health Visitor Professional Lead
- Health visitors
- Deputy Director of Public Health, Plymouth Public Health Development Unit
- Head of Development - Research, Plymouth Teaching PCT
- Head of Education, Plymouth Teaching PCT
- Nursing lecturers, University of Plymouth

An academic supervisor made initial engagement with the first Health Visitor Lead and some of the other stakeholders. The researcher, through telephone and e-mail correspondence, maintained subsequent contacts. No contact was made with the local Children's Commissioning Manager until later in the research (see Chapter 8).

Six presentations were made to health visitors and other stakeholders to improve engagement with the health visiting service and encourage recruitment of health visitors for the Feasibility Study. An example presentation is given in Appendix III. The inclusion of the health visiting management team helped to mould the study to fit the requirements of the local area and research aims.

Engagement with stakeholders was very important for the researcher because of his background in engineering. In this case, the request to conduct research

came from an individual outside the health care sector, completely unknown to all potential stakeholders.

The main barrier to involvement in the research highlighted by the health visiting management team was the financial cost to the service and the time required by the health visitors to participate in the Feasibility Study. Nevertheless, on the 15th April 2005, following two meetings between the second Health Visitor Lead, the Deputy Head of Development and Research within the Teaching PCT, and the researcher, it was agreed that funding would be given to provide backfill^{*} pay for 40 one-hour health visitor visits estimated to cost £1,200 (= 40 client visits x £30 per visit). The health visitor management team did not agree to consider participation in the research as an 'education exercise' for their health visitors, as they were not convinced of any merit from the research and the suggested activity had not been commissioned by the Children's Commissioning Manager.

4.3.2. Plymouth City Council

The review of health visiting and discussions with health visitors early in the research (during presentations and the first visits) indicated that when health visitors had referred their clients to a landlord or the local authority, the referrals were not always followed up. Therefore, the researcher contacted the Housing Services in Plymouth City Council to set up a referral system, where the health visitors could make direct written or verbal contact with a specific member of the Home Energy Team. This contact was also a Housing Strategy & Development officer empowered to deal with referrals from Plymouth City Council, housing

^{*} Backfill pay requirements arise when health visitors are conducting work outside of their contractual obligations – non-commissioned work. Pay is deducted for the time spent on the 'outside work' but can be 'backfilled'= repaid from another source.

association, private-rented, and owner-occupied properties. In the case of private-rental tenants, the health visitor had to contact their respective landlord first to request action. However, the referral system was set up so that the tenant or their landlord could approach the Housing Strategy & Development officer for help if they could not fulfil the required actions. In a situation where a landlord did not fulfil an action that was needed to ensure the client's home met the Decent Home Standards⁶⁵, the officer helped to enforce the action. In all cases, regardless of property ownership, referrals could be made to the Plymouth City Council's care and repair scheme, to the Devon Energy Advice Centre (for advice on grants related to energy efficiency), and to other suitable agencies, such as the Citizen's Advice Bureau. No formal information feedback mechanism or complaints follow up procedure was put in place for landlords after they had received the initial reports from the health visitors, since this was outside the scope of this research. All participating health visitors were given the same contact name within the Council; therefore, the officer soon recognised the more enhanced reports from health visitors participating in the research. Plymouth City Council decided not to prioritise such reports (referred to as 'housing letters' by health visitors).

4.3.3. Research Governance and Ethics Committee

An application was made to the Peninsula Primary Care Research Management and Governance Unit (Governance Unit)³³⁸ in line with the process suggested the Plymouth Teaching PCT and the online NHS Research Ethics Committee Application Form-Version 3.0 January 2004 from the Central Office for

³³⁸ Previously known as the Research Management & Governance Unit, Exeter PCT

Research Ethics Committee's^{*} original website was used. The assessment by the Governance Unit included an inspection of data protection, patient information, and the reliability and validity of the proposed research strategy. Once provisionally approved by the Governance Unit, the application was sent to the South West Devon Research Ethics Committee (Ethics Committee). An application was made to the Ethics Committee on 21st May 2004 and finally accepted on 28th September 2004 with conditions. Plymouth Teaching PCT gave permission for work to start on 29th November 2004.

In addition to Ethics Committee approval, the researcher obtained police clearance (20th April 2004 Criminal Records Bureau) to visit clients' homes. Exeter PCT gave the researcher an honorary NHS contract for the Plymouth area (8th December 2004). The University of Plymouth and Teaching PCT provided the researcher with indemnity and compensation insurance.

During the development of this research, it was clear that any messages given to the public regarding health-determining aspects of their indoor environment must be sound, safe, and morally equitable whether the evidence was based on research, clinical expertise, or personal experience. It was recognised that it would be unethical to impose theories on an unsuspecting public that were not fully tried and tested.³³⁹ It was further recognised that if the health visitors gave any advice to their clients as part of the discourse of this study they would be held responsible as part of their duty of care for their clients.

^{*} The Central Office for Research Ethics Committee was incorporated in the National Research Ethics Service on 1 April 2007

4.3.4. Other Interested Parties

In addition to stakeholders, the researcher engaged with other interested parties to obtain peer review of the methods and implementation of the research. Fourteen academic presentations were made at postgraduate meetings and conferences to fellow students and to academics in the field of the indoor environment and health visiting.

4.4. Pilot Study

4.4.1. Aim and Objectives

The aim of the Pilot Study was to find out if it would be at all possible to attempt the proposed Feasibility Study. The main objectives of the Pilot Study were to determine:

- The available time health visitors would reasonably be able to spend participating in the Feasibility Study
- The health visitors' willingness to participate in qualitative research to investigate their understanding of their suggested new role

4.4.2. Methods

A participant observer, Pilot Study was conducted. Initially, the Pilot Study methods were discussed with the first Health Visitor Lead in Plymouth Teaching PCT, who then briefly discussed the research objectives with her health visitors and asked them to participate. The first Health Visitor Lead recruited five health visitors in 2003 (Table 2). Before work commenced the researcher signed a 'Visitor's Declaration' on 25th June 2003 to allow up to a maximum of five half

days working with health visitors in the community. No ethics approval was sought for the Pilot Study. No confidentiality forms were signed but clients gave oral consent.

Each health visitor who had agreed to work with the researcher was given a half hour briefing in their office on the research subject and introduced to the measuring instruments used by the researcher. The health visitors chose properties to visit that they suspected had indoor environments that influenced their client's health. The researcher carried out an environmental assessment in each house (based on previously used methods^{81,340}), giving the health visitor the chance to experience the format of the assessments and learn about the context of any findings. Each health visitor was encouraged to take measurements resulting in a combined visit report for each client. These were sent to the first Health Visitor Lead with a copy for the health visitor. No follow-up action was offered from the researcher and the participating health visitors and Lead did not request follow-up.

At the end of the final visit with the health visitors, the researcher held an informal, face-to-face, follow-up conversation or held phone conversations with them to explore their views of the research.

4.4.3. Results

The participating health visitors had an understanding (nonpropositional knowledge) that there were health-determining aspects to their clients' indoor environments and that their clients' health would benefit from good quality indoor environments. This was confirmed by the review of health visitor training

that indicated that there was little formal training on the indoor environment and health issues.^{251,253,252,254} Although the health visitors were aware of the subject matter they were sometimes poorly informed about how to handle certain problems. For example, the health visitors knew about health risks from smoking, poor cleanliness, and overcrowding. Further, they were not equipped with any instruments to quantify environmental findings. The four health visitors suggested that having information from environmental assessments would empower them and in-turn their clients to write accurate housing letters. The health visitors were not aware that running a modern, thermally insulated house required different (mostly daily ventilation) routines compared to managing an older house, to prevent health problems and to prevent damage to the home through condensation, mould and related damages. This observation led to the development and publication of an article highlighting these issues (Paper 2).

The health visitors perceived that the research concept was interesting and feasible. They would be able to make use of environmental assessments and quantified information in their day-to-day work. There were suggestions that other workers might also take part in the research, particularly Family Support Workers.^{*}

One health visitor that volunteered but did not take part in the Pilot Study was contacted by telephone and asked why. She was positive about the research but was new to health visiting and found it difficult to take on additional work.

^{*} A division of Children and Young People's Social Services

During the follow-up conversations, the four health visitors were asked for feedback on the methods used in the Pilot Study. They commented on micro-management issues for example, changing monitoring sequences for the protocols and changing the way they were asked to approach their clients to gain access for the researcher during the Pilot Study. Input from the health visitors and their immediate manager suggested that the assessments had to be limited to around 30 minutes. All health visitors emphasised that physically burdening them with heavy and cumbersome measuring instruments would not be acceptable. They pointed out that the tool kit the researcher carried during the Pilot Study visits was unacceptable. This confirmed the necessity of developing a tool kit with light and simple to operate measuring instruments. When the health visitors and researcher met up before entering a client's home, some of the health visitors informed the researcher that they did not want their inexperience with the subject matter exposed to their clients when working with the researcher in the field, thereby risking being undermined in their 'authoritative' trusted capacity vis-à-vis their clients.

Chapter 5. Development of a Tool Kit and Feasibility Study

(Soft Systems Methodology Stage 2)

5.1. Development of a Cost Effective, Simplified Tool Kit (Objective 1)

5.1.1. Background

Existing indoor environmental monitoring methods were not suitable for health visitors to use due to the complexity of the methods, health visitors' time restraints, and the cost and weight of the required measuring instruments. The researcher had developed a tool kit for a housing and health study in Torquay, UK. The Torbay Healthy Housing Project^{127,341} included the monitoring of 38 indoor environmental variables before and after housing improvements in 115 council owned properties.³⁴² The methods used for data collection during the Torbay Project and from two other similar projects^{81,340,343} were investigated to determine if the number of variables measured in the three studies could be reduced and still enable health visitors to make good quality assessments of the indoor environment in their clients' houses.

5.1.2. Data Reduction Analysis

Papers 3 & 4 present the methods and development of the tool kit used for this Feasibility Study. Paper 3 describes the statistical analysis of the three housing and health databases using principal component analysis and Paper 4 describes some of the theoretical background to the development of the dedicated tool kit. Principal component analysis was the main technique available for identifying groups or clusters of variables in a database.

Principal component analysis of a database will result in a list of components that explain the maximum amount of variance in a correlation matrix using the smallest number of variables, thereby reducing the amount of equipment needed to measure them.^{344,345} The principal component analysis of the three databases highlighted 18 clusters of variables that should be included in an assessment. These were further reduced to 14 components (Paper 3). The analysis presented in Paper 3 described the rationale for choosing particular measuring instruments to quantify the 14 components, which represent approximately 80% of the information that would have been collected using the original assessment methods.

Thus, the final choice of indoor environmental variables to be used in the Feasibility Study was based on previous research, the findings of the literature review in Chapter 2.3, the researcher's available measuring instruments, sampling costs, the researcher's own experience, and the results of the principal component analysis.

5.1.3. Measuring Instruments

The 14 components were assessed individually to determine the most suitable measuring instruments for the health visitors to use. Market research was conducted to assess available measuring instruments in terms of unit cost, weight, size, and ease of understanding of the output data. When calibration costs were taken into consideration, choosing an inexpensive measuring instrument was more cost effective than paying for re-calibrations. For this research, a comparable tool kit was put together for the health visitors based on availability of similar measuring instruments and financial limitations (Table 3).

To complement the measurements, household related questions were included (Table 3). These questions represented variables that were observed either because they were too expensive to measure, for example, asking if anyone in the home smoked as against measuring the number of airborne fine particles or because they were difficult to quantify. The tool kit used by the health visitors was referred to as the simplified tool kit.

The tool kit used by the researcher (henceforth referred to as the 'gold standard' - the point of comparison for the accuracy of the health visitors' assessments) incorporated all the equipment and questions described Table 3. In addition, airborne particle counts and carbon dioxide were measured. The numbers of particles per litre of air were counted using a MetOne model 227B portable, laser beam, particle counter equipped with a temperature/ relative humidity sensor (MetOne, United States of America). Fine particles 0.3 to 3.0 μm and coarse particles 3.0 to 7.0 μm were measured ($\pm 5\%$ accuracy) outside each home, in the living room, and a child's bedroom. A carbon dioxide monitor (Kane International, UK) was used to measure carbon dioxide outside each home and in the living room (range 0 to 2000 parts per million, 0 to 40 $^{\circ}\text{C}$, 0 to 90% relative humidity, and accuracy $\pm 10\%$).

5.1.4. Health Visitors' Presentation Pack

A Health Visitors' Presentation Pack was developed as a training aid and a source of reference (Appendix III). The six, one-page fact sheets included in the pack had a Flesch-Kincaid,³⁴⁶ United States of America Grade Level score of 7 (12 to 13 years old).

5.1.5. Data Collection Sheets

A data collection sheet was developed for the health visitors (Appendix III). The sheet was tested during the Pilot Study, and then discussed with the first Health Visitor Lead. Data collection was based on a total elapsed time format. Other than geographical data, there was no overlap between the health visitors' existing recording system and the new sheet. An *aide-mémoire* was printed on the reverse of the health visitors' sheet with a brief description of the monitoring methods (Appendix III). A similar data collection sheet was used to record gold standard data (Appendix III).

5.1.6. Monitoring Methods

A method was devised for each measuring instrument to ensure that each health visitor made accurate and repeatable measurements (Appendix III). The gold standard methods have been described previously.^{81,342} Outdoor measurements were taken within 2 to 5 metres of each home. The bedroom assessed was chosen because the child believed to suffer the most from symptoms associated with the indoor environment slept it in.

5.2. Feasibility Study Methods (Objective 2)

5.2.1. Ethics and Confidentiality

Consent forms and an information sheet about the research were developed (Appendix III). Competent participating householders (including children over five years old) were asked to sign a consent form before participating. The health visitors were responsible for ensuring clients had read the information sheet and that all competent participants had given consent before

assessments commenced. They were also responsible for explaining the assessment procedure to their clients and to prepare them for a joint visit by the researcher. During visits, all data were collected in full view of householders and offered for inspection to increase the transparency of the research. Householders were encouraged to ask questions about the study.

After assessments were completed, if the health visitors wanted to make immediate suggestions for remedial actions, this was checked and discussed with the researcher. In addition, when clients questioned a health visitor about a subject directly related to the research that the health visitor was unsure of or was answering incorrectly, the researcher intercepted. This prevented any poor decisions the clients may have made based on the health visitor's advice. The health visitors were told that the study had a local Ethics Committee approval but were not given any details.

5.2.2. Sample Size Calculations

Statistical power calculations were conducted using G*POWER 2.0.³⁴⁷ One assumption of the calculation was that the number of health visitors would be flexible as the study was limited by the number volunteering to participate.

A-priori analysis (before conducting the research) indicated that 40 one-hour visits would provide data with a 97% (probability value (p) = 0.05) chance, to detect large differences (large effect size 0.8³⁴⁸) between the gold standard and health visitors' measurements. To achieve the 40 one-hour visits, a minimum of four health visitors conducting ten visits each, would be needed but if this were not achievable, more health visitors conducting fewer visits would have to be

acceptable. This was the case, where 29 visits were conducted instead of 40, requiring the sample size analysis to be re-run. *Post-hoc* analysis indicated that, allowing for a large effect size (0.8)³⁴⁸, 29 visits would provide data with a power of 91% ($p = 0.05$).

The non-random nature of the convenience sample meant that the sample size calculations were not valid for the qualitative data, however, the sample was representative of health visitors in Plymouth in terms of age, sex, and experience.

5.2.3. Recruitment

5.2.3.1. Health Visitors

Recruitment of health visitors was conducted through six presentations about the proposed research organised by the Teaching PCT and the University of Plymouth in 2004 to 2006.

Eleven health visitors (all female) volunteered, of which nine participated in some form (Table 4). None of the volunteers had taken part in the Pilot Study. All health visitors who volunteered were accepted to participate in the research, providing a convenience sample.³⁴⁹ The nine participating health visitors represented 18% of the full-time equivalent health visitors (51) in Plymouth Teaching PCT (27% if the Pilot Study participants are included).

The researcher made telephone enquiries (talking directly to the participating health visitor or a member of staff at their base) to determine the reasons why

³⁴⁹ A convenience sample is a sample where the patients are selected, in part or in whole, at the convenience of the researcher

some health visitors only partially participated in the research and why some had not conducted any visits.

5.2.3.2. Clients

Each health visitor was asked to recruit clients from their caseload who were due for routine home visits. The selection criteria were that clients were living in a home that their health visitor was concerned about and or that the client had children with respiratory problems. Ninety-eight clients (number of adults and children recorded on the researcher's data collection sheets) were recruited. In all cases, the clients were completely unknown to the researcher. Participation of the clients was not conditional on clients' accepting any advice and any actions they took were not measured outcomes of the study. No remuneration or other mention of merit was provided for the health visitors or clients for participating in the research.

5.2.4. Training

5.2.4.1. Classroom Training

The teaching methods recommended by the Department of Health¹⁰¹ and the Nursing & Midwifery Council²⁵⁵ formed the basis for the training methods used in this research. At the end of training, the health visitors needed to understand:

- Associations between health (mainly respiratory) and the quality of the indoor environment
- How to assess the quality of the indoor environment
- Actions clients could take in their homes to improve their indoor environment

The educational model included anecdotal evidence from the researcher's experiences, discussion of the health visitors' experiences, and the provision of a comprehensive research evidence base. Part of the training included a classroom session incorporating theory about the research and the indoor environment. The health visitors were encouraged to use their Presentation Packs as a reference resource based on the precedent set by the general use of the Health Visitor Practice Development Resource Pack.¹⁰¹

The researcher had previously trained five environmental science students, in the techniques and knowledge needed to make an indoor environmental assessment. Therefore, the style of teaching in the classroom was based on the researcher's style. The researcher was cognisant from previous experience and general recommendations that someone chairing a meeting should consider a number of points, including:

- Being well prepared
- Sticking to an agenda
- Avoiding controversial areas
- Listening carefully
- Trying to understand the fears and needs of the health visitors about the research
- Recording any requested information or problems with the learning process, following through information requests
- Agreeing dates for visits and tasks during the meeting³⁵⁰

Participating health visitors were assumed to all have the same level of training. Technical jargon was avoided but the health visitors had to be taught some new terms and phrases. The classroom sessions were designed to be informal and provide a forum for discussion.

The educational model used for this research was not solely based on problem based learning, as there was a need in the first part of the classroom training to teach the health visitors about the indoor environment as such and how its quality related to health. The attendance of the classroom sessions is shown in Table 4. The preparation time (in addition to the development of the Presentation Pack), for the classroom sessions, printing and delivering the Health Visitors' Presentation Pack, and arranging and setting up the venue, took approximately six hours. A further hour was needed before each of the sessions.

The training sessions took place in a relaxed room in a private dwelling with refreshments provided. The researcher led the classroom sessions with ample time given for input from the health visitors. It was assumed during the training that health visitors did not have any prior knowledge of health-determining aspects of the indoor environment or of the researcher's previous work.

A full kit of measuring instruments was on display at the training session. The researcher operated each instrument and the health visitors were encouraged to do the same. The method of conducting the on-site surveys in clients' houses was discussed, including the collection of mould and dust samples, with a detailed explanation of the sampling, collection and handling techniques. The

risk of cross contamination and risks to health from handling the samples were discussed in detail.

During the classroom training, the health visitors were warned that houses that clients consider to be of inferior quality are seldom so bad that they should be condemned or need substantial refurbishment. Inhabitants are often unknowingly the cause of indoor environmental problems, and are reluctant to agree that they are contributors to problems. The health visitors were further warned that the outcome of an analysis would not necessarily result in the outcome that the client and health visitors wanted.

The health visitors were guided as to what sort of advice they should give their clients, regarding remedial actions for their indoor environmental problems. Actions suggested were based on the research conducted for the literature review (Paper 1) and the researcher's experience as an environmental scientist. It was explained that in some cases, the remedial actions would not suit their clients because of entrenched habits for example, people keeping cats when their child was allergic to cats. Suggested interventions were listed in order of cost and difficulty to implement (see Appendix III). The health visitors were informed that their role was to make suggestions, encourage their clients to change, and help refer them to other agencies as appropriate. The researcher and health visitors discussed how the results from their indoor environmental assessments could be incorporated into a plan of action/ follow-up for their client(s).

Where possible, the health visitors' or researcher's experiences were used to create scenarios for discussion. For example:

You may walk into a home where the heating is on, there are three occupants, and none of the windows are open. It is not raining and there are low wind speeds. You make your measurements and the record following data:

Aspect = south/ south west

Temperature outdoors = 10 °C

Temperature in the living room = 17 °C

Relative humidity outdoors = 46%

Relative humidity in the living room = 63%

The humidity in the house is very high (refer to values suggested in your Presentation Pack on the Humidity Fact Sheet), especially compared to outdoors. You look for reasons: no washing is drying indoors and no one is cooking, the house has been insulated and the weather is unlikely to be a contributory factor.

Your conclusion should be that the ventilation is not adequate for the number of people in the house. The simple (remedial) answer is to open the windows more regularly. Ask if there are any air vents, which should always be left open. Explain that the high humidity may lead to damp walls and condensation on the windows and this may cause mould to grow, which in turn might influence someone's health.

5.2.4.2. One-to-one Field Training

During the first visit made with the researcher, refresher guidance was given on how to proceed with the assessment. The health visitors were shown appropriate locations to take measurements. Further guidance was given after the first visit if a health visitor requested it or if the health visitor was about to give inappropriate advice to their client. The ideas of 'learning by doing' and 'having a go'¹⁰¹ were a major part of the field training. The field training was conducted in the context of 'shadowing others' as the health visitor learnt from the researcher.

5.2.5. Structure of a Visit

The visits were arranged by the health visitors and where possible took place during the school term, between 9.30 and 14.00 to avoid school children being at home.

During the outward travel time (approximately 20-30 minutes) to each visit, the health visitor briefed the researcher on the client, their home, and situation. After each visit, the return travel time was used to discuss the health visitor's thoughts on their results from their environmental assessment.

On approaching a house a visual inspection was advised to spot obvious building related deficiencies that might influence the indoor environment, for example, broken drainpipes, clogged guttering, missing roof tiles.

At the start of each visit, the health visitor was asked to introduce the researcher emphasising that his presence was for research purposes only and that the researcher would not be acting on their behalf to enforce actions or help them with any issues they had with their home. Such an explanation clarified the status of the researcher for the participants.³⁵¹ Clients were advised that a visit would take about 40 minutes, what it would entail, and what was expected from them. The information sheet and confidentiality forms were presented and signed, when not signed in advance.

Enquiries were made as to what perceived problems or difficulties the householder had with their house.

The environmental assessments commenced, with the health visitors making their assessments and forming an opinion as to possible causes if any, for any indoor problems. The assessments required access to the living room and a child's bedroom. Comparative measurements were taken outdoors. The researcher conducted a parallel assessment using the gold standard.

During the visit, the researcher observed how the health visitor handled the measuring instruments, how they interpreted the data collected, and how they interacted with clients when talking about their indoor environment. The researcher took field notes.

At the end of each visit, after the assessments had been completed, the health visitor and the researcher conferred on the outcome of the assessments and the health visitor was encouraged to express her preliminary views on the indoor environment and make possible recommendations for follow-up work. Once the researcher had ensured that the health visitor had the correct information to give the clients, the results of the assessments were explained to the clients and they were given time to react to any findings presented. The researcher observed how the clients reacted to the summary of the visit by the health visitor. Where necessary, the researcher stepped in to advise or talk to the client.

After each visit, a 'researcher's report' was produced by the researcher based on the gold standard data, highlighting any problems in the home and what actions could be taken. These reports were produced for the health visitors to support any advice that they might want to give their clients after a visit and to

check against their own reports before referring their clients on or developing a plan of action. The reports were not to be given to any third party.

5.2.6. Quantitative Data Collection and Analysis

5.2.6.1. Data Collection

Data were collected between 2005 and 2007. Study numbers were assigned for each health visitor and each visit. The researcher did not keep any records of client's names or addresses. The study numbers assigned to the qualitative interviews (Chapter 7) differed from those used for the quantitative analysis. This was to ensure the anonymity of the interviewed health visitors. The seasonal distribution of the visits is shown in Table 5.

5.2.6.2. Statistical Analysis of Data

5.2.6.2.1. General

Analysis was conducted to determine the accuracy of the health visitors' measurements in comparison to the gold standard – the level of agreement. Different statistical methods were required to analyse categorical and non-categorical data (Table 6). Analysis was conducted using the Statistical Package for the Social Sciences 15.0 for Windows (LEAD Technologies Inc.). Comparisons of data between the health visitors were not applicable because they each rated different homes, giving a different baseline for each visit.

5.2.6.2.2. Analysis of Non-categorical Variables

Descriptive Statistics

Descriptive statistics³⁵² were performed to determine means, medians, and standard deviations.

Distribution Analysis

Histograms were plotted for each variable to visualise distribution. Shapiro-Wilk's test was performed to determine whether the distribution of data for each variable differed from a normally distributed variable with identical values for means and standard deviations. A p value > 0.05 indicated that the Shapiro-Wilk statistic showed a non-significant variance from a normal distribution and $p < 0.05$ indicated the opposite. The Shapiro-Wilk test is suited to small sample sizes and is the preferred test of normality because of its ability to detect small differences in distribution.³⁵³

Agreement/ Association Analysis

The majority of the non-categorical variables had a non-normal distribution; therefore, non-parametric (assumption free) tests were used. Although, the most commonly used test for testing agreement is the Kappa (κ) statistic, it is not applicable for non-categorical data. Therefore, relationships and differences between the data from the health visitors' assessments and gold standard were tested. Kendall's tau-b (τ) correlation coefficient and the Wilcoxon signed-rank test (z) were conducted. The Wilcoxon signed-rank test indicates whether there is a significant difference between the raters and indicates the size of the difference. The statistic is reported as a z score, which is the value of the data expressed in standard deviation units. The variable has been converted to

have a new distribution with a mean of 0 and a standard deviation of 1.⁴ For Kendall's tau-b correlation coefficient, (suitable for small sample sizes), the closeness to one of the correlation coefficient indicated the closeness between the individual health visitors' data and the gold standard. For the Wilcoxon signed-rank test, $p < 0.05$ indicated a significant difference.

5.2.6.2.3. Analysis of Categorical Variables

Introduction

The categorical data were not continuous so were by default designated as non-parametric. Frequency tables were produced for each variable. The agreement between the health visitors and gold standard for each variable were tested using Kendall's tau-b (τ), Spearman's Correlation coefficients (r_s), Kappa tests (κ), and Pearson's chi-square test (χ^2). Both the Kappa and chi-square results were affected by asymmetry in the cross tabulations (the raters used different scores) so were not reported for the polychotomous variables.

Polychotomous Variables

Kendall's tau-b correlation coefficients were used to indicate the relationships between the variables. Kendall's tau-b is reported, as it is a more reliable statistic for small samples than Spearman's coefficient.³⁴⁴

Dichotomous Variables

Cohen's kappa statistic³⁵⁴ was used, as the data could be tested on a one to one basis - two observers classifying subjects into two categories. This method was chosen over Pearson's Chi-square test, as the chi-square test is a test of

$$z = \frac{X - \bar{X}}{\sigma}$$

association, not agreement and is affected by departure from chance agreement.³⁵⁵ An important assumption of chi-square is that the expected frequencies should be greater than 5 and this was not the case for some of the variables. The Kappa values were used to show the level of agreement between the gold standard and each health visitor for each visit taking into account the proportion of agreement that was due to actual agreement (P_o) and agreement that occurred by chance (P_e). Values 0 and 1 indicate chance agreement and a perfect agreement respectively. Negative values represent an agreement that was less than would be expected. The operative formulae are:

$$\text{Cohen's Kappa } \kappa = \frac{P_o - P_e}{1 - P_e}$$

$$\text{Observed agreement } P_o = \frac{a + d}{n}$$

$$\text{Expected agreement } P_e = \left[\left(\frac{B_1}{n} \right) * \left(\frac{A_1}{n} \right) \right] + \left[\left(\frac{B_0}{n} \right) * \left(\frac{A_0}{n} \right) \right]$$

Where:

		Researcher's observation		
		Yes	No	Total
Health visitor's observation	Yes	A	B	A_1
	No	C	D	A_0
	Total	B_1	B_0	n = sample size

The interpretation of the Kappa values listed below was adapted from various sources.^{356,357,358}

$\kappa < 0.2$ Poor agreement

$\kappa = 0.21-0.4$ Fair agreement

$\kappa = 0.4-0.6$ Moderate agreement

$\kappa = 0.61-0.8$ Good agreement

$\kappa = 0.81-1.00$ Very good agreement

5.2.7. Qualitative Data Collection and Interpretation

5.2.7.1. Standardised, Open-ended, Face-to-Face Interviews

Two interview scripts were developed for the research, the first addressing participating health visitors and the second addressing their managers (Appendix IV). The content and phraseology of the scripts were based on experience gained before and during the study, observations of the health visitors, and the need to meet the objectives of the study. The scripts were based on addressing the interviewees with open ended, where possible non-directive statements sorted into 'topic blocks'.¹⁵⁹ The topics in the scripts were arranged to represent the progress of the research from recruitment to client's reactions. The topics were intended to help the health visitors explore certain areas of their experience of the research and allow room for freely made comments.³⁵⁹ The final questions sought to explore the health visitors' perceptions about the overall research. The scripts were designed to help the interviewer capture as much information as possible and minimise bias.³⁶⁰

The interviews were conducted in August and September 2007 around 9 months after the visits were concluded (range 2 to 17 months). Five health visitors and two health visitor managers completed the interviews. Four of the

interviewed health visitors had attended the classroom training and all five had had field training. All health visitors interviewed had been on at least two visits. The interviews were conducted by an independent, specialist interviewer (Dr. Gloria Lankshear, University of Plymouth). The same script was used for each health visitor during a timed interview, which ranged from 30 to 45 minutes. Although the interviews were planned to last 40 minutes, extra time was allowed to ensure all the topics were covered.³⁶⁰

The interviewer was encouraged to empower the interviewees through active listening, a non-judgmental manner, and demonstration of sensitivity.³⁶⁰ This meant that the interviewer aimed to keep emotional neutrality and to avoid commenting on the interviewees' responses whilst maintaining an empathic 'outlook'.^{178,228}

There was no opportunity for the researcher to formally gather the health visitors' clients' opinions after the visits. However, an attempt was made to capture some of the feedback from their clients indirectly through the interview process with the health visitors. Statements were added to the interview script to prompt the health visitors into recalling their clients' reactions to participating in the research.

5.2.7.2. Participant Observation

Throughout the whole of this research (recruitment presentations, training, and visits), the researcher observed and where suitable, recorded field notes on the reactions and inter-reactions of health visitors and clients. In particular, the researcher observed the health visitors learning and practising new ways of

working, their confidence following training, and their communication of information about the indoor environment to their clients. Spontaneous remarks made by all participants were also recorded. Participant observation is the closest description for this type of observation as, although the researcher was not participating directly in the health visitors' own routines, the researcher was interacting with the health visitor and their clients on matters concerning the research objectives.³⁶¹ The researcher explained to the health visitors that no comments would be made about the health visitors' skills in making assessments whilst in the presence of their clients or to their managers.

5.2.7.3. Qualitative Data Analysis and Interpretation

The taped data from the face-to-face interviews were independently transcribed into Microsoft Word files. Before any analysis was attempted, the researcher closely read the transcripts. The transcripts were then converted to rich text format^{*} and imported into a project document in NVivo 2.0 (QSR International Pty Ltd., Australia). The texts were explored and coded as part of a structured analysis of the data. Coding was used to determine the occurrence of certain standard 'reactions' and identify emergent themes.³⁶²

In parallel, the transcripts were sorted using the topic headings of the original interview scripts. The responses from each interviewee were combined under each topic from the scripts. This was then compared manually using Microsoft Word to the output from using NVivo.

^{*} Rich Text Format is a document file format accessible for different software and operating systems

The pattern of results found in the collected data was compared with a pattern predicted based on the results of the Pilot Study.¹⁴⁹ Distinct outcomes³⁶³ were expected from the Feasibility Study, including concerns about time constraints; empowerment in terms of facing outside bodies; concerns about making recommendations, concerns about organisational turmoil, and perceived usefulness of concept. A second person (one of the researcher's two supervisors) checked the process of thematic analysis carried out with the qualitative data.³⁶⁴ The qualitative results were examined in terms of plausibility and believability.³⁶⁵ The field notes from the participant observations were read several times and summarised for comparison with the interview output.

Themes emerging from the qualitative data were interpreted based on an eclectic approach, having regard to:

- Avoidance of the researcher's experiences during the research (collected through observations and field notes)
- Recognising the risk of preconceptions of what the health visitors perceived to be the results from the research
- That any interpretation was limited by the original responses to the topics chosen. The 'right' questions may not have been asked
- Respondent validation

5.2.8. Method of Integrating the Quantitative and Qualitative Results

A comparative interpretation was made of the results from the quantitative data with the findings of the interviews and observations. A comparison checked for agreement between the health visitors' comments about the assessments they

made and any inconsistencies in the measurements highlighted by the quantitative analysis.

To allow integration, the results from the quantitative analysis were themed based on the strength of the statistics to show whether the health visitors could accurately measure a variable (easy to measure) or whether their measurements were inaccurate (difficult to measure).

Chapter 6. Quantitative Results

(Soft Systems Methodology Stage 4)

6.1. Available Data

Paired data was available for 22 visits collected by the researcher and five health visitors (out of the 29 visits made).

6.2. Non-categorical Variables

The differences between the health visitors' and gold standard data for individual variables are summarised in Table 7. Table 8 shows that there were significant differences between the health visitors' and gold standard results for the three temperature measurements. There were strong relationships, suggesting a pattern in the differences. The Wilcoxon signed-rank test results were based on negative ranks, therefore the health visitors were consistently recording significantly higher temperature data than the gold standard. The health visitors' measurements of 'aspect' and 'wall surface damp' were not significantly different to the gold standard but there were poor correlations.

Box plots were created to visualise whether the significant differences and poor relationships in Table 8 were related to particular health visitors or overall difficulties with a particular piece of measuring equipment (Figures 13). For the variable wall surface damp, the lack of a relationship between the health visitors' and gold standard data was due to extreme values skewing the results. Figure 13 shows that there was a consistent difference between the health

visitors' and gold standard data for all measurements of temperature. However, the medians of the health visitors' data fell within the corresponding interquartile range for the gold standard. The health visitors' measurement of temperature using the digital temperature/ humidity pen was consistently higher than the gold standard, suggesting a potential error with their equipment or the way the equipment was used. This was explored further, where a comparison was made of the variables relative humidity and temperature, both measured by the digital temperature/ humidity pen (Table 9). The health visitors' measurements of relative humidity were within the 5% accuracy error level of the gold standard measurements.

Table 9 shows that the health visitors' measurements of temperature were consistently higher than the gold standard's by approximately 1.8 °C. Temperature was measured differently by the health visitors despite the closeness in ratings for relative humidity measured by the same instrument. A manual check of original records indicated that health visitors MS1 and MS2, who consistently recorded higher temperatures than the gold standard, made most of the higher measurements. This is demonstrated more clearly in Figure 14. MS1 conducted most visits (7), therefore her results had the strongest influence on the overall results.

A re-analysis of the results in Table 8 indicated that when the data for MS1 was removed, the relationships between the data improved slightly (Temperature outdoors $z = -1.42$ ($p=0.16$), $\tau = 0.81$ ($p<0.01$); Temperature living room $z = -0.75$ ($p=0.46$), $\tau = 0.59$ ($p=0.01$); Temperature bedroom $z = -2.76$ ($p=0.01$), $\tau = 0.83$ ($p<0.01$). This indicated that the differences were not due to equipment

error but due to consistently higher temperatures recorded by a particular health visitor – MS1.

6.3. Categorical Data

6.3.1. Polychotomous variables

The levels of association between the health visitors' and gold standard data for the polychotomous categorical variables are given in Table 10. The poorest associations were for the variables Age of House and Type of House. This inconsistency was due to the health visitors not recording any answers rather than entering a wrong answer (where Age of House = non-agreement 2 (9%), unrecorded 8 (36%); Type of House = non-agreement 2 (9%), unrecorded 11 (55%).

6.3.2. Dichotomous Variables

The frequency of agreement for the dichotomous variables is given in Table 11. The results of the tests using Cohen's Kappa statistic are shown in Table 12.

The Kappa values for MS2, and MS4 do not have significance levels reported because the number of visits was too low. Overall, there was a consistent agreement between the gold standard and health visitors represented by values closest to one, however MS1 disagreed with the gold standard on noting whether a dust mite sample had been collected in the living room or not. The Kappa value of -0.2 suggests that the agreement was less than could be expected.

Chapter 7. Qualitative Results and Discussion

(Soft Systems Methodology Stage 4)

7.1. Participant Retention

The reasons for dropping out of the research are given in Table 13. The reasons can be categorised into 'left health visiting'; 'personal reasons' or 'work commitments'. Where the reason is marked 'n/a = not applicable' this relates to health visitors who took part fully in the study.

7.2 Health Visitor Interviews

Five health visitors' responses are discussed under the emergent themes from the interpretation of the interview responses (the original interview scripts are given in Appendix IV). Each response is identified by HV (health visitor) or M (manager) followed by a number to be able to trace the responses to their original anonymised transcripts.

Views on how health visitors came to participate in the Feasibility Study

Colleagues who had attended the presentations or had already taken part in the research recruited health visitors through presentations, word-of-mouth, and encouragement. The need for volunteers for the research was discussed during a health visitor professional group meeting and was championed by the Health Visitor Lead and Professional Lead. Most participated because of word-of-mouth persuasion, rather than being coerced by their management or encouraged by the researcher.

HV5: *"It came down from our sort of professional group that meets regularly just asking for volunteers, as I recall...and I think X saw me and said 'oh do you want, would you like to this' and I said 'oh yes, that's quite interesting'."*

One health visitor volunteered after the first presentation and was subsequently very active in recruiting colleagues through her enthusiasm for the research. This health visitor championed participation of her own accord.

Reasons given for participating in the study

Participation was influenced by the idea that the outcome of the research might be useful in their work and beneficial to their clients. Housing problems, particularly damp, was an issue regularly raised by their clients, therefore, taking part was relevant to their current work.

HV3: *"...well people do ask us to write letters about damp and things like that, I felt it would be quite interesting to have some more information."*

HV5: *"...it's definitely a piece of work we could do really to benefit children."*

Participation occurred because the research was seen as a potential way to improve skills and the research subject was interesting.

HV5: *"Well, I was, well just sort of this sounds quite interesting, because I thought it had some potential there for health visiting."*

Having a secured referral pathway to report housing issues was very useful in their busy work.

Reasons for health visitors not participating were also discussed. Participation was strongly linked to whether they perceived they had clients with indoor environmental problems and whether they had any 'spare' time.

HV1: *"Maybe they're just not ready to take it on board, maybe they've got enough going on, their caseload was too busy. You know, you have to free up a certain amount of head space to find the time and maybe they're not...their clients aren't coming to them with damp at that exact moment."*

Views on training and training materials

HV1 did not participate in the classroom training because of work commitments, however, if time had been available, she would have attended because she had a free hand in whatever she did. This response highlighted general perceptions of flexible work practices and self-management of workload. Those who attended the classroom session perceived that they had adequate time within their workloads to pursue extra curricula activities.

The classroom training was seen as informal and not viewed as a true 'classroom' session. The training was seen more as a briefing about the Feasibility Study, how it would be conducted, and what the researcher was expecting from participants.

HV4: *"Right, well, I met [the researcher] to start with and he spent a good couple of hours at least with me discussing the study and explaining the aims and objectives but actually, using his equipment, showing me how he used it and that was inside and outside his home actually where we met, and introduced me to the sort of equipment and the type of data that he would be using."*

HV2: *"No, it was informal, we just went round to [the researcher's] house and he showed us the equipment...very brief overview of how the equipment worked and what he was looking for, because he said he would actually be conducting the tests when we were in the property."*

Suggestions that the classroom training was very basic, summed up the overall view of the training, although there was a good understanding of what had been taught.

HV3: *"I thought there was enough information there for what we did."*

The perception that the training was basic was linked to a perception that the researcher would conduct all the assessments; therefore, more training was not going to be needed.

Views on the use of the Fact Sheets and their clients' reactions

The Fact Sheets (Appendix III) were not seen as appropriate for some clients who could not or would not read them. Talking to a client was more beneficial.

HV2: *"The sort of people we see, if you give them a sheet they just discard it, they don't actually sit and read it and take in the information, it's actually better showing them on a practical level what they need to do and talking to them each time we see them and reiterating the advice previously given, we can't just continue to give out paperwork and sheets all the time."*

HV1: *"...because, I think with one of the families I would query their literacy and their ability to read the sheet."*

Views on the length of time and effort for the training and its impact on their routine work

The length of time training took was acceptable to understand the basics of the study, although in some cases more time could have been spent on classroom training.

HV4: *"I had sufficient time, maybe two to three hours, I felt it was sufficient time to learn the basics which I would be working and to get some idea of the*

broader agenda that he was working to but certainly, the equipment and why it was used and how it was used and what I would show was sufficient during that time, for me to get a good grasp of what we were going to be doing."

Views specifically relating to the field training

The field training was discussed in terms of the breadth of the training and the concept. Many side issues were highlighted when the health visitors discussed the field training. Field training was interesting but difficulties were highlighted that could arise when assessing clients' indoor environments. Field training was easy to follow and more was learnt through hands on, practical experience than in the classroom.

HV3: *"And I learnt quite a lot about the moulds and things, with him talking about them and what is really damp, what isn't damp, those sort of issues, a lot of people call their houses damp but they're not really damp."*

Participation informed them about the indoor environment and health, even if clients had not understood.

HV1: *"I thought I learned a lot. I think for the clients, whether they took the information given on board or not, is another matter...for me it was useful, and I learned a lot about, you know, aerating rooms and that sort of thing and the nature of damp, which I find useful."*

The presence of the researcher during assessments led to the perception that less knowledge was required by the health visitors about the technical side of the indoor environment. This reconfirms the previous perception that some considered that only some training was needed because the researcher would do the assessments. The presence of the researcher helped in understanding the concept and making assessments.

HV5: *"...there was some terminology in there that maybe I didn't quite always understand but I didn't have a problem asking him anyway."*

Views on the support available to be able to participate in the study

Backfill pay, arranged by the health visitors' management team before the Feasibility Study, developed into a problem

HV2: *"...subsequently fitting in the visits became problematic, although we were promised some sort of backfill, that never came about..."*

In addition, it was difficult finding somebody qualified to cover ordinary visits whilst participating.

HV5: *"We were supported by our management in terms of getting some cover. Not that it was easy to get it."*

Perceived impact of the time it took to take part in the Feasibility Study

The assessments resulted in an extra visit being scheduled, rather than taking place during a routine visit.

HV3: *"...you sort of plan your weeks ahead but, things have to be dropped, at a certain time you're off sick, or that sort of thing and I think that was probably frustrating for him, it took quite a lot of time to get it all done, you think, you are going to have just ten families but it's not as easy as that and we were fitting it in, and the visits did take [time]...But in, essence you couldn't fit it in as a separate visit because having somebody else there doing these things just meant you couldn't do anything else so it was extra work really."*

Perception of the types of information given to clients

The Information Sheets were mostly not given to clients before a visit as suggested by the researcher during the training session.

HV3: *"I'm not that certain. I don't think we'd given them to everybody. I think, I gave them when we left, I gave them a Fact Sheet about what the study was alongside the consent thing. I do not know whether they actually read them"*

Perceptions of the length of an environmental assessment

The length of the visits was acceptable, noted as long, but necessary within the remit of the study.

HV2: *"It was well over an hour's visit, quite a long time in the client's home."*

The visits were approximately 45 minutes but this did not include preparation and follow up time.

HV4: *"[The researcher] informed the families that it would take about half an hour to forty five minutes and in fact it was more like at least forty five minutes. And I didn't feel that it was overly long, I don't feel that the families we saw were getting particularly impatient or were encouraging us to wind up and leave."*

An hour or more for an indoor, environmental assessment was necessary because a client would have their own viewpoint on the state of their home environment and needed time to justify this.

HV5: *"...you were dealing with families who needed to tell their story in all this, they have a story to tell and, and it needs to be told...So, first thing I learnt was I needed to allow more time for it."*

The length of visits could inconvenience clients. As clients are busy, most routine visits do not take one hour.

Views on the Presentation Pack and other information given during the study

The health visitors viewed the Presentation Pack as containing a 'fair amount', up to 'a lot' of information. Although some did not recall the Presentation Packs that well, the packs were perceived as including good information.

HV4: *"...very clear, very precise, very comprehensive, very easy to understand, very useful. Certainly not confusing, not particularly complex. I developed a folder and actually put it in there with each division according to the part of the programme it was going to be used in. So, very logical."*

The Presentation Pack was seen as a valuable resource, with information relevant to health visiting.

HV5: *"Mould, temperature, humidity, allergens, dust mites that sort of thing. It seemed quite wide-ranging to me and quite appropriate for what we were looking at, 'cause we were looking specifically at children with respiratory disease, and, all of those fitted into that."*

Some continued to use the Presentation Pack after the study had finished.

HV5: *"I did photocopy it for one or two families, and it's there and I think I still might use it. I've still got copies of them."*

Views on the Fact Sheets

The Fact Sheets were only given to clients when it was thought relevant.

HV3: *"...they might have been useful, for a follow-up. I think it goes out of your head by the time you're going back for you next visit."*

Although, the Fact Sheets were handed out, in some cases they may not have been useful to the clients.

HV5: *"Well I think I photocopied them once or twice to give them out and I certainly used them for me as well, there was good information for me as well, quite clear. A lot of the stuff I did know but also it brought that stuff up to the forefront again, but some of the stuff I thought, oh, I hadn't thought of that before."*

There was an uncertainty about how the Fact Sheets should be handled. One health visitor in particular did not hand out the Fact Sheets commenting that they did not provide her with any new information.

Views on the tool kit and environmental assessment

There was varying degrees of confidence regarding understanding of and ability to use the tool kit. Data and data collection was better understood after several visits, although one health visitor stated that she did not understand the data at all.

HV1: *"I'm sure if I'd done it more often I would have got to know it better, but ... and I think the idea was for me then to be able to do it on my own, but I don't think on two visits I ever quite got to that point."*

HV3: *"Yeah, reasonably easy. I think in terms of the bits that we had to do it was ok. I think obviously the bits that he did that were more technical but we weren't expected to do, for what we did it was ok."*

HV4: *"I've probably only spent about three hours with him. And each time I've felt that I was the learner, still have a steep learning curve to undertake..."*

Temperature and damp measurements were useful for health visitors, whereas mould and dust samples were impractical to collect both in terms of costs and time.

HV3: *"I think those were the right things the sort of things that mean something to people like humidity and temperature and, he was obviously measuring particles in the air."*

Although particle measurements were seen as relevant in terms of proving that clients smoked, the particle counter was considered too complex (even though it was not part of the health visitors' tool kit). Establishing aspect of the front of the house, having to record the age and type of house, number of residents, number and type of pets or having to take outdoor climatic measurements were not discussed. In general, the assessments were considered a bit intrusive, particularly the need to enter one of the bedrooms

Recollection of the variables measured

Recall was related to the relevance of the variables to health visiting and their work. In particular, circumstances were mentioned when temperature, humidity, and damp measurements were useful to show a particular environment problem that a client was facing.

HV3: *"We went to a house where there was a girl using a tumble dryer and not really opening the window and in that house the humidity upstairs was something like 65% and that was useful being able to demonstrate that to her."*

HV3: *"Yeah, because he was saying that a mattress after ten years weighs something like, well I can't remember the figure but it weighs four, something like four and a half or five times what it does when you first buy it because of all the skin that goes into it. And actually when you think of it like that its disgusting isn't it, but he was telling people, actually our parents had the right idea, hoicking it out and bashing the hell out of it... There was the mould, wiping the damp mould with a piece of toilet tissue, dry tissue, rather than a wet cloth, and then disposing of it down the toilet because if you use a wet cloth it just spreads it and then it sits in the cloth, so actually just wiping it down. And, very rarely did you find mould, where it meant there was damp, what it meant was that there was inadequate ventilation."*

Perceptions of the referral network in place for the study

Referrals were not always necessary because the problems found during the assessments were linked to clients' lifestyles. In some cases, it was thought that this caused disappointment amongst the clients because the assessments did not give them the evidence they were looking for (that it was a housing problem). A major benefit of the assessments was that clients and their families were made more aware of their indoor environment. The advice had empowered clients with knowledge and evidence to take to their landlords to 'force' changes.

This links into another issue that health visitors cannot be seen to side with landlords, housing departments, or environmental health officers. They are seen as the 'enemy' by clients who think that the problems in their home are related to the structure of the house. If environmental assessment highlighted that the client was at fault, if the client did not believe this, they might see the health visitor as part of their problems.

Referrals were made (seven during the course of the Feasibility Study to the Council), where evidence from the assessments was used to prompt action. When 'housing letters' were written backed up by assessments which led to a change in their client's circumstances the importance of expressing indoor environmental conditions based on measured data was experienced.

The issue of reporting on environmental and housing problems revealed misconceptions and problems surrounding tenant-landlord relationships in general. It was suggested that landlords do not necessarily have to do something about a housing problem.

HV3: *"...we have this difficulty with people living in housing provided by the local authority and housing provided by private landlords and it is a very difficult, different relationship... if it's a private landlord, because we could flag up all sorts of things and the landlord doesn't necessarily have to do anything about it and often the tenants won't take action because they're frightened..."*

Presence of the researcher

The presence of the researcher became awkward at times and although the health visitors did not mind him accompanying them, it caused a number of issues with clients. Clients were reluctant to let anyone into their home. In addition, the presence of the researcher disrupted the client-health visitor relationship.

HV1: *"Sometimes for me, it was quite difficult introducing a third party because I didn't know the clients that well, because it was a new case load and often I might have just met them once or a couple of times...and integrating somebody else coming in and also on both of mine, there wasn't damp."*

HV2: *"...I think it would spoil the relationship that we have to work hard to build for a lot of clients and they wouldn't trust anybody else would they...taking a third party in really doesn't help and this was very intrusive as well, I felt, to do the testing he had to go into various rooms in the property, going in the bedroom, looking at the bedding, vacuuming the mattresses this is very, very difficult, for some families, it's difficult for me to do as well...Actually there was reluctance in trying to get people...(Interviewer: So you had refusals?)...into the study yeah, and then feedback I got from the few visits that I did one lady felt particularly uncomfortable about it particularly going up in the bedrooms."*

It was noted how there were differences between the researcher's approaches to the clients compared to their own. The researcher could be more direct and straight to the point since he would not be going back to the houses.

HV4: *"...he said so himself that he doesn't beat around the bush, I at times found he was judgmental of the families. They didn't seem to mind that sort of approach. The way that we work as health visitors is not quite so direct, because we are working with these families for maybe five years, we want to*

make sure we can get back in to see them again, so it's more of a gentle softer approach, but [the researcher] was very clear, direct but he knew that he would see them only once and then withdraw."

However, it was good to have someone else challenge clients about their lifestyles.

Clients' understanding of the study

The clients understood why the researcher was there, although their understanding varied from the idea that they were involved in a study, to the idea that they were just letting someone [the researcher] in to help them.

HV1: *"I think they'd got somebody to give more advice and to look at the damp. I think they did know why that was happening."*

It was difficult to fully inform the clients of the purpose of the visits, especially as in some cases the health visitors had not established a relationship with their clients. The idea of being monitored was a concern for some clients.

HV3: *"Some of them were a little bit sort of edgy about it and from hoovering the carpet and loads of stuff came up, and [they'd say] 'we've only just hoovered' [laughs]. So on the whole, I think most people were ok with it."*

HV5: *"I didn't get any negative feedback. Most of them were living in a home that they desperately wanted to improve if not move out of, it was sort of counselling, they were happy to undertake 'anything', so monitoring their home environment was not a problem."*

Some health visitors had a high level of compliance from their clients in taking part in the study. Possibly, clients who were happy to participate were receptive because they had housing issues which they wanted solving.

HV3: *"I think that was managed ok and nobody took umbrage with it and actually families that we work with... they're saying they've got problems, they're all quite receptive to having somebody who might help."*

HV4: *"...no, he had his ID [which] he showed, he told the families exactly who he was and why he was there and told them about the study he was doing, with the University. And none of them have come back to me since querying who he was, or perhaps with a level of misunderstanding of why he was there or what he was doing, and I certainly got a high level of compliance from the families."*

The health visitors thought that the clients used the researcher's visit as a chance to get a problem resolved, and they were disappointed if they did not get what they wanted and may have not been interested in learning during the visits.

HV1: *"They were saying that there was damp and the landlord had to do something about it but both of them tended to be condensation and lifestyle sort of things and balancing the two was quite ...the clients didn't get quite what they expected."*

HV2: *"...it was sort of disappointment because they perceived the problem to be different, they didn't perceive it to be condensation, where opening their windows would help, they just perceived it to be damp and [that] something needed to be done."*

HV5: *"I think on the whole they were ok but sometimes, some of them heard what they didn't want to hear, smoking being one of them, not a good idea to smoke in the house, advice they had been given even prior to this, if you have young children don't smoke near them but again, that was something else he once again [emphasised] so I'm not comfortable with that. And I think sometimes, certainly, when it came to dampness, they didn't want to hear what I suspect we had, the council had already said, and that is 'open your windows, stop drying you clothes in here and you know, wipe condensation off the windows'."*

There was some confusion over the purpose of the visits but the clients could see the relevance in terms of their current problems with their indoor environment.

HV1: *"[laughs] I think they were quite bemused. I think that the second one we went to see was quite shocked about the levels of smoke, because she felt she smoked outside all the time."*

HV3: *"I think they were all interested to see, because if they felt the house was damp they had a sort of vested interest."*

HV5: *"I think they did, yes, and they certainly understood it, especially the humidity and sort of mould and collecting our specimens because it was fairly clearly explained to them. I think they did find it interesting, yes."*

Again, the recurrent reason for client participation was that they thought someone was coming to prove to their landlord that they had structural damp.

HV1: *"I think they just wanted to know where there was a lot of damp on the walls – they wanted to be told the damp was caused because it was in the walls...They wanted the landlord to come and do something to sort this damp out."*

HV2: *"...they perceive to have these problems with their housing [and] consented to it because they were looking to Plymouth housing or whatever to get repairs done."*

Views on clients using the advice given during the study

One subject raised during the interviews was that the reason clients did not attend to mould was that visible mould was evidence that they had a problem and if they removed the mould they would have no proof with which to approach their landlord.

HV1: *"...they tend to leave it there, because that's evidence of how bad their house is. So, they don't want to clean it off. To a certain extent, to be able to say, it's not going to change because [it is the result] of your lifestyle and what you do and hand the responsibility back to them."*

There was a suggestion that providing evidence through selective sampling had helped clients understand their problems.

HV4: *“Yes, certainly in one of the homes we went to there was a need to collect a small specimen, of, some growth that was on the curtains and soft furnishings, and I think that the parents were particularly pleased that this was being done because I think she felt particularly lost about what she should do about it...she was given advice to, further advice as to how to treat it as well. So recommendations and advice were very well received generally.”*

The health visitors suggested that giving advice on the indoor environment was not a problem for them since it was already part of their role when home visiting.

HV2: *“Well, it’s something that we do all the time really, we are always giving advice about smoke free homes, we are always looking at ventilating properties and the damp, so, its something that we do all the time so I felt quite comfortable with that.”*

Without scheduling a specific follow-up visit, it was unlikely that the same households involved in the study were revisited. There was a general feeling that getting their clients to use the advice was a challenge.

HV1: *“But that’s sometimes the client group you work with. Changing, changing habits and getting them to help themselves can be quite, quite a challenge.”*

A major issue highlighted was that the client group targeted by health visitors did not always have the resources to remedy a problem. For example, many could not get tumble dryers instead of drying clothes indoors, so they put up with the damp. In addition, advice on removing net curtains would be ignored because clients could not live without them. It was suggested that in some cases, the advice given was not at all appropriate for the client group; therefore, clients could not be expected to use the advice.

HV2: *"They had a couple of dogs and some cats I think, and they knew it was all contributing factors to the child's asthma, but they were their pets and they were trying to keep these pets in a cellar out of the house and you know they would love to have wooden floors but at the end of the day they could not afford to replace their carpet with wooden floors, so they weren't able to follow the advice."*

In reply to the above response, the interviewer highlighted to HV2 that if her clients did have condensation problems they could have cured the problem by opening windows (hinting that this was the answer for HV2's clients who were not happy with the results from the tool kit). HV2's response suggested that she was aware that her clients' damp homes were often caused by their lifestyles but that it was hard to get the message across that they needed to ventilate their homes.

HV2: *"They could have done but then their argument is that they are losing heat and they have to keep everything shut up is their answer to it, it's about education isn't it? And these people who are on low income and no benefits, heating properties is more of a priority, than opening a window they just see it as wasting their money. And you know, a lot of time when there is a lot of people in the property and again they just don't understand about ventilation, is actually where a lot that is perceived to be damp and its not its just condensation."*

Another example was cluttered homes, although household items should be stored away, it was not always possible for clients to follow this advice because they had no room or storage facilities.

HV3: *"...one case I think I took him to, there were five children in one bedroom, so by the time you got the bunk beds in there, there was actually no room for anything else, so what happened was the clothes were all piled on the floor and so that just generates so much dust, so actually even getting a cupboard or container or something to put them in, or stacking boxes..."*

At the other end of the social scale, affluent clients in particular might find it a problem being advised on the quality of their indoor environment.

HV3: *"...I think it depends on the sort of client group isn't it. I think the people we worked with found it ok, and I think some clients might be intimidated by or challenged by it, particularly with the particle measurement and things...Because I think if people perceive it as an identified problem then that's fine, they're ok with it. But I think if you tried to take that into some people's clients, I'm thinking of more affluent clients I think they'd really get quite shirty about it."*

There were positive responses received from the clients, suggesting that they had used the advice given to them. There was evidence that clients had done something.

HV3: *"I think in some cases they certainly attempted to tidy up, remove the clutter and ventilate. So I think they did learn something. As I say, taking down net curtains, let more light in, I think some of them did learn something from it. (Interviewer: And they did change some behaviour?). Yeah, some behaviours were changed."*

HV4: *"They were interested in the outcomes, they said when we were there that they would make the changes that [the researcher] had recommended, which mainly involved ventilating with opening windows and removing net curtains and seeing to draughts..."*

HV5: *"...And I'm not saying she wasn't smoking in the house but it was probably less because there was definitely a smoking area outside which wasn't there before, so I think maybe things have been done...Definitely noticed windows being opened. I used to drive around, I used to go see it - I remember it was one of the big things – get some ventilation in these houses."*

There was evidence that weeks after an indoor environmental assessment visit, clients still regularly opened windows and smoked outdoors.

Although monitoring the client's reactions was not part of the study objectives, understanding how the clients reacted gave a further perspective into how the health visitors reacted. If the clients were negative about an aspect of the study, this was reflected in the health visitors' own perceptions. There was a

definite mixed reaction, which was to be expected. Clients taking action or gaining a successful referral gave a sense of empowerment both for the health visitors and their clients.

During the classroom training, the health visitors were warned that houses that clients considered to be of inferior quality were only occasionally so bad that they should be condemned or needed substantial refurbishment. Inhabitants were most often the cause of the problems found in this study. It was explained to the health visitors that some houses are more difficult to run than others. The health visitors were warned that the outcome of an analysis would not necessarily result in the outcome that the client and health visitors wanted.

The lack of follow-up of the advice given was seen as a problem and it was suggested that a way of getting feedback from the clients should have been set up.

HV4: *"...if I'd had perhaps more opportunity and time it would have been better for me to arrange a date, perhaps four weeks later to go back and do a follow up visit but the volume of our work is such that, that actually was a pretty low priority and I have not been able to follow up those crimes."*

Client enthusiasm for the concept was linked to a tangible outcome for example; where action had been taken by the council or landlord to rectify a problem. Advice given on lifestyle changes was received well by some householders.

Views on client confidentiality and trust during the Feasibility Study

There were some ethical and confidentiality problems in having the researcher taking part in visits but this was dealt with. The clients had to be reassured

about taking part both before an environmental evaluation was conducted and then afterwards to 'smooth out any misunderstandings caused by the evaluation process'.

HV5: *"I was sort of constantly being wary, it is like confidentiality which I never thought was an issue with [the researcher]. I have to be careful and I had to make sure that clients were aware this is somebody that does not work in health and therefore was not bound by confidentiality, although the researcher I had no doubt was not going to take anything away...So there was those hurdles for me to get over and for me to deal with ethical issues. Which I managed, it was just different and it was more about me constantly being aware of that and reassuring them that this information that we were taking, was confidential. That was written down and clearly stated but I needed to verbalise it to make sure they understood it as well. So it was ok but it did need thought and it did need some work."*

The issue of client confidentiality again brought forward the view that they would rather discuss something with their clients and that the Information Sheets may not have been that useful.

Client intimidation because of advice given

The clients did not feel intimidated by the concept, provided the results from an assessment were passed over sensitively. Intimidation was a problem when smoking habits had to be discussed. There was an issue of being seen as 'going on' about cigarette smoking. In addition, it was very difficult to tell someone not to smoke, as it was their way of coping with stress.

HV5: *"I don't think they'd really find it a problem apart from the smoke [inaudible] we tell you to stop smoking. I think most, can overcome that, I think, but then some of us will not allow it to happen because they don't want to hear it. But then that's not enough for us not to do that piece of work, I think they would take it on board, the vast majority would take it on and welcome it to be honest."*

Ethical Issues

There was a concern that conducting assessments might be seen as 'policing' clients' homes.

HV1: *"Well I think that if someone is living in a house that is condemnable, then maybe, that should be known, but I think it depends, I wouldn't go in as a policeman and say, looking around the house inspecting it and saying I think you've got to deal with that..."*

HV4: *"...people might see us as the health police, perhaps. They might see us as checking up on them, what sort of standard housing that they're in. And may not understand that we are actually there to do a lot of prevention work, preventing children developing breathing difficulties, which will impact on their health, well-being and educational potential in years to come..."*

The idea of monitoring the indoor environment had to be reconciled with the fact that some people smoked and had different cleanliness standards. Some people might think advice about their lifestyles was unethical.

HV2: *"... we have to respect that people live differently and you know some people, for example, smoke because you know their stresses are so high and that's what they use actually to keep themselves at a level they can function and, and you can't be judgmental, you can give advice and I always give the advice that it would be better if they did x, y, z but at the end of the day we can't force it can we? And cleaning the house up and that kind of thing, people have different standards don't they, different expectations and unless the property was absolutely [inaudible] impacting that it became a child protection issue then I don't have any right to...And we're visitors in their home as well, we don't have any right of access to their homes we are invited in as health visitors."*

There was thought to be a fine line as to what and what was not acceptable in an intervention in health visiting practice but that there were not any 'extra' ethical problems associated with monitoring the indoor environment. There was a moral issue of advising people about the link between respiratory health and pet allergens.

HV5: *"As to pets I think it's a long way before we have to say you have to get rid of your pets and I would hope that would be without being insulting, because that would have to be quite bad to say that. But I think there's information that we can give that can contain it as an issue, about keeping them away from where there's children all the time, in their bedrooms and their play areas and hopefully contain it a little bit and I think that's certainly valuable and useful information that parents can take on board without feeling too threatened...But then I don't see it as an ethical problem."*

Potential problems like growing and dealing in drugs and storage of stolen goods were issues health visitors had to deal with. In cases where a client had something to hide the health visitor would not gain access to the home anyway. Checking the sleeping conditions of a child is considered an important part of childcare, however, this practice was no longer carried out, and therefore, measurements in the bedroom were an intrusion in terms of normal routines.

Benefits of participating in the Feasibility Study

The Feasibility Study was perceived by the health visitors as being enjoyable and useful, and gave confidence to encourage families to deal with problems that many times were caused through their own lifestyles. Taking part in the Feasibility Study and the presence of the researcher helped with clearing up long-term problems.

HV5: *From my point of view I thought it was useful. It taught me, I learnt quite a lot from it really. It was useful in terms of identifying issues within the home or potential issues. I think the families found it very interesting going around and doing these measurements and things. So yes, I would say it was useful."*

Empowerment and continued knowledge after the Feasibility Study

Indoor environmental problems could still be identified after the study. Although health visitors had some nonpropositional knowledge about the indoor

environment, participating in the study increased confidence in giving advice about it to their clients.

HV3: *"Yeah, I think it's not something that I would do with every family, I think if obviously if there was a housing issue that presented I would feel more, if somebody said to me 'oh you know I think my house is really damp' you know I'd feel slightly more confident, I would say let me see and, say well actually this is because.... and then question them a bit closer about the [perceived problem]."*

HV5: *"...it gave me quite a lot of confidence doing it about housing, even now, even though I might not remember exactly how to use those instruments I am more confident if I need to deal with housing issues if there are issues with an environment, I am more confident saying 'you know, this is not serious.' So it has given me that as well...but as time went on I think I grew in confidence with that and really give them some advice."*

HV1: *"...I have that knowledge now and I find that useful. I think about net curtains now, people complaining about damp. I hadn't thought about the way they dry their washing and that. I suppose I assumed that if I could see a horrible mouldy house, I'd assumed it was the quality of the house and it was, but I wouldn't make that assumption any more."*

Views on continuing the new practice after the study

Confidence in continuing to look at their client's indoor environment varied with personal and professional interest in the subject and with the number of visits conducted with the researcher. One health visitor in particular did not feel confident to carry on after the study partly because the researcher was 'in charge' of the testing procedures during the Feasibility Study. In addition, because assessments would not be conducted regularly, then any expertise built up would be lost. There was a perception that because the researcher 'overshadowed' the assessments in some cases they would not feel confident on their own giving advice on the indoor environment.

HV1: *"He did it, most of it, he got me to do stuff and I had to read stuff off, but he was very much taking charge of it... and I think it's just against the time factor of how often you do it. Because if you can build up an expertise in it then you don't do it for a couple of months, and you have to go back to square one all the time, it's not as if you're doing it, it's your job and you're doing it regularly or, [at] varying intervals."*

The same health visitor was prompted further by the interviewer to try to understand how she felt she could be made to feel more confident.

HV1: *"...focussing in, this is what I'm going to do, focussing, getting the equipment, looking at it, asking the questions I need to ask..."*

The simplicity of the environmental assessments aided confidence about being able to carry on in a similar role after the Feasibility Study was complete.

HV2: *"At the time I think I could have done because it was fairly simple, I could have gone in there and carried it out. (Interviewer: Did you think it would have been better if it was something you did rather than bringing a third person in?). It would have been better..."*

HV3: *"I think I felt a little bit more confident, once I'd been around, out with him a few times and I was able to say, oh take down curtains for instance, oh there were some very practical things like taking down curtains to increase the light entering a room, removing net curtains and looking at the room, as I say, that you put a child in, thinking about the temperature, the outside walls."*

There was a strong sense that the health visitors would have felt more confident during and after the study, if they had completed more assessments.

HV4: *"I think I need to complete all ten and then be watched while I do it and be sure that I'm clear about what I'm doing and why I'm doing it, so, certainly not at the moment but perhaps if I was to complete the course then yes possibly."*

A refresher course on using the equipment after the study would have aided the ability to carry on conducting assessments if equipment was available. The training was still relevant after the study.

Time constraints of the concept

There was a strong theme related to time constraints both in terms of the Feasibility Study and health visiting generally. Introducing the concept of monitoring and advising on the indoor environment could be another major burden on time and resources. Certain aspects like making referrals and conducting follow-up work was already part of the routine for many clients. The idea of becoming a 'specialist' in a certain field and having to spend more time on indoor environment issues than their core remit was a concern.

Another issue raised was that health visitors could be wasting their clients' and their own time by raising expectations. This was based on the idea that measurements may prove the client was the cause of the problem and not their landlord.

The issue of health visitors' time emerged repeatedly as a barrier to the inclusion of indoor environmental assessment as part of routine visits. One health visitor was adamant that the adoption of the tool kit and assessment could not become part of the health visiting routine, as it was not cost effective in terms of time.

HV2: *"Time consuming, didn't really give the sort of the results, very invasive for the clients...Like I say, a lot of the time, it didn't tell me anything that I wouldn't have already known on just entering the atmosphere and just sort of doing, part of a health visitor assessment, you can tell if the environment is smoky, you can tell if its been ventilated, if there's damp on the walls you can see, it really didn't tell me anything more."*

Health visitors now make fewer home visits, effectively only making three routine visits to families with newborn babies, limiting their time on home visits.

Although home visit time was limited, everyone sees health visitors as a portal for getting information to clients.

HV1: *"Our core visits are if everything is all right with the family, we might just do two visits initially and then a check [in] about a year and then that's it if everything is absolutely fine. So, I think there is a great danger in health visiting in that, because we are going in, people use us to get a message across and I think over this particular point we have to be quite careful about what we say we'll take on... So I think it's incredibly useful and it does, it would improve the quality of my visits to the clients, but to plan that out so you do it to everybody who has a damp problem would, the work implication for that would be very, very great."*

Health visitors' changing roles

The flux in the health visiting system affected participation and would affect any future adoption of the concept.

HV4: *"... our workforce has reduced significantly with people retiring and the people who are left are going off long term sick, so they're stressed and it's affecting their physical health and during the summer months we also have the added impact of annual leave being taken and our work is increasingly becoming child focused and into child protection work far more and a lot of, defensive practice to make sure, children are kept safe. And actually, the home environment and the air quality is actually reducing down the work agenda, and when we have to reduce the amount of essential stuff we do, air quality's going to be very low on our priorities. Sorry about that but that's reality."*

The home environment is moving down the work agenda and was not a priority amongst all other health visiting commitments.

HV5: *"I'm not sure that I could work into a routine I think that it could work into specific families. And that is where there are children under the age of five with a respiratory problem. You know, there are going to be quite a lot if you look at asthma. So I think that would be the way to go forward but not routinely. It could be that if you went into a home that looked, you thought oh this is terrible, even then implement it in there, because somebody needs to look at this home 'cause this home is not good. But I would say routinely no, I wouldn't do it routinely, in every home."*

Caseloads

Due to the variety of work and size of caseloads involved in health visiting, arranging something like a study based visit in advance was difficult.

HV4: *"It's become increasingly a problem because since we started [the study] I've taken on another 320 under fives clients so..."*

Having specialist skills, in this case the ability to make indoor environmental assessments might increase caseloads.

HV1: *"Yeah, I think, I think you have to be careful how people see health visitors as well... You know, 'are you the damp lady', sort of thing? I think that you'd have to be quite careful..."*

There was a fear that the health visiting service might be swamped if the public were to get to know that health visitors could conduct an indoor environmental assessment.

Perceptions on recommending the concept

Environmental assessments would be recommended for certain clients.

Although in some cases, only if the housing situation was 'absolutely dire'.

HV1: *"I think it is a good thing to do. I don't know who, it would depend who I'm asking to recommend it for, but if somebody has got damp in the house and they want to know whether it is, as I say, whether it is condensation or whether it's in the walls or whatever or the nature of the damp, then yes, I would recommend they had it tested."*

Recommendations would be made to colleagues to either take part or engage in environmental assessments if they were available. The concept could be presented to colleagues by one of the health visitors to determine what they thought of the idea.

HV5: *"I do have a thought, sitting back there where I get a breather, I'd gather together the others and say I think we should present this to the manage... we should present it to our colleagues and management as to potentially what they thought about it. So that's sort of sitting there in the back of my head, and hopefully in the not to distant future, I would..."*

Views on their colleagues' views

The health visitors (this refers to both participating and non-participating) had discussed the Feasibility Study amongst themselves, during meetings and conversations with colleagues. When discussing the research with colleagues the consensus was that it was a useful concept. There was a possibility that some health visitors would not like the concept if they did not have successful referrals or clients using the advice immediately.

HV3: *"I think a couple of people thought it was useful. Think, another colleague didn't really think it added very much to what we do already. So, it's a bit of a variable experience. I guess if you've had a couple of really extreme cases."*

Where the concept had not been discussed, the health visitors were keen to see what the other participants thought.

HV5: *"I must really go and see what the others think because I haven't really seen any of them, but I'd quite like to get down with those and just say what do you think of it, do you think there's some work here? ... Because they might perceive it totally different, I don't know and I don't think that none of them found it useful but whether they see it going the same way as me I don't know."*

Suggestions for implementation

The main use of the concept might be with the introduction of the 'skill mix'^{*} concept into the health visiting service.

^{*} Skill mix – where some of the services associated with health visiting are provided by health visitors' assistants, other health professionals and community workers.

HV4: *"...we have been told in the next couple of years we may be able to introduce a level of skill mix where we take um, qualified and unqualified um, health workers into community work and it maybe that within their work structure they may be able to adopt this method of working."*

Until the skill mix was fully introduced into health visiting, it would be difficult to take on environmental assessments. However there would be an opportunity for someone within the skill mix to advise people on the indoor environment, for example, health visitors' assistants.

The concept would have to be commissioned, although that would be difficult because the core of health visitors' work was child protection, public health, family centred work, and child surveillance.

HV4: *"...if the commissioners thought that it would be valuable, that it is evidence-based, that it has reached a sort of a level of acknowledged success and that the outcomes are outcomes that meet what the commissioners want to buy then they will purchase it. But otherwise it's not going to figure...in this day and age it nearly always has to fit into either National Institute of Clinical Excellence guidelines or recommendations or some of the White papers that were, that we're also having to attend to as well. So if it ticks those boxes then it's more likely to be accepted, and if it doesn't then it won't."*

In terms of further research, a reduced format may be more suitable.

HV3: *"I thought it might have been better if he had just two health visitors and that somebody have given them some time, like a week to do it, to get it done and got it over and done with. I think the way, it felt like a dribs and drabs approach really and I don't know if that's how he feels, but he had to do a lot of chasing, and phoning running around and things, people went off sick, couldn't do it you know."*

Another way of integrating environmental assessments would be to buy two sets of the tool kit and provide some basic training. If health visitors could carry

a thermometer all the time to help clients understand the temperature differences within their homes this would be useful.

HV3: *"I think we were able to use it when we showed it was a girl that had a child in a room with two outside walls and he had quite a lot of chesty things. And I think we sort of demonstrated that the temperature in one of the other rooms was actually much more, it was, two or three degrees warmer than just through the fact it had two outside walls. Therefore, that gave her food for thought. So yeah, I'm thinking that that sort of simple measurement, that was here, I wouldn't like to carry it round with me all the time, but if I could show people I don't see that would be a huge cost implications."*

Housing quality and the indoor environment should be a subject in health visitor training but currently there is little or no tuition on the subject.

Lack of cooperation with other health departments

Another side issue related to the concept was the idea that health visitors helping with their clients' indoor environments would not work if other organisations were not 'on-board'. During the Feasibility Study, the referral network helped but there was still a lack of a joined-up approach to child health care within the NHS. Children coming back from hospital with a file note on 'respiratory conditions' would benefit from having an environmental assessment carried out in their homes. At the time, apart from participation in the Feasibility Study, there was no one to approach for such a service.

7.3. Management Interviews

The two managers were interviewed using a different script to the health visitors (Appendix IV), however, initially M1 was interviewed using the health visitors' script in error. M1's responses to the health visitors' script are given here

because they revealed an insight into how M1 was informed about the research and how she understood how the research progressed. Later in her interview, the correct script was used.

Initial views about the concept

The managers thought that the concept was a good idea and highlighted that the health visiting profession lacked knowledge on the subject matter.

M1: *"...it was a good idea, that actually there were, some situations in the housing in Plymouth that are very poor and that actually we as a profession don't know that much about the different implications for the things that he was talking about. There was a lack of knowledge and as a profession we joined because we were a group ideally placed by going into homes of every family and for some health visitors it was more relevant than for others."*

Neither manager was in post at the start of the Feasibility Study, causing some issues with understanding what the study entailed.

Views on how the team came to be involved in the study

M1 heard about the Feasibility Study through the Research Governance process and through their professional lead (within the Teaching PCT).

M1: *"I think [the researcher] contacted the service and it came through our clinical governance and professional group processes. I also think he contacted our clinical effectiveness lead person who, because obviously it had to be, we had to be sure that we were doing the correct thing by working with him and so there was a two pronged attack."*

Views on recruitment of individual health visitors

M1 suggested she played an integral part in coercing health visitors to join the Feasibility Study. A particular barrier to recruitment was the demand on the health visitors' time during the study.

M1: *“So, then we’d have a meeting and “Right girls, [the researcher] is desperate, who’s got somebody?” So, I’m actually quite pleased with how they did step forward in the end, because, let’s face it, we’re all busy people. The time requirement for a visit did put pressure on people, but what happened was that people would do it and then when they saw a positive outcome they would think that was worth the effort.”*

M2 thought the study and recruitment was complicated by her engaging late with the study. She and the researcher had different expectations of the time element of the study, which had an impact on the speed of recruitment. The flexibility of the research methods aided in getting cooperation from the health visitors.

M2: *“I was quite involved in it and again, I think because I, by the time [the researcher] then began to work with the individual health visitors, he had been dealing with somebody else which made it a bit, complicated so I think he had one expectation and I then, had another expectation in terms of the times really and I wasn’t then as clear about the time element of what he actually required. I mean the method of recruiting health visitors, we tried to do it one way and it didn’t work as effectively and then we thought of a different way so we got eventually the amount of numbers of families that he needed for his study.”*

The managers’ perceived a slight reluctance of the health visitors in participating. The managers thought they had to push the health visitors to join. This is a different view to the health visitors, who mainly thought that word-of-mouth recommendations from their colleagues were the reason they joined. Management agreed with the health visitors that time constraints were the main barrier to recruitment.

Views on training health visitors during visits

Time taken by the health visitors who were part of the study might have affected the whole health visiting team.

M1: *"They talked about what they did and how the plan was, because obviously, for everything that he did there was an implication for the amount of time, it would take extra time to have it done. So there were obviously issues around how that was going to fit into the practice more strategically and how that impacted on their team members."*

The health visitors found the training challenging but understandable.

M1: *"I think getting their heads around it initially was a bit of a challenge, but once they did, then it was okay."*

Due to the problems with recruiting health visitors and the time span of the research, the training did not follow a set format.

M2: *"I think, the training he did might have been slightly different for the different health visitors, but I definitely know that he arranged, that they had a half day, joint session when he went through the whole thing and I'm sure he would have seen people individually as well."*

The training was appropriate, easily understood, and relevant to health visiting.

One of the benefits of participation was the team learning new skills, helping them to address issues in clients' homes.

M2: *"The relevance to the job, I mean they were really pleased because in some instances they had been going into families and hadn't necessarily had the skills to be able to do something about it."*

Views on the Feasibility Study within local research needs

The study met research needs within the local setting. It was important to incorporate research into health visiting and to work closer with academics.

M1: *"...we are now the Teaching Primary Care Trust, research has begun to have a higher importance...We needed to be thinking about actually how we*

would work with people who were primarily in academic settings and how that would fit in with what we were doing...”

The research was very applicable to the Plymouth scene because the city has many deprived areas with particular housing issues. Housing quality varied across the city, therefore, this type of work could not just be conducted in target areas or target housing (for example, just private rented accommodation). Housing was seen as a universal health visiting issue.

M1: *“We have high numbers of deprivation, but the actual quality of the building, the housing stock is variable even within that...So, in some areas of the city it's really, really important and in other areas of the city with equally the same amount of council housing, it's not.”*

Views on the methods of the Feasibility Study and overall research

M2 thought the researcher wanted a randomised control type study and had to try another approach. M2 perceived that the research methods were successful, as the study did not affect participating health visitors' service delivery.

M2: *“I think, people really felt, the way that he [the researcher] initially wanted them to be involved, for example, the way he wanted a randomised control trial in terms of the caseload, we just couldn't accommodate that. We then tried the next best thing...once we sorted that out and we came to a joint consensus, the researcher understood how we worked then it was okay ...”*

Views on applicability of research to own reporting

The research could be used in management reports about health visiting in Plymouth, forming part of collaborative working. Plymouth has a service level agreement, where health and local authority services need to work together to improve the well-being of the people in Plymouth. M1 thought the research was

not applicable to recent reports on parenting. Although she later made the link between parenting and poor quality indoor environments.

M1: *"...it would very much depend on what we were using it for, because some of the recent reports that we write are not about housing, they are about parenting and things like that, and so it very much depends on what we are aiming it at."*

Views on the benefits of the concept

The outcomes from environmental assessments could be potentially useful because health visitors might be able to initiate remedial actions.

M2: *"Yes, it would be very useful to us because certainly the kind of anecdotal feedback that I've had is that some of the health visitors on the basis of visits that they've done with the researcher, they've actually been able to ensure that the families they've visited, have been re-housed or work has been done or they've actually even been able to encourage the families to just do some very basic preventative measures to improve their situations that's not necessarily costing anything..."*

Views on the timing of the research in the current climate

The current climate in the health visiting service made the study more difficult to implement but no other time would have been more or less suitable as health visiting is in constant flux.

M1: *"It is difficult and especially when you are asking people who are approaching serious overload, but I don't think there is any way around that, there would have been no other time that would have made it any better because we live in an evolving environment and, you know, nothing is ever going to stay the same any more"*

Changes in the service affected the research and would affect any future implementation of the concept. Without the researcher's persistence, the

research would have failed because of changes occurring and because of the working practices of health visiting.

M1: *“... we are an awfully difficult profession to work with and unfortunately we are known for it as well and that’s purely because of the challenges and the fact that we do a lot of lone working and so it just makes for people who are contentious... Sometimes we are not the best completers, health visitors, and we are all full of creativity and thinking ideas and all sorts of things like that, but finishing ... very challenging. But, with him, pushing it and being so insistent actually it was completed.”*

This was not actually the case because the Teaching PCT had authorised 40 one-hour visits where 29 visits were completed. The concept could fit well with health visitors’ changing roles because it provides a way to measure clients’ health outcomes, providing an evidence base – now a major part of the health visiting agenda.

M2: *“...there has to be much more, we have to be more scientific or evidence-based in terms of what we do and clear about that what we do is effective and this, this here might very well be an element of that... it could be one of the things that you could actually use almost to demonstrate an outcome from families. I am quite open to it, because they [the health visitors] have been quite positive about it.”*

It was surprising to the management that the research got off the ground in the first place, due to delays and the problems of working with health visitors.

Views on why there were delays in the research

The change of managers during the study was thought to be the main reason for delays in the execution of the research. Although the research was initiated before the employment of the second health visitor lead, the study was not officially in place and was not part of her plans for the Plymouth health visiting service that year. The managers were also aware of the initial delays in the

research caused by the ethics application. M2 further thought that her personal health problems meant the research was delayed for a whole year.

M2: *"I think it's been a long, long time for [the researcher] and I can understand that because it took him ages to get ethical clearance and by the time we got ethical clearance then, in terms of the timing, for the service that then didn't fit either so we then had to wait almost a whole year."*

Views on the time commitments for health visitors participating

To be able to participate health visitors had to allocate more time than first anticipated.

M1: *"The health visitors would have to prepare the family for the visit, then they would do the visit with [the researcher], and obviously that was a learning experience for them as well as for the family, and then they would often have to go back and do a debrief in order to help the family to assimilate ... because some of these families don't assimilate information very easily and it needs to be repeated."*

Considerable time was for visits, but also in preparation and follow up.

M2: *"...not only did they have to do the visit with the researcher, but actually they had to prepare the clients and follow them up afterwards as well, so..."*

Views on the information supplied to the managers

M2 had not seen the research protocol (accepted by the Research Governance Unit) given to her at the beginning of the study. There was a good amount of information received about the research, although there might have been too much information. The information was clear and comprehensive.

M1: *"I think the health visitors that were involved got a lot of information. I don't think we as managers or having an overview got a lot, you know, a huge amount, but we got enough to know what they were, what was being, happen,*

what was being expected of the service, what we were giving permission to happen..."

M2: *"...what he gave me to read was very comprehensive because I got a copy, obviously, of his research proposal, what he was putting through, and he also offered to come and see me which he did and I spoke to him on the phone, so, I think [what] I was given, it was very comprehensive."*

M2 thought a summary could be added to the Health Visitors' Presentation Pack to make it more readable to managers.

M2: *"...because it is quite comprehensive and obviously to whoever is doing the research, that's what they do for a living, whereas for me as a manager it's just a small part of what I do, so actually almost having a very short, sharp executive summary would have been really useful."*

The Health Visitors' Presentation Pack was extensive and positively received by the participating health visitors.

M1: *"The feedback I've had from the girls is comprehensive and they felt that they got a lot out of it."*

Views on the clients' perceptions of taking part in the study

The managers perceived that clients' responses varied and were related to the advice they were given. The clients' perceptions were thought to be related to their own expectations of what they would get out of participating in the study.

M1: *"I think there was a mixed response...because depending on the feedback they were given at the time what was causing the mould, some people are sensitive to those sorts of comments."*

The health visitors had told the managers that the researcher was accepted by their clients, despite the fact that they thought the researcher was perceived as 'quite direct' (by the health visitors and clients). This approach worked, possibly

because the researcher had the expertise and because the concept was based on practical measures.

M2: *"... what he's been trying to do has been very well received by the clients, and actually, they [the health visitors] have been quite surprised because he could be quite direct about, well, do you take the window, or do you do this, whatever and people had really taken that on board and it was almost something to do because I don't know if it's because he almost came with a kick that it was a practical thing, and they could see, something that somehow made it more acceptable...scientific, or whatever..."*

Views on researcher's impact

The managers reiterated the health visitors concerns about the presence of the researcher and the difference in their approach to his approach. The researcher could get away with comments that the health visitors would not make for fear of influencing their relationships with their clients.

M2: *"Do you go in and, for example, see whether or not everybody turns their mattress over as much as they should, I mean that's really personal. That's what the health visitors were saying, it's quite amazing how personal questions that the researcher could get away with asking because it came under that 'scientific label' which was quite funny."*

Both managers commented on how positive the health visitors were in their feedback about the research.

M2: *"I've actually had very positive feedback around the work that he did, I mean, people felt it was very valuable what he was doing."*

The health visitors could see the potential benefits for their clients, particularly in terms of housing issues. The health visitors also experienced the benefits of the concept from being able to write successful 'housing letters'.

M2: *"Well I think on the whole the feedback I've had that it's been very positively received, because they've obviously seen a change for the family's circumstances."*

M1: *"Well they made comments for some of them, that it's been very effective, that what they've been able to get out of it has been very positive and, because we write a lot of 'housing letters' and if we can actually get some success out of it, it's a real, it does give you a bit of a buzz and so when you were able to have enough information to make those letters count they did appreciate that."*

Families in deprived areas need the most help (with regards to housing), therefore, health visitors in these areas were and would be even more keen to learn about the indoor environment.

M1: *"...and the thing was that the areas of most deprivation are the areas where the health visitors are most busy...but then they are also the areas where the health visitors are most eager to help the families, so they are well motivated to do it as well...And the fact that they saw something positive from it [participating in the study], it meant that actually they were up for it."*

The concept was very relevant to the health visiting service and there was a growing understanding of the impact of the environment on health and well-being. Advising clients on the indoor environment could be part of their overall preventative health care.

M2: *"...I have been very positive towards it, because I think it's very, it's hugely important and I can see that's the kind of world that we're living in, we're getting more and more conscious about the environment, aren't we? You know, what we eat and what we breathe...I can see it being used in some situations as well, perhaps, where you've got smoking, or you've got children with asthma or eczema or whatever, I can see that if this is a way or it may be, it could possibly be used as another way of trying to demonstrate to the parents the importance of just changing part of every day behaviour. Whether or not that's just airing your room for a while every day..."*

Views on 'empowerment' and increased knowledge

Health visitors already had a good understanding of their clients' problems in relation to the indoor environment but the training connected with the research helped to boost their understanding. The fact that the health visitors knew which families to recruit for the study suggested that they already knew something about indoor environmental issues.

M1: *"They already understand the problems. It empowered them to do something about it. So, they knew what the problems were, because they wouldn't have been taking them in if they didn't, but it actually gave them a tool to do something for the family. It was a bit more concrete than just saying I'll write a letter, which the housing people always come round and say "it's because you don't open your windows often enough" and if can demonstrate that this is not because they haven't been opening their windows, it actually is very powerful."*

M2: *"Obviously having more detailed information, has enhanced their, knowledge base, so they'd be able to apply that knowledge..."*

Having an enhanced approach to 'housing letters', and knowing the long-term health implications of indoor environmental problems gave the health visitors a more 'scientific' approach to their referrals.

M2: *"...I think that's what was happening in the past, health visitors, you could go in and you can see, can't you, if there's water running off the walls, but just because you can actually see the water running off the walls and you put that in a letter, it doesn't necessarily have any impact, for people to come and do something about it, but actually, if you then know what the long term health implications are, what else is in the air that people breathe in, that's a more scientific argument?"*

Views on the acceptability of the concept to health visiting

Environmental factors were considered appropriate to health visiting because of certain childhood illnesses and health visitors' roles in the public health agenda.

There were problems deciding which of the many issues should be prioritised and that the indoor environment is just one of many.

M2: *“Well, I think things like environmental factors, we do know that they obviously impact on people’s health and well-being, and also, in terms of certain illnesses in children would be impacted and probably even in the long term and I’m sure the problem might be much bigger than we even understand now, so it does fit in, but lots of things fit in to role in terms of public health agenda and remit and I think what the key is to ascertain where you can actually have the highest impact, sometimes, as a health professional because for some families, there’s lots and lots of issues, potentially, to be dealt with...But what of course is fascinating is that if it is well received and peoples’ environment is hugely influential in how they generally feel about everything, because sometimes it can actually help to begin to set a change process in place for some clients.”*

Prioritisation of the indoor environment was a major issue. This links with other responses, where an intervention has to meet current requirements. During the research and in the future these priorities will change.

M2: *“Well I think it is absolutely acceptable, there are so many different things, that impact on people’s health. And again, it’s almost about prioritising, when you go in and identify what some of the issues are for a family. And I think the whole idea would be that the professional involved had got a range of skills and tool kits that they can then use to try and help the family and this could be one of them as well, absolutely.”*

The issue of a child’s indoor environment is very important but unless it was an accepted priority by the health visiting system, it may not get onto the health visitors’ agenda. However, having a tool kit included in the health visitor’s range of skills, would help them identify environmental problems if this was an issue for the family. This would enhance the health visitors’ role.

Due to the time implications of providing assessments for every family, the assessments would have to be targeted to households in deprived areas.

M2: *"But whether or not it would be, I think it would be targeted, because the time implications for every single family, you just couldn't and (inaudible) our work is much more geared towards, vulnerable children..."*

The concept was not feasible as originally envisaged. Part of the basis of the concept was that health visitors would provide an environmental assessment every time they visited a new family but their restricted time would not make this feasible. However, the comments suggest the concept would be feasible to conduct in homes where the health visitors or clients already think there is a major issue. The idea that the tool kit and knowledge is part of every health visitors repertoire is close to the aims of the research, but with the added proviso that the health visitors can pick and chose when they take the tool kit to a house to make an assessment. Although health visiting is promoted as a universal service, health visitors target certain families, gearing their work towards vulnerable children. An issue that may need to be raised is what makes a child vulnerable. Parental problems, for example, low income and drug abuse are part of this but if a child does not face any of these problems but is living in very unhealthy living conditions would this make them vulnerable, particularly in terms of long-term health issues? The overall suggestion is that it should be routine as part of health visitors' learned knowledge and training but not routine in terms of their routine visits, or for every family.

Views on the concept's place within the NHS strategy

There was a place for the concept within the current NHS strategy. It fitted the strategy in the context of addressing increasing asthma cases. From a health visiting strategy point of view, it was 'just another bit' on top of their own work on the environment, particularly as they dealt with smoking already. Although their two foci were young children and vulnerable children, poor housing and

associated issues fitted into their strategy. The environment was a key part of the health visiting services approach to public health.

M1: *"If you think about it, the rising numbers of children with asthma and...the relationship with smoking within the home, we are always talking to people already about their indoor environment, "don't smoke in front of the baby", "make sure that you've got fresh air" and things like that, so it's just another bit to it."*

M2: *"So there'll be two main focuses really and very much on younger children and intensive, input to the most vulnerable children in a very broad context, but it would almost follow that if people are living in very, poor housing that there may be other issues as well, so yes it does fit in and certainly, that's the whole thing around public health, it has to be very holistic and the environment is absolutely key to that as well."*

Views on the referral network

The managers were aware that there was already some form of referral network, and recognised the existing work conducted by energy efficiency advisors. Although dedicated referral networks were a good idea, they tended to collapse and there needed to be a more robust system in place.

M1: *"So, I think that referral pathway is there already, whether there needs to be something that's a bit more robust within the city council, but that is often open to the vagaries of who's in power at the time and how much money is in the coffer. So, you may put a lot of work in to establishing a referral pathway, then one or two people move jobs, and then it's defunct."*

Before the research, response rates from referrals had been good but variable.

The use of the tool kit improved the response rates because of the use of evidence.

M1: *"I have had some really positive responses from Housing, I've certainly heard anecdotally people who've had good responses from the energy people and those energy people will go round and do an assessment in the house about what people's energy needs are."*

Due to potentially limited finances in the housing departments, health visitors may have to use a scoring system to make referrals, prioritising clients. The problem was they might end up referring more clients than the referral service could cope with. One outcome of the Feasibility Study was that it pinpointed a flaw in existing referral pathways. The health visitors were positive about the outcomes and responsiveness of the council during the study, indicating that this could not have been happening beforehand.

M2: *"...it almost goes back to the point I was saying before that very often, what ends up happening is that, the demand outstrips supply in terms of what these people can do...I would think that's why he was, thinking about doing it that way because the health visitor may be able to, if she identified a problem as part and parcel of what she's already doing whilst she's doing a visit about something else, she could perhaps be using the tool kit and then she would be referring in the ones, there could be a pathway about the ones that, if people score, have over a certain amount of scoring get referred in."*

M2: *"I suppose the fact that the health visitors have been positive about it and they've been able to influence an outcome in terms of either having work done, or people being re-housed would tend to suggest to me that there is a need for it because otherwise you would think that would have happened anyway."*

Experiencing clients' housing problems being resolved encouraged the health visitors to stay in the study and encouraged more to join. The successful referrals during the study verified one of the reasons for this research in that measured evidence of a problem in a home was more likely to get a response from a landlord than unqualified complaints. Before the research, health visitors had referred clients that they thought had a problem relating to the house and wondered why the housing department did nothing about it, but now that they had more understanding of potential problems caused by their clients' lifestyles they only referred documented problems that in their judgment firmly related to

the house. The training and assessments as suggested in this research provided a way for the health visitors to cut out 'false' referrals.

Recommendations for future implementation

Before the concept could be universally implemented there would need to be further research, with a need to build up the evidence base on the topic. As a team, health visitors would have to look at the 'success rate' of implementing the concept and whether it was effective. Some form of refresher course would be needed if the participating health visitors wanted to conduct assessments on their own. This reflects the needs of evidence-based nursing and the need to provide evidence of health outcomes before something is commissioned.

M1: *"I think we'd probably have to look at it in terms of how much time it takes, the efficacy of it, if it is only successful a certain percentage of the time, actually is it worth being put into place. Well I think really what [the researcher] has done is, in effect, a bit of a pilot in terms of testing it out...But the next step on is that you are expecting health visitors to do it by themselves and we would need to know for sure."*

Any further research involving the health visiting team in Plymouth would require the management team being given a lead-time of six to nine months with a clear understanding for financial considerations. Any environmental assessments or referrals would require client consent before being conducted.

M1: *"...then be able to say "Actually, what do you think about your housing? There is this that we can do that may help you in your discussions with the Housing Department. Would you like us to do that?" Because obviously we cannot do anything without client consent and so it gives us something else that we can offer to them."*

Environmental assessments could form part of a holistic assessment routine for health visitors but not in every house. All health visitors needed to be aware of indoor environmental issues.

M2: *"...we should be doing a holistic assessment that would include the environment and obviously, if we have got tools that help us do that, then that's something we need to...Well, you would do as part and parcel of any client, you might very well assess the environment, but I suppose whether or not you go into every single house."*

In terms of resources, providing tool kits to individuals would not be necessary, and the cost and the scale of the problem would need to be assessed before tool kits were provided. Potentially, a trained person with a tool kit could be called on by colleagues when an environmental problem was found rather than issuing all health visitors in Plymouth with a tool kit. Health visitors could use tool kits in a preventative fashion to highlight problems.

M1: *"I think groups. I don't think every Health Visitor would need to have a kit, you don't need them out in Plymstock, you might have a house down in Pomphlett that is poor, but then you could ask one of your colleagues who perhaps works at Greenbank where the private rented accommodation is absolutely dire and it's needed more there, they would use it more, they'd gain more confidence and then their colleague could say to them "come over here and have a look at this."*

The concept might better serve certain areas of Plymouth, those being the most deprived neighbourhoods – prioritising the implementation of the concept. As health visiting is a universal service, there would have to be an opportunity for health visitors in the least deprived areas to access a health visitor with the suggested specialist training and a tool kit.

The managers talked about 'when' the concept is implemented rather than 'if'. The concept would need to be carried forward by a team to get it embedded in practice and maybe it could be put through the Public Health Development Unit in Plymouth. The concept should be considered for future implementation but that this would have to be considered within the commissioning framework.

M2: *"...it all depends on the cost and the commissioning agenda and I think how the NHS has changed since [the researcher] first started this is that these days, if you can convince the commissioners that something is really good and is evidence-based then they'll commission that service and ultimately, I'm now managing a provider arm, so we would, in a way, provide what is commissioned from us and obviously we influence that in a way, so it's all about, finding out... I suppose the next step would be to almost assess people's quality of life, wouldn't it, post-[the researcher], if there had been some sort of measurement around pre- and post- and obviously there are loads and loads of things that would impact on people's quality of life..."*

Although there were costs associated with environmental assessments, these were outweighed by health benefits.

M1: *"It's about, actually, where does that fit in the overall scheme of things? And how much is it going to cost? Because that's, it's going to come down to that. It will come down to that, because these days everything is money driven. (Interviewer: Yeah. Of course, it would appear it doesn't have to be that expensive). No, no, and to be quite frank, if you put that against health and reducing the costs of asthma inhalers and things like that, you'd make your money back in spades, so we have talked about an updating session..."*

The managers did not seem to see the completion of the Feasibility Study as the end of the concept. In terms of progressing the research barriers were reiterated – how much is it going to cost, who is doing what and how does it fit in to commissioned services. One of the managers suggested that the concept was a useful tool for measuring outcomes and met their need for providing an evidence base in their work.

7.4. Participant Observations

The main themes identified by the researcher when working with the health visitors were as follows.

Training

Throughout the training and subsequent visits the researcher noted:

- There was a requirement for health visitors to provide more robust 'housing letters' by including a list of previous complaints both from themselves and their clients as well as their 'quantified' letters. The historical perspective should have been highlighted in the Presentation Pack given to the health visitors, possibly providing a template for producing an effective housing report
- Overcrowding was not addressed in the training despite the fact that it is an issue leading to indoor environmental issues, in turn leading to health issues
- The '*Aide-mémoire*' sheet did not give enough information for health visitors to quote rates of ventilation for private dwellings
- Advice on energy saving is needed. The present local initiatives to train health professionals and raise their awareness of local grant funding is quite different from advice on energy saving
- In retrospect, indoor environmental assessments should not have been conducted until a health visitor was properly classroom trained and familiarised with back-up paperwork. This comment refers to several untrained health visitors who had heard about the research asking for help

to resolve difficult housing issues based on simply using the researcher's expertise

Conducting Assessments

The health visitors were comfortable addressing subjects head on with their clients. The health visitors quickly converted their knowledge learnt during training into advice for their clients. There was a tendency by the health visitors to 'let' the researcher sort out 'situations' beyond their training in the field. Some health visitors detached themselves from situations where they should have advised on some aspect of the indoor environment.

In some cases, the health visitors were hesitant in giving advice to households where they were aware of the degree of poverty – concerned about advising people who said that they could not afford to take measures. There was a need to diffuse the idea that a healthy home does not require a major expense for a family.

None of the health visitors were seen to make use of the *Aide mémoire* provided in the Presentation Pack during the assessments.

Using the data collection sheets

The health visitors were sometimes slow to fill out their reports because they were unsure of how to commit themselves to data that they thought intrinsically they did not understand well enough. The presence of the researcher, who was also filling out a separate data collection sheet, seemed to detract from the

health visitors filling out their own data. There was a sense they did not need to complete the data collection sheet because they had the researcher's data.

Advice giving

The researcher noticed that sometimes the health visitors missed giving advice and needed prompting. For example, using a vented tumble dryer can help reduce indoor condensation, however, encouraging as much outdoor drying as possible will save their client money for electricity. It seemed to be awkward for the health visitor to give advice, which entered too far, into what they perceived as the family's personal world. One example was advising the client to move children out of their present bedroom into a south facing, dry room. Although the health visitor could see the potential benefit, they were uncomfortable giving this type of advice.

Difficulty in taking on new work

The health visitors often expressed how reluctant they were to take on new work or new tasks because they already considered themselves overburdened with requests and routine work. There was also a sense that because they did not have clearly defined roles they had everything thrown at them. One health visitor expressed this as the health visiting service acting like a 'dustbin' where anybody could throw anything into the bin and expect health visitors to run with the projects. Thus, her response was to only run with projects that suited her goals and ambitions and that she readily understood.

Support for conducting research

There was a problem with attending training or participating in the research in connection with backfill pay. Some of the health visitors commented on how they could or would not take part in activities without support. One health visitor suggested that not resolving the issue of backfill pay prevented some health visitors from participating in training and information seminars in general not just for this study.

Computerised records

It was noted at the start of the study, that most health visitors involved were still recording their client's details on paper with no portable electronic word-processing equipment in use. Stationary computers in the health visitors' place of work did not have access to clients' records.

Arranging visits and length of visits

Before a health visitor made a visit to a client, they conducted preparatory work. Appointments needed to be made, time allocated for travelling and follow-up time to write records. Preliminary observations during the Pilot Study and discussions with health visitors in Plymouth, indicated that the health visitors spent approximately an equal amount of their time interacting with clients during a visit, as they did, to set up and complete follow up work.

To clarify, a thirty-minute home visit took at least thirty minutes to set up and follow up. In addition, further administration and travel time took sixty minutes. These estimates given by the health visitors in Plymouth were similar to those listed by Cowley for visits to children one year old and younger.³⁶⁶ Private

correspondence with Cowley showed that an equal amount of time is required to cover clinics, special situations, and child protection issues.

To theoretically determine the availability of time health visitors would need to conduct environment assessments during their routine visits to a home, the following calculations were made, based on national statistics and figures for local conditions.

As of 12 March 2008, Plymouth Teaching PCT had 63 health visitors, equivalent to 47.27 full time equivalent (37.5 hours per week) staff.* They worked on average 212 days per year (((52 weeks x 5 working days) – (27 days average vacation)) – 5.55% sickness) - 8 public holidays.*

If each health visitor works 7.5 hours per day, on average there are 1590 working hours per health visitor per year (1,590 hours = 7.5 hours x 212 working days).

On average, each health visitor in Plymouth is responsible for 265 children.²²⁹ Out of the 265 children around 28% are under one year old (74 children)³⁶⁷ and require 12.5 hours of health visitors' time each (5 hours of home visits and 7.5 hours total for travel).³⁶⁶

This means that 58% of total available health visitor's time per year is spent on under-one year olds (58% = (74 children x 12.5 hours) ÷ 1590 hours).

* Personal Correspondence, Freedom of Information Officer, Plymouth, Teaching PCT, 31 March 2008.

This leaves 89 ($212 - (0.58 \times 212) = 89$) working days for the remainder of services health visitors provide per year. If the remaining children (older than 1 year old) receive one visit per year taking two hours to complete, this means 51 further days are used up ($51 \text{ days} = ((265 \text{ children} - 74 \text{ children}) \times 2 \text{ hours each}) \div 7.5 \text{ hours}$).

In theory, a health visitor working the hours suggested above has 'used up' 174 days ($123 + 51$) of her available 212 working days. The remainder of her 38 working days (18% of her total available working hours) per year are available for related work such as child protection.

The researcher's interactions with the health visitors did not confirm that all older children are visited regularly - the health visitors tended to prioritise vulnerable families.

Estimated time implications of the concept

It was assumed that health visitors would conduct at least one environmental assessment for each of the 788 clients (7.2 %) in Plymouth for whom health visitors had reported a housing problem in 2006.¹⁰²

If each of the 788 families received a dedicated two-hour visit (environmental assessment and follow up), this would require 1,576 hours per year of health visitors' time. This would require an average of 33 hours per year per health visitor ($1,576 \text{ hours} \div 47.27 \text{ health visitors}$) or 4.45 working days per year per health visitor ($33 \text{ hours} \div 7.5 \text{ hours}$) in Plymouth. The actual spread of these hours would vary for different areas in Plymouth depending on housing

problems. The requirement in time for environmental assessments equates to 11% of unallocated work time (4.45 days + 38 days).

The estimate of 33 hours per health visitor assumes that each would make a 'special' visit to conduct an indoor environmental assessment. This time would be reduced if the health visitors carried a tool kit permanently and could take measurements whilst on a routine visit. The 788 clients probably did not represent all the clients with housing problems, and health visitors trained to monitor the indoor environment might become aware of more environmental problems. However, if the health visitors could address these problems, there is the possibility that the statistic of 'poor housing having detrimental effect'¹⁰² could be reduced.

Equipment weight

The health visitors were accustomed to carrying a bag of equipment and paperwork. Before the study, health visitors in Plymouth carried between two and four kilograms of weight with a volume of approximately 0.024 m³ into clients' homes. Part of this load is created by scales, which are not always carried. The Health & Safety guidance on handling loads suggests that lifting from the ground near the feet should not exceed seven kilograms for women.³⁶⁸ The weight of the tool kit was 2.2 kilograms including the heaviest item, the vacuum cleaner. The increased load was thought to be a reasonable addition and feasible for the health visitors to carry during the study.

7.5. Referrals

Following the 29 visits made during the Feasibility Study, the health visitors made seven referrals to the Housing Development Officer at Plymouth City Council. These referrals were made independently of the researcher. The referrals resulted in actions being taken in five cases to rectify identified problems. The dedicated person dealing with these reports claimed that no extra work was created for the Council by acting directly on the health visitors' reports. The Officer stated that the reports were of such good quality that the Housing team took them at face value, reducing the need for a housing officer to make a similar report before a maintenance crew was sent out. The Council did not offer any priority for repairs for homes highlighted by the research. In reality though, the Council processed requests from the health visitors engaged in the research quickly, simply because they could act directly on the reports. The Officer pointed out that 'acted upon' did not necessarily mean that the health visitors' requests had been granted; it simply meant that the correspondence had been acknowledged, studied, decisions taken and acted upon.

When addresses were available, the health visitors addressed letters concerning problems with their properties directly to landlords. When this was not the case, all 'housing letters' were addressed to the Council. There were no records of how many letters sent to the Council were redirected to private landlords.

It was confirmed by participating health visitors that two of the homes, which were privately rented, received substantial maintenance work following the referral reports from the health visitors. Both properties were 'observable' by the researcher and therefore it was easy to confirm that refurbishment work was carried out. It may be a reflection on the importance of an evidence-based report that the health visitors had previously not made a successful referral about these very same properties over several years.

The Housing Development Officer indicated that it would cost them approximately £80 to conduct an individual assessment of a home and file a report similar to the ones produced by the health visitors during this research. The environmental assessments from the health visitors, allowed time saving by the housing department, since they did not have to send out an environmental housing officer to check the houses in question because they relied solely on the comprehensive reports. Thus, based on seven reports acted upon by the Council in this way they have saved £560. In addition, the fact that in some cases the health visitors were referring houses that the council had not been aware of as having a problem, improved the council's access to unreported problems.

Chapter 8. Re-Engagement with Stakeholders

(Soft Systems Methodology Stage 3)

8.1. Introduction

Stage 3 of the soft systems methodology cycle within this research involved re-engagement with the original stakeholders to discuss how the concept might be improved and possible ways the concept could be carried forward.

8.2. Methods

8.2.1. Plymouth Health Visiting Service

In December 2007 and February 2008, the researcher wrote to the Commissioners for Children's Services in Devon and Cornwall, following suggestions made by the health visitors and their managers during their interviews (Chapter 7). The letters presented the preliminary results of the Feasibility Study and asked whether the Commissioners would be interested in commissioning a further study. Each letter was followed up by a telephone call.

Due to the continuing support and encouragement by the Plymouth Public Health Development Unit, the research was discussed with the Deputy Director of Public Health and a Community Public Health Practitioner from the Unit during telephone conversations, e-mail correspondence, and four meetings beginning in June 2006. The Plymouth Public Health Development Unit were asked whether they would be interested in funding research to follow on from the Feasibility Study.

In November 2007, a face-to-face conversation about the research and health visitor training was held with the Specialist Community Public Health Nursing Programme Lead (in charge of the training of Specialist Community Public Health Nurses at the University of Plymouth in Truro, Cornwall). The conversation was held after a presentation made by the researcher to the Community Practitioner's and Health Visitors Association Annual Professional Conference, in Torquay, Devon.

In early 2008, a telephone call was made to the Specialist Community Public Health Nursing Programme Lead, at the University of Plymouth (in charge of designing the training of Specialist Community Public Health Nurses in Plymouth). The call was made to enquire if the new class of nurses would receive the same training on the environment as nurses in Cornwall.

8.2.2. Plymouth City Council

It was suggested by health visitors during the Pilot Study that Family Support Workers in Plymouth might be able and interested in participating in the research study. The Family Support Workers' manager was contacted by telephone in early 2005. A follow up meeting was arranged and it was agreed that a small number of pilot visits could be made. One Family Support Worker was accompanied on two visits, using the same techniques as in the Pilot study. In July 2006, a letter was written to the manager to get feedback on the concept.

8.2.3. Engagement with other Interested Parties

Throughout the research, the concept and findings of the Feasibility Study have been disseminated in the field of health care, environmental science and social sciences to invite feedback.

8.3. Results and Discussion

8.3.1. Plymouth Health Visiting Service

The Devon based Commissioner responded indicating that despite the positive outcomes of the research and the support by the Plymouth based health visiting managers there was 'no room' within the scheduled work to accommodate changes in Devon. The Commissioner in Cornwall did not respond. A telephone conversation with the Health Visitor Lead in Cornwall indicated that the health visiting service had problems with reducing numbers of health visitors and overstretched budgets, confirming the general feedback from the interviews. The Health Visitor Lead highlighted that any new practice for health visiting must fit into the current Department of Health agenda and must meet their current priorities.

The Public Health Development Unit's interest in the concept and results from the Feasibility Study led to the commissioning of a series of one hour workshops across Plymouth City in early 2008 promoting the concept combined with an emphasis on fuel poverty (to meet with funding priorities). The workshops were aimed at any home visiting health professionals and were directed towards informing participants rather than training them. Emma Quest presented the first half from Plymouth City Council on Plymouth's Healthy

Homes energy efficiency grant scheme. The second half was conducted by the researcher and gave an overview of the problems found in the indoor environment and what could be done to address the problems. All information was supported with handouts. A full range of health professionals attended the five lunchtime workshops. Positive feedback was received about the workshops during and after the sessions. Health professionals who had previously attended similar energy advice seminars indicated that the addition of information about the whole indoor environment was more interesting. In some cases, it was more relevant since they visited homes that were warm, but still had obvious problems such as mould and condensation.

Following on from the workshops, the Plymouth Public Health Development Unit asked the researcher to develop an A5 sized booklet (16 pages with illustrations) to be distributed by front line health professionals, giving basic advice on managing the home environment. The booklet entitled 'Your Home and Your Health' was produced and 5,000 copies were offered to health visitors and district nurses in Plymouth in the spring of 2009 (Appendix V).

The Specialist Community Public Health Nursing Programme Lead for Plymouth suggested that the present programme was full, with no room for additional information on the indoor environment as, although this is an important factor, in reality, health visitors refer such matters to housing departments.

The present guidelines for training of Specialist Community Public Health Nurses (part 3) according to the document 'Standards of proficiency for Specialist Community Public Health Nurses'²⁵⁵ gives numerous references to

both indoor and outdoor environmental factors that influence health, for example, whilst executing 'Standard 3 – Balance of practice and theory', students are encouraged to "...gain in-depth knowledge of how communicable diseases are spread and risk management in the context of environmental pollution". Further, Standard 9 (Knowledge Underpinning Practice) states: "The curriculum should reflect contemporary knowledge and enable development of evidence-based practice". Strategies for integrating knowledge and skills gained in both academic and practice environments should be evident'. The Specialist Community Public Health Nursing Programme Lead lecturer for Cornwall indicated that the indoor environment was an important factor in health visiting and that text concerning the indoor environment had been inserted in a module in the training for the academic year beginning 2008. No details were given about the text and the curriculum is not available for public view.

In general, communication with health visitors' managers, commissioners, and health visitors was slow and difficult throughout the research. Responses to all forms of communication were substantially delayed or non-existent at times. The suggestion seemed to be that getting hold of people to discuss the research was not due to a dislike of the concept, the researcher, or subject but a general problem in setting aside time to even think about discussing something new.

8.3.2. Plymouth City Council

The work with the Family Support Workers revealed how the boundaries between the health visiting service and the Family Support Workers at times were blurred. The Department of Health wants health visitors to move towards

a public health role centred around the Sure Start structure; the Family Support Workers are fulfilling a role similar to health visitors with an emphasis on the family unit, operating partly from their centres, and partly through home visits.³⁶⁹ The detailed, complete feedback from the Lead Family Support Worker in Plymouth in November 2006 highlighted that:

"In principle we felt it was an excellent idea to train and equip family support workers in techniques needed to undertake the necessary indoor environmental checks in families homes. Many of our clients reside in damp, unsuitable accommodation with their children. They are often quite marginalized people who would not have the tenacity or necessary skills to insist on their landlords undertaking the necessary remedial work to rectify problems, especially damp and mould in their homes. Where these environmental factors impact on the respiratory problems experienced by these families it is extremely useful to have professional, well-evidenced, scientific data to appropriately challenge landlords and demand that effective repairs are undertaken, Knowing that the tests, and subsequent results, are being given credence by various landlords is heartening.

The main pros of the concept were, we felt, that the appropriate remedial work could be undertaken by those, for the upkeep of the fabric of the building and would lead to alleviation of the symptoms associated with environmental conditions. This would inevitable result in reducing the levels of stress that the families in these situations face and produce better health outcomes for their children.

Our main reservation would be that the Family Support Workers have a very clear remit in terms of the work they undertake with children and their families in the home.

Many of the children we work with are on the Child Protection Register and as such, we need to focus our work on addressing the issues as outlined on the Child Protection/ Care Plan. Issues outside this are not really on our list of 'things to do' and the time available to many workers is very limited.

I believe that introducing a task such as checking the indoor environmental conditions of the home would blur the boundaries of their work and might even result in families using it as an excuse for poor parenting and an inability to protect their children from other sorts of harm. Our primary objective is, and must continue to be, assisting families to address poor parenting.

I think this concept is an excellent one with plenty to recommend it but I am unsure if this could ever become a mainstream requirement of my workers. Whilst this process certainly does have value, I believe it needs to be a specialist service that stands alone from our main work, and as such, I do not believe it can be 'part and parcel' of what we offer as a Family Support Service.

I believe that with sufficient training, resources and, more importantly time this task could be undertaken by any professional who is academically and socially astute enough. As previously stated I think it is marvellous that some landlords are accepting, and acting on your findings.

In conclusion, I think that this work has enormous merit however we have a limited amount of time per family in terms of home visits. As previously stated our remit is very clearly defined by referring Social Worker and needs to address poor parenting, inadequate regard to children being safeguarded from harm and the indoor environment would be a long way down the list of priorities given these underpinning requirements on my workers' time."

There are parallels that can be drawn between this response and the health visitors' responses (see Chapter 7). The Lead Family Support Worker suggested that the concept was not in her organisation's remit, that they did not have time, and had other priorities, yet they could see the merit in understanding the indoor environment. It begs the question, who does see the quality of the indoor environment as part of their remit in child welfare?

The research coincided with the government's desire that Home Improvement Agencies (230 of them in England) expanded their remit into new areas. Since Home Improvement Agencies' offices already employ handymen to 'care and repair' premises primarily for older people and vulnerable families, there might be a natural progression to increase their service to help clients improve their home generally, not just address 'housing' issues. In Autumn 2006, Plymouth's Care & Repair team contacted the Researcher by telephone to make him aware of their services and their availability to health visitors for making referrals to them. The organisation wanted to be included in the reference list given to health visitors.

The discussions with the Housing Officer in Plymouth City Council (described in Chapter 7) showed the council's enthusiasm for evidence-based reports from health visitors on behalf of their clients. In August 2007, the researcher met with Maria Schingen from the Council to explore using the results to get funding for a project. The project would involve providing health visitors with tool kits in the most deprived areas in Plymouth. The project did not go ahead, because there was no health outcome evidence from the research to date and thus not applicable to the funding stream the Council were applying to.

8.3.3. Engagement with other Interested Parties

In terms of peer review, the research has been discussed at 15 academic presentations. On 14th November 2007 the research project was discussed at the UK Indoor Environment Group Annual General Meeting and scientific meeting in York University and no objections from the audience were raised regarding which variables were measured and their relevance to the study aims. The audience knew of no similar project and expressed their sympathy towards engaging with health professionals.

During a presentation of the Feasibility Study at the National Institute for Clinical Excellence conference in Torquay in May 2005, the Researcher met with Sergeant Aynsley of the Devon & Cornwall Constabulary based in Camborne, Cornwall. Sergeant Aynsley gave the keynote speech about how Police Community Support Officers teams operated. The management of the Police Community Support Officers' team realised there was an opportunity for applying the training being offered to health visitors. The rationale was that a Police Community Support Officer often dealt with hard to reach households.

Eight Police Community Support Officers were trained in March 2006. Applying some of the lessons already learnt in the Feasibility Study, the training was a two-day event, in a specially chosen locality with practical experience given. The previous health visitors' tool kit was significantly reduced, and somewhat different equipment used. Sergeant Aynsley had already set up a referral network.

Chapter 9. Discussion

(Soft Systems Methodology Stage 3)

9.1. Introduction

This chapter is a discussion about changes that could be introduced to the local health visiting service as identified during the research and whether the aim and objectives of the research were met. The study was small, and based in one city with a temperate climate thus it is not possible to generalise the findings outside the city.

The two objectives (Chapter 1.2.2) are discussed first. The suitability of the methods used, the barriers to change, and acceptability to clients and professionals are discussed in the following sections:

- 9.2. To develop a cost effective, simplified tool kit with which health visitors can assess the indoor environment [Objective 1]
- 9.3. To assess the feasibility of health visitors quantifying and qualifying environmental variables [Objective 2]
- 9.4. Suitability of the research methods employed
- 9.5. Barriers to change
- 9.6. Acceptability of the concept to health visitors' clients
- 9.7. Acceptability to health visitors and their managers
- 9.8. Additional outcomes

An article on the results and discussion of the Feasibility Study has been submitted to the journal *Public Health Nursing* (Paper 5). Based on the results

and discussion of the research, recommendations for further research are presented in Chapter 10.

9.2. To develop a Cost Effective, Simplified Tool Kit with which Health Visitors Can Assess the Indoor Environment [Objective 1]

9.2.1. General

Objective 1 was met early in the research with the development of a tool kit, although development continued during and after the Feasibility Study. There is no known precedent of equipping health visitors or other health professionals with monitoring equipment, apart for the Seattle-King County Healthy Homes Project.¹¹³ In terms of the evidence base on how the indoor environment influences health, the tool kit and assessments chosen for the health visitors directly tackled five topics highlighted in Figure 2 - humidity, temperature, air quality, housing improvement, and space. The research indirectly tackled a further five topics:

- *Noise* - reduced by installation of insulation in walls and lofts and double-glazing
- *Safety* – improved by reduction of clutter and badly stored items which create tripping and fire hazards
- *Light* - encouraged with the removal of light blockers like net curtains
- *Social networks* - improved when people are not ashamed of their home
- *Physical activity* - improved as housework increases!

The indoor environmental assessments covered some of the variables associated with asthma as suggested by the Institute of Environment and

Health, UK,⁴⁷ and the Institute of Medicine, United States of America.²¹ The health visitors found questions where they had to use their own judgement more difficult than taking measurements, highlighting the usefulness of having monitoring equipment over subjectively observed variables and or relying on self-reporting.¹¹³

Observations of how the tool kit was used in the field highlighted that certain components were not easy for the health visitors to record because of the time needed to prepare, conduct, and follow up a visit. Ideally, the tool kit should have been more physically compact and simple. Surprisingly there were few comments during the interviews about the tool kit. The outcomes of the research in terms of each variable, instrument, and monitoring methods are discussed.

9.2.2. Discussion of Measurements

9.2.2.1. Weather Data (Rainfall, Wind Direction, and Wind Speed)

Health visitors do not have the time to follow up indoor environmental assessments and complete their Data Collection sheets with information from a local weather station. Although the health visitors did not mention difficulties in obtaining weather data during their interviews, the difficulties expressed about time management suggested that it was unlikely that they would collect the data.

9.2.2.2. Relative Humidity (Outdoors, Living Room and Bedroom)

The health visitors accurately and easily measured relative humidity using the digital temperature/ humidity pen. During the interviews, some health visitors could remember occasions where they could link high humidity with particular situations indoors.

9.2.2.3. Temperature (Outdoors, Living Room and Bedroom)

There were discrepancies between the health visitors' and the gold standard results for the measurement of temperature. The results indicated that the higher average measurements recorded by the health visitors were influenced by the results of one health visitor, suggesting personal rather than equipment error. The health visitors thought temperature was an important variable to understand their clients' indoor environments. There was a perceived usefulness in showing clients the difference in temperature between rooms and being able to explain causality with building design and orientation. Some health visitors commented that it would be useful to carry or have easy access to an instrument similar to the temperature/ humidity pen. It became obvious as the study progressed that the variables humidity and temperature were important indoor environmental issues for clients and that health visitors need a good understanding of the related issues to be able to properly advise their clients.

9.2.2.4. Microbial Samples (Outdoors and Bedroom)

Due to financial and time constraints, samples were infrequently collected. Some sampling was carried out where the researcher considered the quality of the indoor environment as possibly threatening to health.

9.2.2.5. Dust Samples (Living Room Rug or Carpet and Child's Mattress)

Dust samples (for dust mite analysis) were seldom collected and the health visitors would not be able to carry out sampling because of limited resources. A more sustainable approach would be to give advice to householders on the potential dangers of house dust i.e. allergic conjunctivitis and especially where a family member had an allergy to dust mites.

In reality, the health visitors were unable to undertake the measurement of house dust mites or collect mould samples. Although these are important environmental measurements and their removal from the tool kit would represent a loss of data, they were not essential for the health visitors' first appraisal of a home and the subsequent success they had in getting remedial action taken. Variables that were subjectively assessed, such as observing visible mould or damp, ventilation, airing of bedding, and presence of carpeting, all contributed to reducing the need for microbial and dust sampling.

9.2.2.6. What Direction does the Front of the House Face (Aspect)?

Health visitors found it difficult to take compass readings, in many cases resulting in the variable being left blank on their Data Collection sheets. With hindsight, the researcher poorly explained the reasons the health visitors were asked to record this variable.

9.2.2.7. How Many People in House During Visit?

There were no problems in recording the number of people present during a visit. In the future, it may be more pertinent for health visitors to ask questions

about normal occupancy levels to help their clients understand issues associated with overcrowding.

9.2.2.8. How Many Smokers?

There were no problems in recording the results from this question, with the answers normally given freely by the clients. Where the health visitor was unsure of the presence of smokers, they were encouraged to observe signs of smoking such as ashtrays and odours.

9.2.2.9. How Many Pets? What Type of Pet?

There were no problems in recording the results from this question. Details about pets were recorded so that if health visitors' clients had respiratory problems there was a possibility to link these with pet allergies.

9.2.2.10. How is the House Heated?

The health visitors had 100% agreement with the researcher on this variable. However, for this variable and other question-based variables the health visitors and the researcher would have heard the same answer from the clients. Type of heating is important information to put in referrals because clients often had concerns about heating their homes.

9.2.2.11. How Old is the House and what Type is it?

There was a poor agreement between the researcher and the health visitors for these variables and in many cases the health visitors left the questions blank on their Data Collection sheets. These are difficult variables to observe or estimate and very often, the information is not available from the occupant of the house.

Originally, the questions were included to guide the health visitors in understanding what to expect with different ages and types of houses. The health visitors found questions where they had to use their own judgement more difficult than taking measurements, highlighting the usefulness of having monitoring equipment over subjective/ observed variables.

9.2.2.12. Are any Windows Open?

There was a strong agreement on this variable. The opening of windows was an interview topic raised by the health visitors and one of their managers. The advice to open windows was considered an important subject and the health visitors thought their clients opened their windows more often after receiving advice. Some of the comments on ventilation highlighted some deep-seated misinformation adhered to by both the clients and the health visitors about the benefits and the cost of ventilation.

9.2.2.13. Is there any Mould or Damp in the House?

There was a strong agreement on this variable. However, at times, the question was only answered by observation because some clients were not aware of the presence of mould. The health visitors and both managers commented extensively on the problems of mould and damp, highlighting that it was a problem regularly highlighted by their clients. The health visitors were able to distinguish between damp and mould although there was a problem with their understanding of types of damp. The health visitors could distinguish condensation from other sources of damp, such as broken pipes, but said that their clients had either condensation or damp, not quite understanding that condensation damp is a recognised form of damp. The health visitors

perceived that monitoring and learning about mould and damp enhanced their own subject knowledge, helping them to understand the underlying causes and consequences for health.

9.2.2.14. Wall Surface and Wall (Internal) Dampness

There were no significant differences between the health visitors' data and the gold standard, although, there was a poor correlation for wall surface dampness, possibly indicating that more knowledge transfer is required for this subject. Problems with damp homes were given as reasons why some health visitors took part in the research. The damp meter was seen as a useful tool that should be available to health visitors.

9.2.2.15. Location of Measurements

There were no particular problems observed or highlighted by the health visitors about recording data outdoors or in the living room. Taking measurements in bedrooms was more difficult because of the perception of intrusion into a private space. One health visitor thought that clients found the requirement to enter bedrooms disconcerting.

9.2.2.16. Data Collection Sheets

When the health visitors were asked during their interviews to recollect filling in Data Collection Sheets, they did not recognise using such forms. The health visitors thus uncovered a mistake made by the researcher in that the word 'Protocols' was used in the interview scripts instead of "Data Collection Sheets". Once the confusion over the name had been sorted out some of the health visitors confirmed that they experienced problems when completing the Data

Collection sheets. Some health visitors did not want to fill them in during the visits, considering such actions as unsettling for their clients, who wondered what was being written about them. During training, health visitors had been recommended to show clients their Data Collection sheets before they left the property and explain the data collected. The Data Collection sheets could be seen as a 'formal assessment guideline' and it has been shown that health visitors do not always find this helpful and therefore try to avoid using such methods.²³⁵

By 2007, 94% of health visitors had access to the Internet²⁴² but were not provided with handheld personal digital assistants to connect to a computer. The results from any environmental assessments by health visitors in the future should be computerised to allow transmission of data. Computerisation of health records has already been highlighted as a way of enhancing health care.³⁷⁰ The managers suggested that having detailed Data Collection sheets compiled over time could provide health visitors with a way to demonstrate measurable health and environmental outcomes from remedial actions for their clients.

9.2.3. Conclusions about the Tool Kit

The results suggest that in its current format the tool kit was not acceptable for every-day use by the health visitors, although it was accurate compared to the gold standard tool kit. For the purposes of health visiting, they did not need the same amount of information as an indoor environmental assessor to achieve their goal, which was to motivate clients into making changes to their indoor environment and or to provide a well-documented referral to an outside agency.

To provide a tool kit that would measure temperature, relative humidity, and damp, would cost around £143. A good example of such a measuring instrument is the Testo 606-2 (Figure 15) made by Testo Ltd, Hampshire, UK. This or similar instruments were not available when the research was initiated.

9.3. To Assess the Feasibility of Health Visitors Quantifying and Qualifying Environmental Variables [Objective 2]

9.3.1. The Ability to Recruit Participants

All the participating health visitors volunteered for the Feasibility Study, but experienced difficulties in fulfilling the agreed amount of 40 one-hour visits. Health visitors who chose not to participate might have represented a group who did not find the concept acceptable based on initial perceptions. The fact that the health visitors volunteered and were not told to take part by their managers was thought to be an important part in the sustainability of the Feasibility Study. The volunteering aspect was important when considering that the health visitors saw themselves as working alone in the community, having to manage their own schedules, incorporate new information themselves, and cope with requests for extra activities.

Although in the interviews the managers suggested that they cajoled the health visitors into participating, the health visitors suggested they joined through their own initiative. One manager, highlighting the idea that pressure from management was not going to make them participate, described health visitors as 'contentious'. However, both the health visitors and their managers

expressed a similar sense of responsibility to assist the researcher to complete the research. The health visitors' managers suggested that health visitors 'never stick at anything' indicating that there was some enthusiasm for the research from the participants.

At the outset of the Feasibility Study, the researcher had not considered the subject of recruitment of health visitors as a difficulty because of the ease with which health visitors had been recruited for the Pilot Study. When the Feasibility Study was discussed with Plymouth Teaching PCT, there were no warnings from them or the second Health Visitor Lead that the health visitors would not be available or able to carry out ten visits each because they were already under pressure to fulfil their workloads, and could be difficult to work with.

One health visitor volunteered for ten visits, following the first presentation of the research, an early adopter and was subsequently very active in recruiting colleagues through her enthusiasm for the research, completely fulfilling Rogers' definition of an early adopter.⁹⁴ This was of major importance to the outcome of the research, as she was the person to 'check with' to see if the concept was acceptable.⁹⁴ Having an innovation champion helped in recruitment of further volunteers. Recruitment was aided by the idea that participating in the research might help solve disputes about housing problems, for their clients.

9.3.2. The Feasibility of the Classroom Training

Once the health visitors decided to participate in the research, they accommodated the training into their work schedule as best they could. However, there were problems in organising classroom sessions where more than one health visitor could attend. The health visitors suggested that they had no problem in attending the classroom training and easily fitted it into their practice, however, the difficulty the researcher had in arranging training showed that this was not necessarily the case. Three out of the eight health visitors who conducted visits did not manage to attend any training. Locating the training in the researcher's house was unsatisfactory, misleading the health visitors into thinking that they had not participated in an actual training session.

Health visitors are used to 'away days' and protected (time) learning activities when receiving information or training from different facilitators.²⁶² The health visitors were based in and around Plymouth in isolated offices, making traditional centralised information sharing difficult.

9.3.3. The ability to carry out Visits and the effect of Field Training

Many issues were raised about the visits including discussions about the concept *per se* and the methods of the research. Due to the presence of the researcher on each visit, some of the health visitors considered that the responsibility of understanding and advising on environmental issues lay with him. This highlighted a misunderstanding of what was expected of the health visitors. They had been informed during their training that support from the researcher was only offered for the first visit and as a last resort during further visits, to avoid incorrect information being passed to clients. The researcher

wanted to determine if it was feasible for health visitors to monitor the indoor environment and thus they had to try to do the assessments themselves – this was a central issue in this research. It is unclear if this requirement to carry out assessments under supervision might have been too onerous resulting in dropouts. Confidence in conducting assessments was closely linked to the number of visits conducted.

The health visitors noted that both they and their clients absorbed practical knowledge better than written advice. The training during visits could be classified as 'problem-based' learning, since every house visited presented a different social scenario and a new environment. A recurring theme in the study was that the health visitors already had too much paperwork to deal with and could absorb new information more easily in a hands-on situation. The training method used for the Feasibility Study reflected the health visitor curriculum, which consists of practical experience and theoretical training.

Data collected by health visitors who did not attend classroom training might not have been comparable to data collected by those who did. This was not tested statistically since the numbers involved were too small. However, the ability of the non-classroom trained participant to conduct assessments and recall information during the interviews shows that field training had a substantial positive impact.

The arrangement of visits was complicated because the health visitors chose not to conduct environmental assessments during their routine visits and instead arranged a separate visit specifically for the researcher to attend. The

need to arrange an extra visit is a barrier to implementing the concept, as it would increase workload and costs. The health visitors were concerned that arranging visits to some clients was already difficult and the presence of a third person increased the difficulty. In hindsight, the idea of conducting a study visit on top of a routine visit was not possible. However, by arranging a separate visit, the health visitors created the ideal conditions for them to be able to concentrate on learning about the indoor environment.

The health visitors and their managers suggested that extra work was created because they had to conduct follow up visits. The original idea was that health visitors would follow-up their environmental assessment visit when they made their next routine visit. The managers indicated that the health visitors had to go back in a few cases to debrief the participating clients, and explain the information given to them, or to comfort clients because they were disturbed by the visit. However, the health visitors suggested that in the majority of cases they did not make a follow-up visit because they had not planned to visit those clients again. The managers' knowledge of the training was limited and it is not known whether the training fit within their training expectations. The managers did not attend the training and did not accompany the health visitors on any visits, although they were invited to join in.

The health visitors' abilities to recall information from the classroom and field training during the interviews were impressive suggesting that the training methods were effective. The study highlighted the need for a form of assessment at the end of the classroom training to ascertain knowledge

retention to ensure that the health visitors were ready to conduct assessments in the field.

9.3.4. The Impact of the Length of Visits

The visits took an average of 45 minutes, which was considered appropriate as training was taking place alongside the environmental assessments. The time taken relates well to the estimated 30 minutes per assessment, plus time for introductions, although this period was thought to be too long if an assessment was to take place in connection with a routine visit. The Data Collection Sheets had a minute-to-minute structure but none of the health visitors followed this. If, as suggested, health visitors carry their own measuring instruments and operate on their own, they would be in control of the length of an assessment and how much detail they would go into.

9.3.5. The Usefulness of the Presentation Pack

The health visitors found the Presentation Pack (Appendix III) useful and some could recall some of the information in the Pack. However, it was quite clear that the Presentation Packs were less important in the learning process than hands on experience gained during visits.

There was a definite uncertainty among the health visitors about how they should handle the Fact Sheets. Originally, the Fact Sheets were intended as a training aid for the health visitors, and as a point of information giving during visits. It was suggested that the sheets could be given to clients after the health visitor had gone through them together with the client. In cases where the health visitor returned to the client, they could then be used to go over subjects

again. Another issue with information for clients was that the health visitors were not willing to act as pamphlet distributors. The health visitors mainly interacted with their clients verbally, based on their experience of best practice. When the health visitors were introduced to the Fact Sheets during training, more care should have been taken to explain how and when to distribute them.

9.3.6. The Adequacy of the Information provided to Stakeholders

The managers thought that they received too much information material about the research when they only required a summary. The managers seemed to have gained a different understanding of some parts of the research than was intended, suggesting that either they had not had enough time to understand the research and or that they had not been properly briefed.

9.3.7. Use of the Consent Forms and Information Sheet

The Information Sheet about the study and consent forms were to be given to clients before all visits to inform them about the visit, and give them time to prepare. This did not happen because the health visitors did not always have the chance to arrange the visits in advance. This practice caused problems because when the sheet and forms were given out at the beginning of a visit, clients were overloaded with information unnecessarily extending the visit.

9.3.8. The Referral System

The referrals acted upon by Plymouth City Council were not intended as an outcome measure of the Feasibility Study. However, the appreciation of the dedicated referral system set-up and the health visitors' comments about problems encountered with referrals before the research concepts were

introduced has elevated the existence of a referral system as a useful outcome measure.

The seven referrals made by the health visitors to the Housing Officer in Plymouth City Council were all accepted and actions taken without the need for a further inspection. The actions taken were defined by the Housing Officer as meaning that the referrals had been acknowledged, studied, and decisions taken, not necessarily in favour of clients. The health visitors indicated during their interviews that they were aware of structural repairs and other minor work that had been undertaken following their referrals. Before participating in the research, the health visitors had made referrals in the form of 'housing letters' to landlords and other agencies. Whilst there is no definition for a 'housing letter', the health visitors and clients used it as a terminology to cover many issues about housing problems. The robust referral pathway put in place for the research project worked well and the health visitors' confidence in gaining a successful referral was increased because they had collected evidence of a problem. In theory, the provision of evidence-based reports may increase the likelihood of a successful referral, therefore reducing the need for more letter writing, *de facto* reducing the health visitors' workload.

It might be assumed from the health visitors' comments that before the research was introduced, they may have referred many clients that did not really need help with their housing, but needed advice on their lifestyles. The training and assessments provided a way for the health visitors to cut out inappropriate referrals.

9.3.9. Ethics Application

The ethics application was complicated because approval was sought for a strictly non-medical study to be carried out. Part of the delay (four months) in obtaining ethics approval was that the ethics application form was primarily geared towards strictly medical research methods and methodology. The ethics approval required informed consent from the health visitors' clients because they would have their privacy disturbed, and because the proposed work went beyond the health visitors' normal duties. This was fully accepted, however, the idea of informed consent from minors, for a non-medical procedure, with no physical intervention, was an unnecessary demand on the research by the Ethics Committee and on the minors.

9.4. Suitability of the Research Methods Employed

9.4.1. Overall Research Method - Soft Systems Methodology

The framework of Soft Systems Methodology allowed the Feasibility Study to take place whilst building on and understanding the systems surrounding and supporting the participants. These systems and work practices have had a major impact on the research and will have implications for any further research or adoption of the concept to accommodate changing roles of health visitors within different theoretical frameworks for practice.^{264,371}

For this research, the researcher's unfamiliarity when dealing with parts of the NHS and especially the health visiting service was reduced by using the Rich Picture technique within the Soft Systems Methodology. Inclusion of the Plymouth health visiting team in the development of the research helped to

mould the research to meet the requirements of the research aim. Throughout the research, the health visitors were encouraged to comment on and suggest changes to the research, to develop the research concept. Utilising the four-stage process of Soft Systems Methodology has indicated a number of issues surrounding health visiting, which have been easier to understand and address. In particular, engagement with stakeholders throughout the research has been vital. Structured discussions were initiated with stakeholders during and after the Pilot Study resulting in a broad acceptability, from all stakeholders, not a total consensus, for the subsequent Feasibility Study to go ahead.¹⁴² A further structured discussion was offered to stakeholders as soon as preliminary results from the Feasibility Study were available (December 2008) and disseminated. Through the fourth stage of the cycle 'action to improve', recommendations have been made for further research (Chapter 10).

9.4.2. Frameworks for Implementing Change

Although this research did not involve the actual implementation of a change to health visitors' current practices, it did involve the implementation of a transitory change during the study. Therefore, the application of the study was assessed in terms of existing frameworks for implementing change.

The process of diffusion of the concept and the research to participants was assessed against Rogers' five stages of diffusion⁹⁴ (Table 14). The researcher functioned as a change agent, as described by Rogers,⁹⁴ when innovations were presented to health visitors and clients. By using health visitors as change agent aides, the researcher was safeguarding the best possible conditions for

the diffusion of information about the indoor environment and health to reach the health visitors' clients.

Although the recruitment presentations and stakeholder meetings were right for agenda setting, recruitment and diffusion of the concept might have been more successful if the researcher had made presentations at the health visitors' monthly meetings. The health visitors matched the study to their own preferences, for example, not doing the assessments during a routine visit but conducting an extra visit specifically for the study. This led to redefining of the methods, as did the discussions with the Health Visitor Lead after the pilot study. Clarification of the concept was highlighted by the health visitors indicating that they participated because of word-of-mouth recommendation, making participation more acceptable. Routinising was not relevant at this stage.

In summary, the research followed Rogers' stages in Table 14 but progress was hampered because of the barriers uncovered throughout the study. However, exploring these barriers to change might aid further research in this area of the NHS. Table 14 indicates the process that would occur if the concept were to be implemented in the health visiting system.

The implementation of the concept during the Feasibility Study was assessed in retrospect as to the potential and resistance for change against Lancaster's criteria (Table 15).³⁰³ Referring to Lancaster's criteria has guided the researcher in the understanding of many of the outcomes from the study. Revisiting Lancaster's criteria to compare major findings from this study

suggests that the health visitors did not find that monitoring and advising on the indoor environment was a major deviation from their 'old ways'. The concept did not clash with their previous practices or teachings and was perceived to broaden their existing knowledge about the indoor environment and add to their skill base. The majority of health visitors suggested that making a quantified indoor environmental assessment was a new skill for them and that conducting such assessments would be a new procedure that they found acceptable. The study identified financial benefits that would occur for the local authority but did not quantify the potential health benefits for clients or financial benefits for the NHS.

Lancaster's criteria are particularly useful as they increase the understanding of the acceptability of a 'change' in a complex system like the health service. This research has now answered some of the questions put forward by Lancaster and the results will aid another researcher in gauging the potential resistance to change before embarking on a continuation of similar research. A difficult area to address for future research is the question 'To what degree and in what manner are the people involved threatened?' This research has answered this question, as the health visitors were not threatened by the ideas embodied in the concept but rather felt empowered with their new skill. However, they felt threatened by the perception that adding a new skill would take up more of their time. The perception that clients were threatened is not so much of a barrier to change as the 'threat' was mostly linked to the presence of the researcher. Communication with and within the health visiting system might be a problem as found in this research.

The frameworks suggested by Lancaster and Rogers should be referred to in connection with further research suggested in Chapter 10.

9.4.3. Feasibility Study Methods

The objectives of the proof of concept Feasibility Study was to determine if the concept would be feasible and acceptable for the health visiting service in Plymouth. The methods used needed to conform to a structure readily recognisable and acceptable to the health visitors and their management organisations.

The flexibility of the methods used for the Feasibility Study helped to ensure that the study was completed. If the Study had been restricted by time or had not been self-financed, (materials, researcher's salary, and communication costs) it is unlikely that it would have been completed in the format it has been. The health visitors' managers were surprised that the Feasibility Study was completed and indicated that health visitors were ambivalent about time. If the methods had been fixed at the outset with few variations allowed, the risk was that the whole study might have collapsed at the first hurdle; for example, a requirement for a fixed number of health visitors participating.

Using mixed methods for this research to produce a good understanding of the concept has confirmed that multiple research methods can lead to a better understanding of results than would be given from just one approach.^{181,372,373}

The quantitative methods analysed the feasibility of the research in terms of the accuracy of the health visitors' measurements, and the qualitative method investigated both feasibility and the health visitors' acceptance of the concept in

routine practice. The integration of the research outcomes helped to identify feasibility problems in terms of measuring instruments and skills, to determine whether changes needed to be made to the measuring instruments, method of measuring, teaching method, or simply to remove the variable.

9.4.4. Sample Size

A sample size calculation for the Feasibility Study was conducted to understand the validity of the quantitative data collected. Sampling in qualitative research is primarily concerned with seeking richness of data.³⁷⁴ Therefore, the size of the sample in terms of representation and transferability to the total population of health visitors was not important *per se* but the small-scale Feasibility Study provided a good insight into the health visitors' perceptions of the concept. The results from this research may not be replicated if repeated in areas outside Plymouth or if applied to other health professionals who visit clients' homes. This does not mean that this research is not representative of a portion of the opinions of the health visiting service as a whole. However, care needs to be taken in considering matching particular results and their applicability in other settings.⁹⁸

9.4.5. Seasonality

The Ethics Committee raised the issue of seasonality. It is acknowledged that some indoor environmental conditions are worse in autumn and winter during adverse weather conditions compared to summer conditions. There were no visits in the summer or winter. This was not by design, but heavily influenced by school times and holidays. Seasonality issues have not hindered the health

visitors being able to identify poor quality indoor environments, thereby justifying the choice not to specify winter visits only.

9.4.6. Bias

9.4.6.1. Participant Bias

It might be assumed that the volunteer participants were already interested in (biased for) the concept and were excited to be involved in the research. It is accepted that health visitors who did not volunteer or dropped out of the research early may not have found the concept acceptable (biased against). However, if the volunteers already found the concept acceptable, it cannot be assumed that they would find the concept acceptable after participating, as demonstrated clearly by one of the interviewed health visitors.

The health visitors chose their clients independently. This might mean that the clients chosen by the health visitors were more receptive to receiving help, biasing them towards accepting the concept. Convenience sampling of clients was thought to be non-disruptive for the health visitors' work routines. Clients who were approached by the health visitor but chose not to participate might have represented clients who found the concept unacceptable. Although no analysis was conducted of non-participating clients, the health visitors' suggested that some clients thought the visits would have been an intrusion. Similarly, the health visitors' perceptions about the concept may have been swayed by how their clients reacted to being asked to participate in the study.

A less biased format for selection would have been to take the health visitors' full caseload of respiratory problem sufferers and randomly select ten clients

from each, regardless of indoor environmental conditions. In reality though, such a random selection would have picked clients who would have refused participation and thus a convenience sample avoided a drawn-out client selection process.

9.4.6.2. Dependency Bias

During data collection, the health visitor and researcher worked very close to each other, sometimes having to use the same measuring instruments in succession. Therefore, there is a definite possibility that the researcher's presence and the gold standard results influenced the conclusions that the health visitors made. This meant that some of the follow up work the health visitors did, might well have been based on the researcher's assessment and advice. The researcher tried to maintain an advisory approach throughout the visits, to avoid giving the health visitors 'the answers'. The researcher did not see the health visitors' Data Collection Sheets until after all visits were completed. Therefore, conclusions drawn by the researcher and each health visitor from a visit were owner-true, compiled at different times, and promoted differently.

Some of the observations required in the assessment could have been influenced by the clients reporting to the health visitor. The risk that the health visitors might rely on clients self reported problems to formulate their reports was pointed out to them. They were taught not to take client reporting at face value but to rely on their own judgment and measurements.

9.4.6.3. Methodological Bias

The gold standard was considered a non-biased, repeatable, accurate representation of the indoor environment at the point of measurement, within the error margins of the measuring instruments. It is acknowledged that some of the variation between the gold standard and health visitor data could have been due to the researcher's errors. Using the standardised assessment procedure developed by the researcher, calibration of the instruments, and the researcher's extensive experience reduced the chance of error.

9.4.6.4. Interview Bias

The interviewer and transcribers may have introduced bias. Using the same script for each interview, rather than allowing a non-structured freely developed conversation, reduced the bias from 'differential stimulus'³⁷⁵ caused by the interviewer varying the wording of their questions. Using the same interviewer for all the interviews reduced the problem of interviewer variance.¹⁵⁴ The interview scripts reduced the possibilities for the interviewer to misinterpret the questions. It has been acknowledged that choosing an interviewer from the same background as the interviewee can make it difficult for participants to remain focused on the research topic.³⁷⁶ Thus, the interviewer was independent of the research and the health visiting service. The structured interviews introduced bias in that the predetermined topics would have influenced the health visitors' responses. Someone independent of the research carried out the transcriptions of the taped interviews.

9.4.7. Reflexivity

Personal and intellectual biases were assessed at the outset of this research and during its progress. Other factors including status and distance between the researcher and the participants were also assessed.¹⁶⁷ This research was carried out by the decider of the research methods and executed by the same person. The health visitors were taught by the same person, arguably introducing the possibility of personality bias. To reduce these biases the researchers' conduct, recommendations, and research methods were all firmly based on independent research evidence wherever possible. The researcher's personal interpretations of the qualitative results have been confirmed with verbatim quotes and independently crosschecked by another researcher. At times, it was difficult not to compromise the researcher's impartiality where it was obvious that clients tried to use the health visitor to sanction change for them on any account. It is accepted that the researcher introduced some bias when formulating the interview questions to illustrate subjects of special interest for the researcher. The presence of the researcher during field visits might well have influenced how health visitors approached each individual situation, since their position encouraged them to please both their clients and the researcher, which at times was not possible. Hence their comments about the researcher's approach towards clients. In any further Study, any influence from the researcher would be removed and therefore some of the mentioned biases would not occur.

9.5. Barriers to Change

9.5.1. Time Implications

Throughout the study, the health visitors' lack of available time at work was cited as a barrier to both the completion of the research and any future adoption of the concept. Although it was feasible for the health visitors to carry out indoor environmental assessments, taking on an extra task in a busy schedule was a major concern. However, it was also suggested that the concept was an extension of what they already did in terms of housing. Therefore, it would not take any extra time, apart from taking the measurements. If the concept was treated as an additional skill that would migrate into the standard curriculum, discussions about lack of time become less relevant.

There are difficulties in assessing how health visitors spend their working time.³⁷⁷ Statistics published about the caseloads of health visitors across England highlight that different approaches must be taken to deal with caseloads that range from 100 to over 1,000 children.²²⁹ A more in depth understanding of how health visitors use time and resources is needed to be able to adapt the concept to make it more feasible to introduce into their practices. In summary, the different time implications were:

- **Timing of the research.** The research coincided with a change in local managerial positions, which led to substantial delays (approximately 14 months) for the start-up of the Feasibility Study. In addition, the tumultuous condition of the health visiting service in general meant that the health visitors and their managers were concerned about taking on new work

- **Protected time needed for training and visits.** It was difficult to make time available for visits and the facility of backfill pay and support was not reliable. Some health visitors suggested that setting up the visits for the research was time consuming and difficult
- **Length of a visit.** The health visitors were not concerned about the length of the visit in terms of training and conducting an assessment at the same time. The concern was that they had created an extra visit to their client, and that normally their routine visits were shorter
- **Time to fit in a new skill.** The health visitors already had too many tasks to fulfil and had little time even to deal with priority issues like child protection
- **Sickness and absence.** The researcher was told by the health visitors that many health visitors had long sickness absences, particularly from stress related illnesses. This increased the workload and time burdens even further on the service. In 2005/2006, the sickness percentage for health visitors working in Plymouth was 5.55% (Personal Correspondence, Freedom of Information Officer, Plymouth Teaching PCT, 31 March 2008). In 2005, the average sickness rate for health workers in the south west of England was 4.2-4.5% and for all PCT workers in the UK the figure was 4.2%³⁷⁸

Research by Hein has shown how trained nurses are systematically overworked, and being exchanged for less qualified staff to the detriment of patients, echoing the situation highlighted by the health visitors in this study.³⁷⁹ Nurses complain that they do not have time for any extracurricular activities, and that their own health record is deteriorating and that nobody will look out for them apart from themselves.³⁷⁹ The perception that health visiting is under

pressure and that workloads are increasing (reducing the opportunities for home visiting, and environmental health type assessments) has been found in a previous study of Scottish and Norwegian health visitors.³⁸⁰

9.5.2. Caseloads

The health visitors discussed their concerns about having to take on more clients if people in their community knew that they could conduct environmental assessments. They noted that if any family with children under 5 years old had health problems related to a suspected indoor environmental condition then they would have to respond, even if the children were not in the health visitors' target group of vulnerable clients. This unforeseen response from the health visitors opened up a possibility that the service might be swamped with additional work if it became known they could conduct an indoor environmental assessment.

There were 47.27 fulltime equivalent health visitors in Plymouth (2007) dealing with 13,503 children under five years old ($13,503/47=287$ each), which equates to 80% of the national average of 358 children per health visitor.²²⁹

An important issue raised was that, however the health visiting service was managed, in reality individual health visitors were in control when taking on new work. One health visitor explained to the researcher that various organisations were always trying to get health visitors to do 'this or that'. Due to the issue of caseloads, the health visitors suggested that two health visitors could be trained to conduct assessments, and be available to work across the city. Ironically, this idea was similar to the original research design for the Feasibility Study,

which was rejected by the second Health Visitor Lead. The concerns about increasing health visiting caseloads because of the reducing number of health visitors indicated in this research, confirms results from other studies.^{229,381,382}

*"It seems that the sheer size of caseloads may inhibit health visitors from developing their educational skills. They have little time to think, to read and to discuss with their colleagues. They may lack time to give a sensitive, thoughtful and responsive service to people. It is quicker to dash in and make a few predetermined points than to give someone the opportunity to identify and develop their concerns. Planning, organising and developing groups also takes time and has to be carved out of a working week dominated by the tasks employers expect to be done"*³⁸²

9.5.3. Support

Any regular professional development programme attended by health visitors requires protected, paid time. Backfill pay and support was to be provided by the PCT, however, there were comments suggesting that this did not materialise or directly supported by management. The 40 hours of authorised backfill pay only accounted for visits, no provision was given for training, preparations for visits, or follow up work. The arrangement of backfill pay is an important part in building the foundations for research and needs to be understood in detail at the outset. The need for another health visitor to cover a colleague's routine work was not envisaged because the assessments were to be tagged on to routine visits. It is not known if taking part in the research had any negative effect on non-participating colleagues who may have had to take on some of the participating health visitors' responsibilities.

9.5.4. Prioritisation of Services

The health visitors' managers highlighted the importance of housing and indoor environmental issues in connection with their clients' health. However, they stressed that housing was currently not a priority within health visiting, whereas other areas such as child protection, obesity, and smoking were. Housing is a priority issue for all services in Plymouth³³² and the health visitors thought the research helped them address this issue. The managers thought the research was related to housing and not parenting, and therefore did not meet health visiting priorities, however, after further discussion they realised there were implications both ways. A reference to parenting should have been included in the original research proposal, as parenting is made harder if parents are stressed or depressed about their living conditions.⁴⁰

The managers were positive about the research during their interviews to the extent that they would refer to the research in their own service reports to the local Teaching PCT. Collaborative working with the University of Plymouth was thought to be useful, as their service had been encouraged to work more closely with academia.

9.5.5. Health Visitors' Changing Roles

The Department of Health has been pushing health visitors to adopt a more 'public health' oriented role and successfully implementing the experiences from this research might qualify as enhancing health visitors' public health roles. Until October 2007,¹¹⁶ the government had not clarified what they expected from health visitors. Thus with poor guidelines of what their role should be and

how it should be executed throughout the research, there is good reason that new activities were avoided if possible by both managers and health visitors.

Health visiting in Plymouth was 'overstretched' according to the management team due to the lack of available qualified health visitors. Pressure was further created on the service by a damning report by the Commission for Social Care Inspection on local children's' services in Plymouth in 2003.³³⁶ Effectively, the health visiting service in Plymouth thought that they were the only professionals safeguarding children. Some of the health visitors highlighted a lack of social service input for vulnerable families and found this restrictive because a disproportionate amount of time had to be spent with families who did not have adequate social service support.

Potentially, if the deep-rooted problems in the health visiting system had become known earlier in the research, it might have been prudent to focus the research on other front line professionals. In the Seattle-King Healthy Homes project, community health workers were trained to assess and advise on the home environment as part of an intensive home visiting study.¹¹³ Community health workers are paraprofessionals trained to provide basic health education to hard to reach families.³⁸³ The use of community health workers in the United States of America to promote home environmental education pre-empts the suggestions made by the health visitors in this study that other professionals in the health visiting skill mix, particularly health visitors' assistants could be trained to advise families about their home environment. Another route would be to use the Home Start outreach programme in the UK, in which volunteers

give advice on parenting.⁹⁷ This would be on a parallel with community health workers.

The planned changes to health visiting would mean that health outreach workers would only be in contact with 'higher risk' families, where a universal service has a progressive approach to such families.³⁷¹ It might well be that such skilled practitioners would find it opportune to understand the quality of the indoor environment when dealing with 'higher risk' families.

9.5.6. Timing of the Research

When the research was originally discussed, none of the stakeholders mentioned any aspects of the suitability of its timing. The main problem with timing was that the research was initiated before both of the interviewed managers were in post. This was why one had not seen the research proposal and why they were both unclear as to what the research entailed. This demonstrates some failure by the researcher to diffuse the study to the health visitors' management, despite repeated written and phone efforts to contact the Health Visitor Lead. It took ten months for the second Health Visitor Lead to decide to participate and tell the health visitors in Plymouth that participating in the research was acceptable. The research was not conducted at an inappropriate time *per se*, since as the managers pointed out, there is never an easy or appropriate time for research involving health visitors. The idea that health visitors are resistant to change has been acknowledged in a National survey of health visitors opinions of the service in 2007.^{237,384}

9.5.7. Lack of Cooperation with other Health Departments

There was a perception that the Teaching PCT and other associated authorities were still missing a joined-up approach to child health care. For example, one of the participating health visitors could not follow up a hospital report issued to her client because no copy had been sent to her, even though a consultant chest physician (from Derriford Hospital, Plymouth) had made suggestions to the client about their home environment and singled out the child's sleeping arrangements. This issue only became known through a conversation with the client. An assessment of the environment in the child's bedroom confirmed the consultant's concerns. The Audit Commission has highlighted this lack of cooperation between government departments.³³⁶

One health visitor suggested that when children in her care come back from hospital with a file note on 'respiratory conditions' she would like to be able to carry out a thorough environmental assessment in the child's home. Such a facility is presently not an option for any health visitor in Plymouth.

9.6. Acceptability of the Concept to Health Visitors' Clients

9.6.1. General

Although monitoring the clients' reactions was not part of the study objectives, understanding how the clients reacted gave a further perspective into how the health visitors reacted. If the clients were negative about an aspect of the study, this was reflected in the health visitors' perceptions. When health visitors witnessed clients following their advice on how to change their indoor

environment, there was a sense of satisfaction, especially when the health visitor had organised a successful referral.

9.6.2. Reaction to Health Visitors Giving Advice

Clients were reassured by the legitimacy of the advice given because it came from their health visitor and because they were part of a study supported in person by the researcher. The fact that the health visitors had already built a rapport with some clients made it easy for the perception of trust to develop about the new information the health visitors were giving their clients.

9.6.3. Clients Understanding of the Indoor Environment

Many of the health visitors' clients lacked knowledge about their indoor environment and how this related to health. From the researcher's observations and from previous experience, householders often think they are very knowledgeable about their indoor environment but are often mis(non)informed. This is particularly so for remedial actions that can be taken to reduce problems as confirmed by the Seattle-King County Healthy Homes Project, which found that participants did not know, for example, that excess moisture could be a health risk and that washing bedding at low temperatures does not kill house dust mites.

9.6.4. Environmental Education

The lack of nursing education on environmental issues has been highlighted internationally and recommendations have been made that nurses should be aware of environmental health issues.^{251,252,253} This study confirmed that health

visitors only had non-propositional knowledge about the indoor environment and thought there needed to be more information in health visiting training.

9.6.5. Reasons for Participation in the Study

The clients' understanding of the research depended on how the health visitors had promoted the research to them before a visit. To overcome the barrier of acceptability to clients, some of the health visitors had 'sold' the request for an extra visit under the pretext that the researcher would be able to help them based on his 'connections'. For the Feasibility Study, the clients should not have agreed to a visit on the assumption that the health visitor and the researcher would side with them when addressing a landlord about perceived indoor problems, because, these might not have had anything to do with the quality of the property.

9.6.6. Relevance of the Research to Clients

The health visitors perceived that the research was relevant to their clients, however, there was a concern that when the clients did not get what they wanted from the assessments the health visitors thought that they did not find it relevant. In nearly all cases, clients wanted to know why certain problems constantly reoccurred in their homes despite sometimes actively taking precautions to pre-empt the problem.

9.6.7. Clients use of the Advice Given

There were mixed messages about whether the clients took onboard the advice offered during the assessments. Getting even a small percentage of participating clients to change something in their daily life would be a major step

forward, although that was not an aim of this study. The health visitors did not routinely revisit their clients after visits; therefore, there was no way to measure the take-up of advice.

In a child health clinic, mothers are inclined to ask the health visitors about 'other' topics, even though they had attended the clinic primarily for other reasons.⁹⁸ Clients appreciate advice given by health visitors during house calls.⁹⁸ These outcomes justify both health visiting as a service, and enable health visitors to address additional subjects such as the indoor environment.

Health visitors may be particularly successful amongst many front line health professionals in promoting behavioural change because they share community, culture, and life experiences and are readily welcomed into most homes.¹¹³ In the Feasibility Study, the health visitors were encouraged to use an individualised approach to address each client's most pressing concerns about their home. The results of the Feasibility Study indicated that clients react well to individualised education provided in their own homes, tailored to their own lifestyle, if presented by someone they know and trust. This correlates well with previous research, which found that householders would make changes to their home if given advice following an assessment conducted in their home.^{86,113} Some clients do not take up advice offered, because of cost, work involved, lack of motivation, failure to remember the recommendations, and procrastination.⁸⁶ In the Feasibility Study, clients had not taken up advice for very similar reasons particularly lack of money. The cost of an intervention is very important in terms of take up of advice,³⁸⁵ which is why each intervention suggested to the health visitors was carefully considered and priced.

9.6.7. Impact on Client - Health Visitor Relationship

The health visitors were aware of protecting their special relationship with their clients and where they had new clients, not doing anything to upset them before establishing a relationship. The researcher observed that some of the health visitors would not venture into discussing what they perceived to be contentious issues brought up during an assessment. Health visitors are known to carefully balance the care and advice they give against an immediate need to intervene, to ensure a continued client relationship.²⁴⁵

People being observed do not behave normally,³⁸⁶ therefore, it is likely that the presence of the researcher may have had some influence on the responsiveness of the clients to what the health visitors were saying. There might have been a Hawthorne effect³⁸⁷ through the involvement of the clients in the research and potentially the clients reacted positively to the concept because they thought that was what their health visitor wanted.

9.6.8. Clients' Perceptions of Intimidation

Most of the health visitors suggested that the clients were not intimidated by the assessments provided the results from an assessment were passed over sensitively. The researcher's approach of having to 'step in' when the health visitors were unwilling to expose client-generated difficulties with their indoor environment was not an intended issue of the research, but became one. In some cases, the researcher's direct approach was successful. Although the researcher went into the clients' homes purely for research purposes, this did impose on client privacy and the health visitor's working environment.

Sensitivity is a central issue for health visitors and they are taught at all costs to take a non-judgmental approach when working in the community.

The problems of working with the researcher were very specific to this research and a one-off situation. If the concept were routinised, the health visitors would conduct assessments on their own. However, at this stage of the research, the health visitors' comments about the difficulties in getting clients to allow the researcher into their homes and the understanding of the researcher's role all has had an impact on the health visitors' views about the research. Importantly the presence of the researcher allowed the participant observation part of the study to take place. Ethically all advice given to the clients had to be sound with ultimate responsibility resting with the researcher.

9.6.9. Ethical Issues

There were no major ethical issues raised about the Feasibility Study or future implementation of the concept. The health visitors thought that monitoring the indoor environment would add no more ethical issues than they dealt with already. However, one issue was that it could be considered unethical to raise clients' expectations about the outcomes of an indoor environmental assessment by the very process of conducting an assessment. The health visitors thought some of their clients had agreed to participate because they wanted a problem resolved. This links into the barrier that the health visitors had to overcome in approaching their clients and saying that their indoor environmental problems were not really the fault of the landlord but due to their own behaviour in the home. This is more a failing of the design of the Feasibility Study than of the original concept itself in that the potential outcomes

of an environmental assessment should have been made clear to all involved from the very outset.

Caution should be taken when asking health visitors to implement the concept in the future. Research has shown that agencies that try to get health visitors to adopt new activities fail to identify the extent to which these would compromise the ethical basis for health visitors' defined role, particularly in terms of the voluntary nature of the health visitor's access to the home compared to how other workers are perceived.²³⁶ This was confirmed in this research as the health visitors suggested that monitoring the indoor environment stepped over their normal boundaries in terms of requiring access to bedrooms.

9.6.10. Passive Smoking Advice

During the Feasibility Study, the health visitors requested more information and explanation of the subject of passive smoking and the spread of environmental tobacco smoke throughout a home. This interest was raised during the classroom training when the researcher was justifying the use of the particle counter in the gold standard tool kit. The health visitors were interested in plausible arguments to convey to their clients about why smoking should only take place outdoors. The questions the health visitors posed were:

- 1) How could they explain that smoking in another room away from a child will not prevent exposure?
- 2) Was there any evidence of how the spread of environmental tobacco occurs?

The issue of smoking indoors was one subject where the health visitors knew that although their clients denied smoking indoors, when the health visitor had left, their clients' old habits returned. To help health visitors explain some of the problems with environmental tobacco smoke an article was written and published in *Community Practitioner* (Paper 6).

9.7. Acceptability to Health Visitors and their Managers

Overall, the health visitors and their managers found the concept of monitoring and advising on their clients' indoor environments acceptable. Whilst the acceptance of the concept was offered with some conditions, the acceptance in principle was an important finding and was a positive answer to the overall research question.

There was a general sense that having a tool kit and giving recommendations for remedial actions was useful to the health visitors and their clients. The health visitors were empowered by the improvement in their knowledge and were able to give reliable referrals for housing improvements. The increase in their knowledge base also gave them confidence in giving advice when the source of the problem was the client's lifestyle.

One concern with the concept and its application within health visiting is that any work on the indoor environment should not replace or detract from a health visitor's traditional work. Practising the concept must not affect health visitors' prioritisation of tasks. Clients were often transitory and therefore it might have seemed a waste of time and effort on the part of the health visitors helping a family improve their indoor environments, when they should be concentrating on

the physical or mental health of individuals. However, the Feasibility Study showed that their own interpretation of vulnerability included living in poor quality indoor environments.

The managers can influence the decision of commissioners, and requested an assessment to understand the impact on people's quality of life after the health visitors had made recommendations. This was originally the plan of the research in that the first stage of the research was designed to find out whether the health visitors found it acceptable and whether it was feasible. Then a full study of the impact of the concept on clients' lives would be proposed. The potential health outcomes are very important and obviously any commissioner would need evidence of the health benefits if the concept were to be rolled out. Although it was not a proposed outcome of this work, the health visitors thought that the lack of a designated follow-up of the environmental assessments was a problem and suggested that a way of getting feedback from the clients should have been set up for the health visitors. They needed evidence to show that their extra efforts had been appreciated, worthwhile and produced benefits for their clients. The paper 'Our Health, Our Care, Our say' suggests that success can be judged by the tangible benefits achieved for the people that services are designed to serve.¹³² In general, the health visitors' managers were very positive about the research and could see the concept being carried on in Plymouth in some form.

9.8. Additional Outcomes

Full national adoption of home visiting health professionals monitoring the indoor environment could help build national information how the indoor environment influences the development and health of children. Evaluation of the indoor environment by professionals with access to homes may provide a chance to assess (with little cost) the country's housing stock over a long period. In the future, health professionals who have trained as suggested, could bridge an identified knowledge gap^{11,51,388} in providing reliable evidence on the status and quality of housing and lifestyles. Currently, there is a lack of clarity about which branch of home-visiting professionals is responsible for the quality on the indoor environment provided for young children. Unfortunately, home visiting in the health profession is reducing. This gap has started to be addressed in the United States of America, with the launch of the National Children's Study, which is tracking, among other parameters, how the indoor environment effects health and development of more than 100,000 children across the country from before birth until age 21.³⁸⁹

Chapter 10. Conclusions and Recommendations

(Soft Systems Methodology Stage 4)

10.1. Conclusions

The aim and objectives of the research were met. The study has added to knowledge, in that the acceptability and feasibility of health visitors working with their clients to assess health-determining aspects of their clients' home environments and to provide evidence-informed messages about the indoor environment is now more clearly understood.

Although the concept was acceptable to health visitors, their clients, and their management, many issues reduced the feasibility of the concept being put into practice, or researched further without changes. A reiteration of the Soft Systems Methodology cycle is recommended.

The results from this research were very encouraging; four of the five interviewed health visitors were positive about the concept of monitoring the indoor environment in their clients' homes and providing evidence-informed messages about their indoor environment. Participation in the study increased health visitors' understanding of health-determining aspects of the indoor environment.

The concept was not applicable or required for every visit made to a child's home. For health visitors to accept the concept and methods, a number of barriers need to be accounted for and addressed in any further research.

A positive outcome from the research was that none of the stakeholders refused the possibility of health visitors carrying tool kits in some format. During the interviews, the health visitors' managers talked about when the concept is implemented rather than if. The results from the Feasibility Study have not ruled out a randomised control trial of the efficacy of the concept in the future. One of the recommendations from the managers was that an evidence-based trial was necessary before any general adoption of the concept. A strong evidence-base would be important for commissioners and the National Institute for Health and Clinical Evidence. The results from the Pilot and Feasibility Studies have provided a strong basis for recommendations for further research on the subject of educating householders about their home environment, and health on a one-to-one base. Figure 13 shows how the diffusion process would look if the concept was diffused to health visiting through an authoritative innovation-diffusion process (according to Rogers⁹⁴).

This research has shown a potential way of providing evidence-informed messages about health-determining aspects of the indoor environment to families irrespective of the standard of the home. Misunderstandings about the source of an indoor environmental problem (i.e. is it related to housing conditions or lifestyle) occur both in the health visiting profession and families. Although the indoor environment is a recognised source of health issues, health visitors are currently not provided with enough information during their nursing or health visiting training.

10.2. Principal Recommendations for Continued Research

10.2.1. Main Recommendation for a Further Study

To progress the research, it is recommended that ten health professionals who regularly make home visits, could be recruited to receive full classroom training as outlined below (10.2.2.) and each be supplied with one piece of monitoring equipment (shown in Figure 12). They would choose their own clients and each conduct 20 unsupervised environmental assessments. When each participant had completed their assessments, copies of their data collection sheets and information of any recommendations given would be sent to an environmental assessor for evaluation. It may be useful for the environmental assessor to conduct random assessments in a number of homes (with the client's consent) to verify the accuracy of the health professional's assessments. The results of this proposed research would be discussed with stakeholders. If positive outcomes were achieved, actions would be suggested for testing the concept in a randomised control trial to determine the health benefits of the concept.

Although this would be the main recommendation for further research, based on the suggestions from the interviewed health visitors, there are alternative models that could be used, as described below.

10.2.1.1. Model 1

A select few health visitors would be trained as local 'experts' in the subject of indoor environmental science and health problems. They would each be supplied with a tool kit and could be called upon by other health visitors requesting an environmental assessment. They would still carry out their

traditional, albeit limited, health visiting work alongside their specialist duties throughout the trial period and then reintegrate into the local health visitor service.

10.2.1.2. Model 2

10.2.1.3. Model 3

Health visitors may not be the best option for promoting indoor environmental awareness because of problems highlighted in this research. Therefore, other professionals within the skill mix of workers associated with health visiting and community health, such as health visitors' assistants could be engaged.

Preferably, model 3 would be used because although health visitors found the concept acceptable and seemed the ideal candidates there may have been too many highlighted issues surrounding them to ensure their involvement in further research.

10.2.2. Detailed Changes

If further research was implemented, there are detailed recommendations to be considered concerning training, information, and the tool kit:

- Classroom training should take place in a formal lecture type setting over two days. The chosen professionals should be given theoretical and practical tuition in the use of the tool kit. The practical, or field training needs to take place away from clients

- An assessment at the end of the classroom and field training is necessary to ascertain knowledge retention and confirm that the health professional is ready and confident to give advice on the quality of the indoor environment
- Similarly, for the field training, a practical assessment of ability to monitor and give advice is required
- Written information to be provided as part of the training and any given to clients must be simple and short
- The health professionals' management team needs to be fully engaged in the training content and attend some training sessions. The commissioners for children's services need to be involved in the research from the outset
- Awareness training for other stakeholders to be offered. It would be useful to make others in the skill mix aware that if they are treating children with respiratory problems, there may be someone available to assess the child's home environment. This would require a defined follow-up system so that all parties involved in a child's welfare were aware of incidences such as hospital admissions for respiratory problems

There is presently no reason to change the variables that have been measured for this study since no new science has been uncovered to suggest other variables or recommend different limit values. However, the health visitor's ability to use the tool kit and their responses in the interviews suggests changes need to be made:

- A more succinct data collection sheet is needed (to allow direct electronic data entry)
- An assessment should only take 15 minutes

- A standardised report format needs to be developed for referrals that is easily recognisable by landlords
- The tool kit measuring instruments need to be reduced to one piece of equipment like the unit shown in Figure 15

APPENDIX I: FIGURES

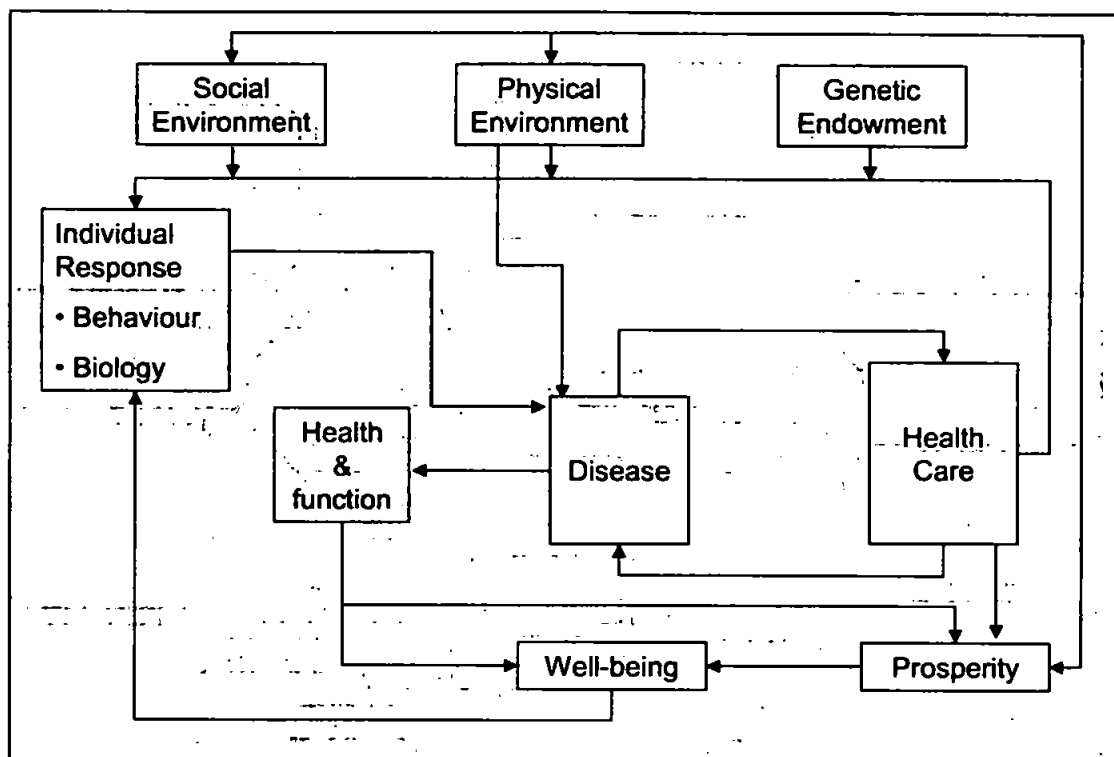


Figure 1 Evans-Stoddart Model (Evans & Stoddart¹⁴)

Evans & Stoddart (1977) proposed a model of health and disease that links to the 'Health Determinants' model.

© Evans & Stoddart

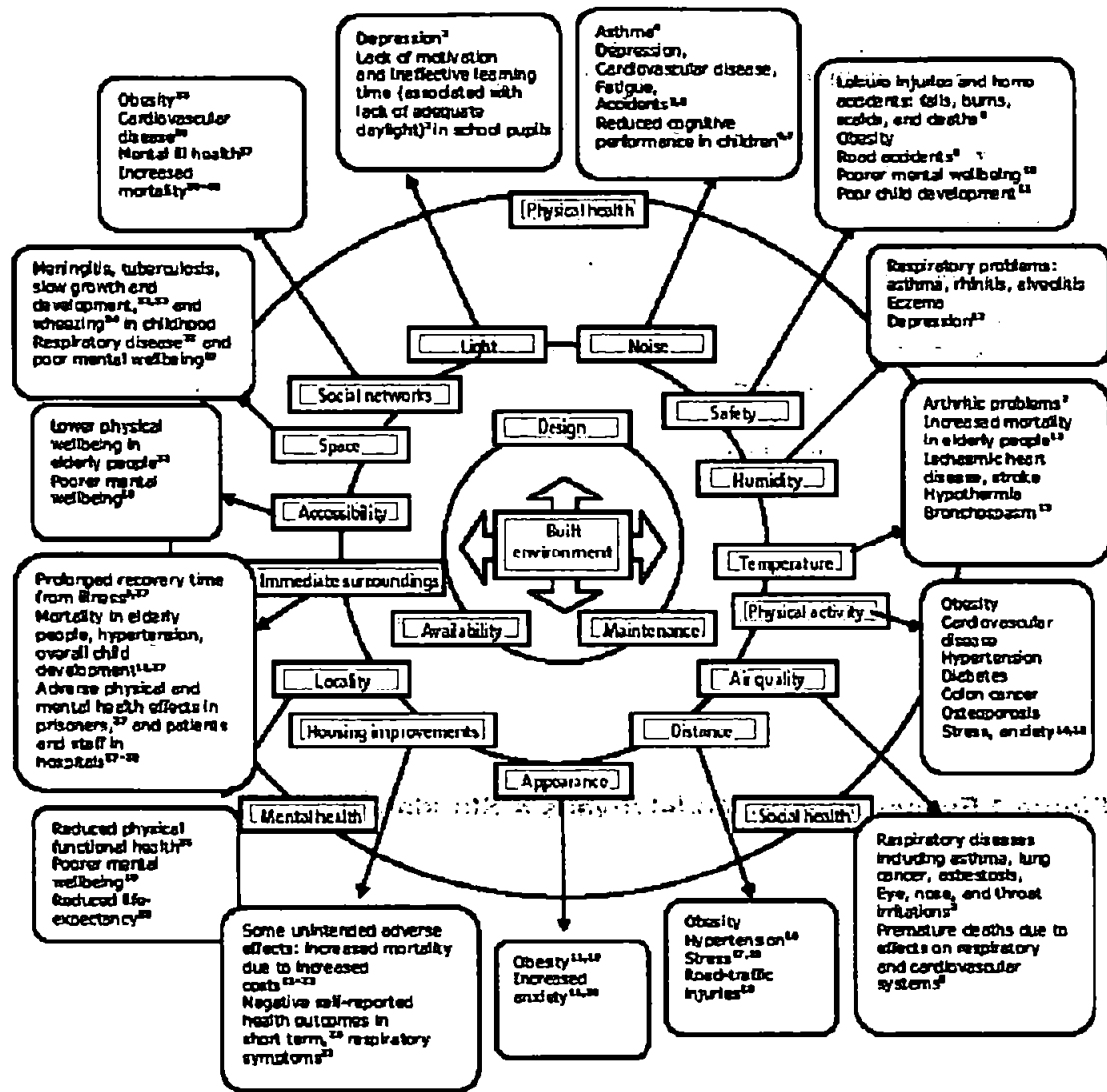


Figure 2 Health Problems and Potential Links to the Built Environment (Rao et al.⁹)

	Qualitative	Quantitative
Social theory	Action	Structure
Methods	Observations, interviews	Experiments
Question	What is x? (Classification)	How many xs? (Enumeration)
Reasoning	Inductive	Deductive
Sampling method	Theoretical	Statistical
Strength	Validity	Reliability

Figure 3 Comparisons of Qualitative and Quantitative Methods (Pope & Mays¹⁷⁴)

Variable	Exacerbation (the onset or worsening of symptoms in someone who already has developed asthma)	Development (the initial onset of the illness in someone who has not previously been diagnosed as having asthma)
House dust mite allergen (<i>Der p 1</i>)	✓	✓
Cat allergen (<i>Fel d 1</i>)	✓	
Environmental tobacco smoke	✓	
Cockroach allergen (<i>Bla g 1</i>)	✓	
Dog allergen (<i>Can f 1</i>)	✓	
Mould	✓	
Nitrogen dioxide, Nitrous oxides	✓	

Figure 4 Variables Associated with Asthma (Institute of Medicine²¹)

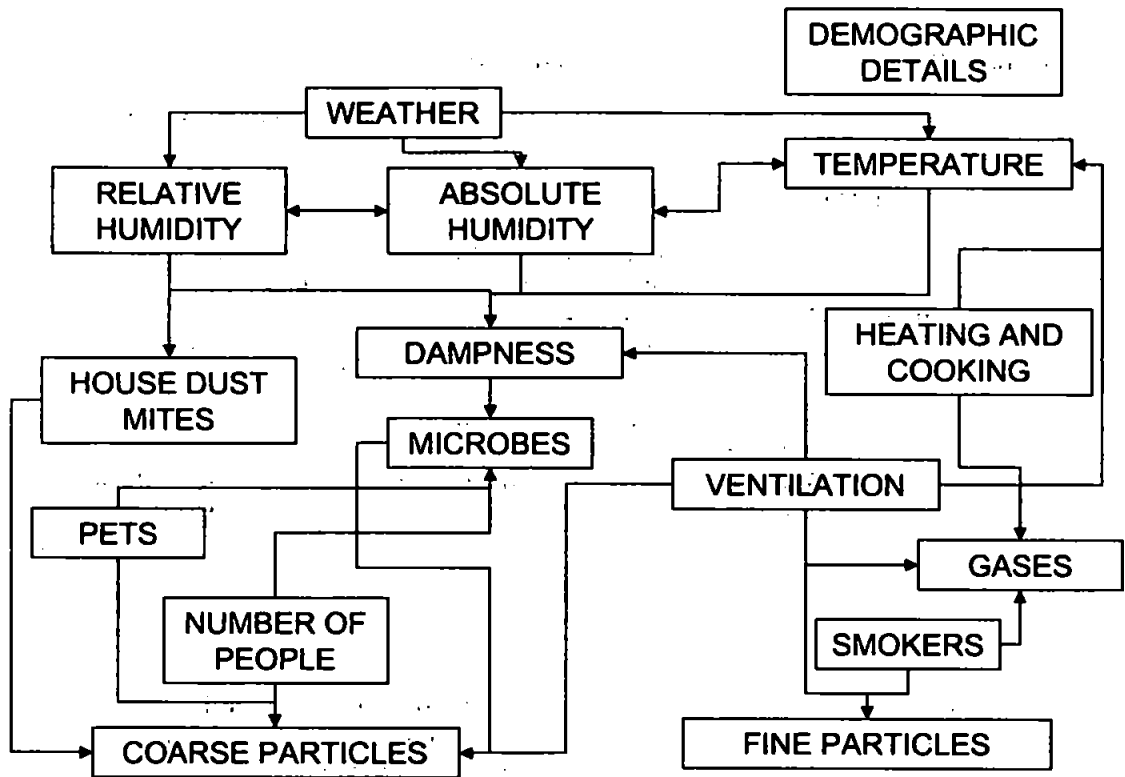


Figure 5 Interactions Between Indoor Environmental Variables

Figure 5 illustrates the complex interactions between various indoor environmental variables. The diagram shows how external factors like weather and demographic details influence indoor temperature and humidity. These factors, in turn, affect the presence of dampness, microbes, and dust mites. Human activities such as heating, cooking, and smoking contribute to the levels of gases and fine particles. The number of people and pets in the space also significantly impacts the concentration of coarse particles. The diagram highlights the interconnected nature of these variables, where changes in one can lead to changes in others, creating a dynamic indoor environment.

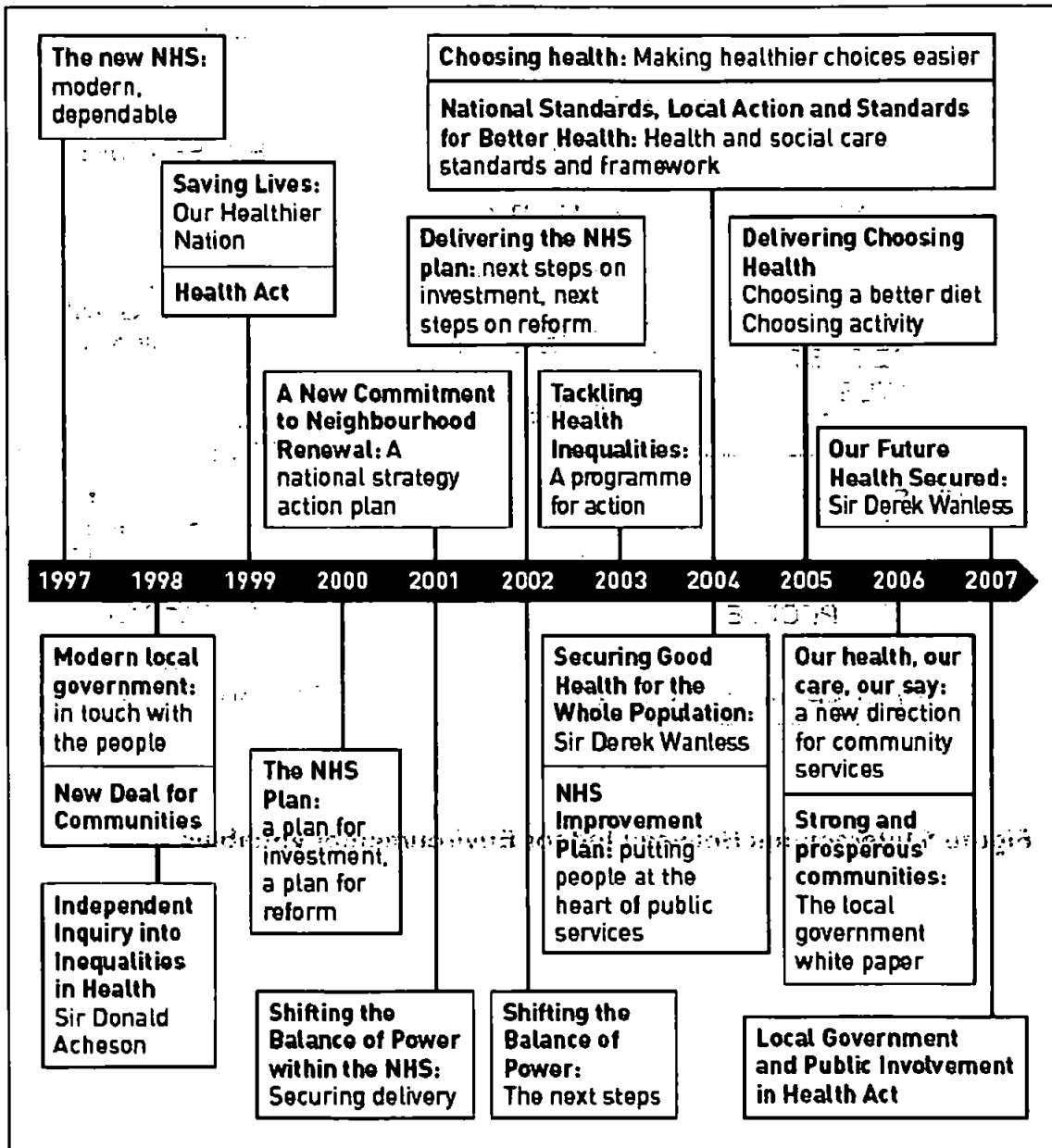


Figure 6 Legislative Framework and Supporting Documents Since 1997

(Commission of Health Care Audit and Inspection²⁶⁹)

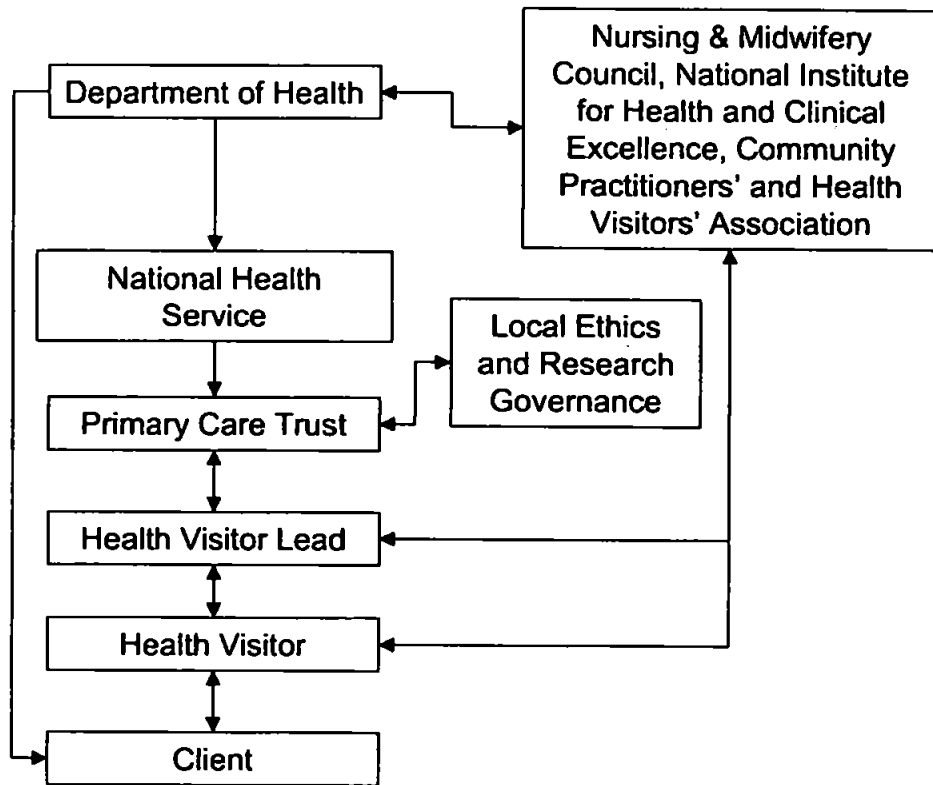


Figure 7 Organisational System of Health Visiting

CASE COMPLEXITY	Range of familiar cases	Well-defined problem, clear parameters	Ill-defined problem without clear parameters
Type of response	Standard or adapted plan to match diagnosis	Develop plan and fine tune to match case and context	Series of small decisions, search for new responses
Level of support	Adequate for purpose	Time pressure limited resources	Limited expertise
Communication with clients	Based on experience with previous clients	Communication seen as part of the problem	Eliciting wider, more detailed information. Joint problem solving.

Figure 8 Typology of Method (Eraut³²²)

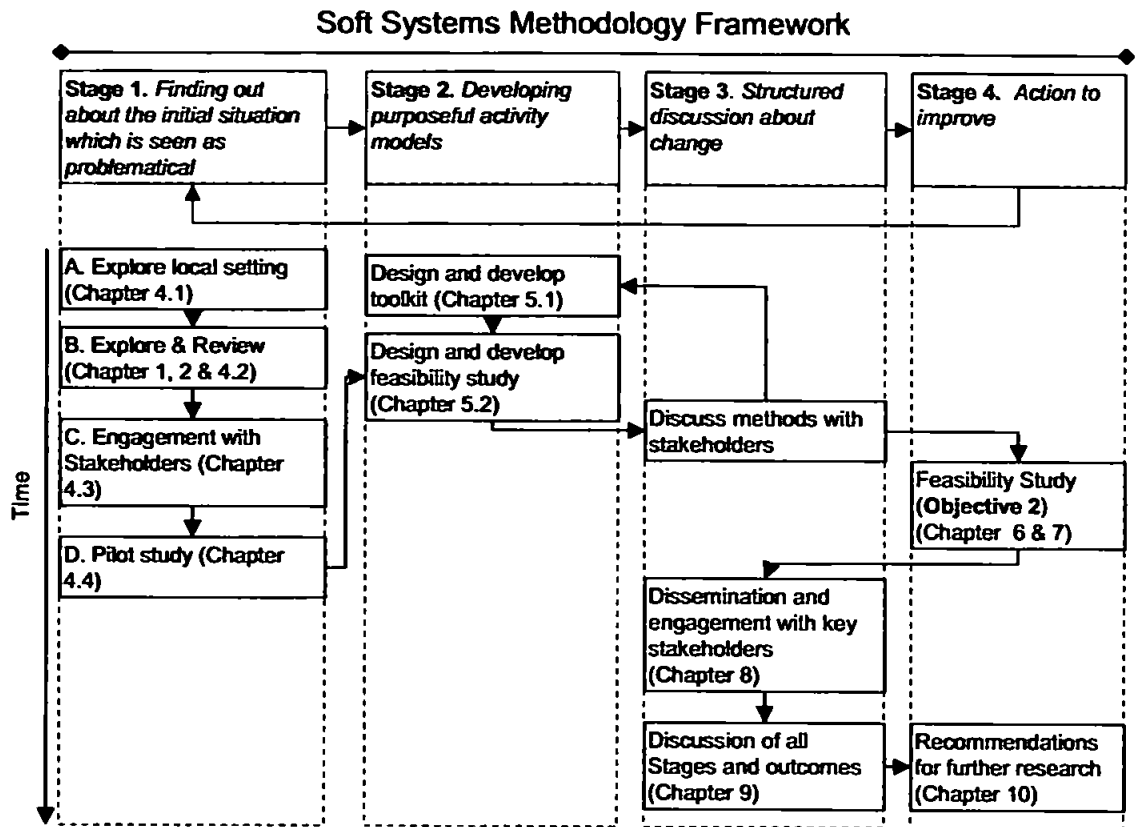
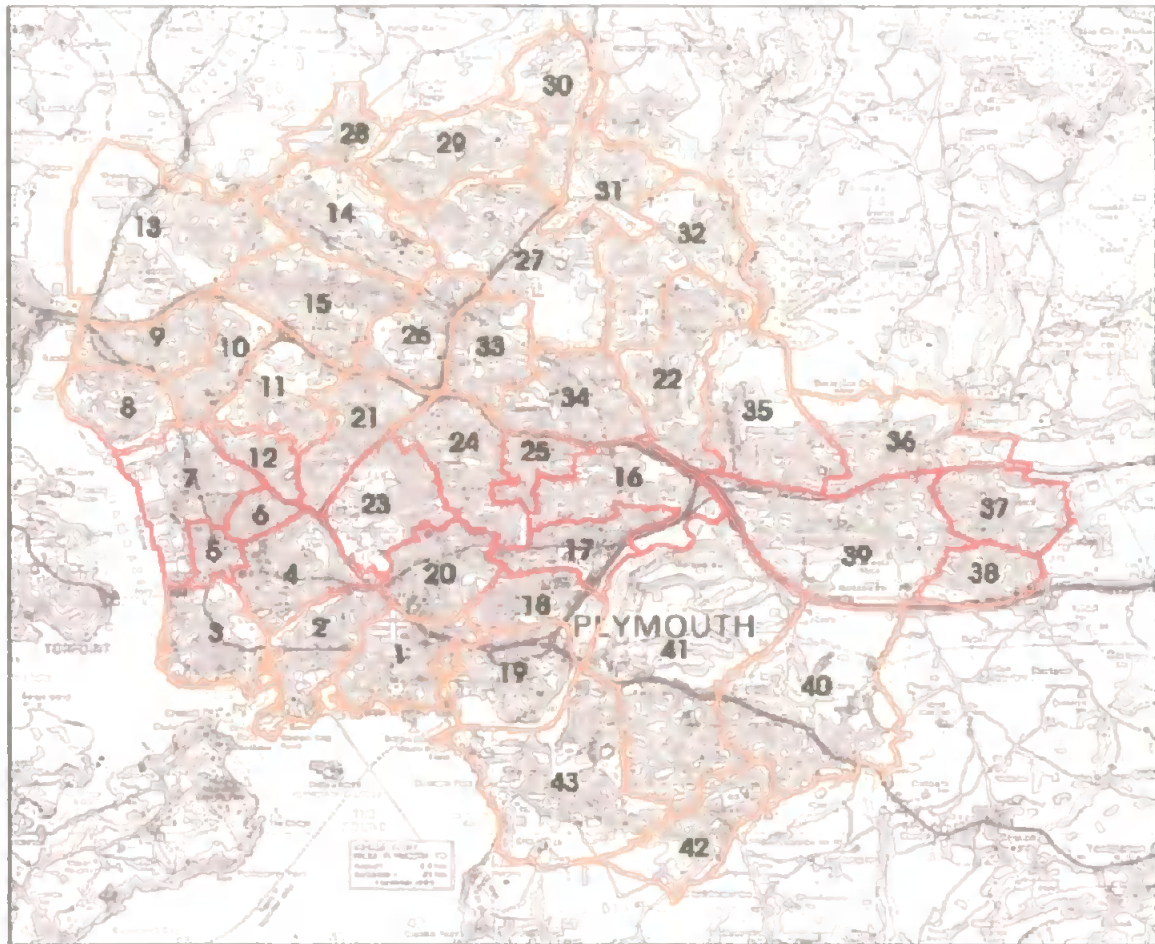


Figure 9 Research Approach within a Soft Systems Methodology Framework

Plymouth Neighbourhoods



- | | | |
|-----------------------------------|-----------------------------|--------------------------------|
| 1. City Centre | 16. Efford | 31. Glenholt |
| 2. Stonehouse | 17. Lipson & Laira | 32. Estover |
| 3. Devonport | 18. Mount Gould | 33. Crownhill |
| 4. Stoke | 19. East End | 34. Egguckland |
| 5. Morice Town | 20. Mutley & Greenbank | 35. Woodford |
| 6. Ford | 21. Beacon Park & Pencyross | 36. Colebrook & Newnham |
| 7. Keyham | 22. Leigham & Mainstone | 37. Chaddlewood |
| 8. Barne Barton | 23. Peverell | 38. Yealmpstone |
| 9. St Budeaux | 24. Hartley & Mannamhead | 39. Plympton St Maurice |
| 10. King's Tamerton & Weston Mill | 25. Higher Compton | 40. Elburton & Dunstone |
| 11. Ham | 26. Manadon | 41. Plymstock |
| 12. North Prospect | 27. Derriford | 42. Goosewell |
| 13. Ernesettle | 28. Tamerton Foliot | 43. Turnchapel, Hooe & Oreston |
| 14. Whiteleigh | 29. Southway | |
| 15. Honicknowle | 30. Widewell | |

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Figure 10 Map Representing Plymouth Neighbourhoods (Plymouth City Council³⁹⁰)

Area	Percentage of homes health visitors designated as 'poor housing' in 2006
Devonport	29%
North Prospect	27%
East End	15%
Barne Barton	15%
Keyham	14%
Honicknowle	13%
Ernesettle	13%
Stonehouse	12%
Morice Town	12%
St Budeaux	12%
Whitleigh	12%

Figure 11 Highest Percentages of Poor Housing in 2006 (Nelder¹⁰²)

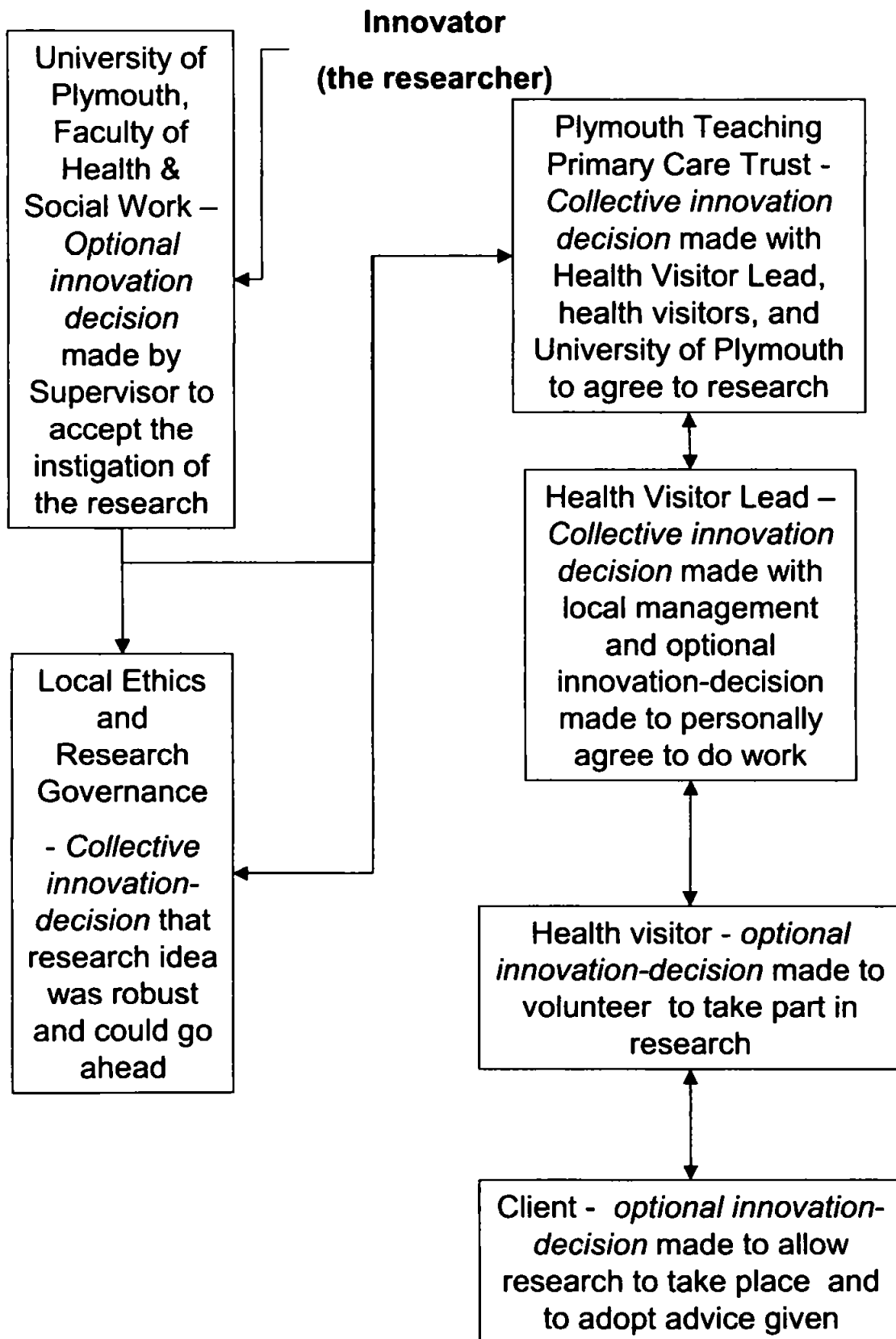


Figure 12 Diffusion of the Research Innovation

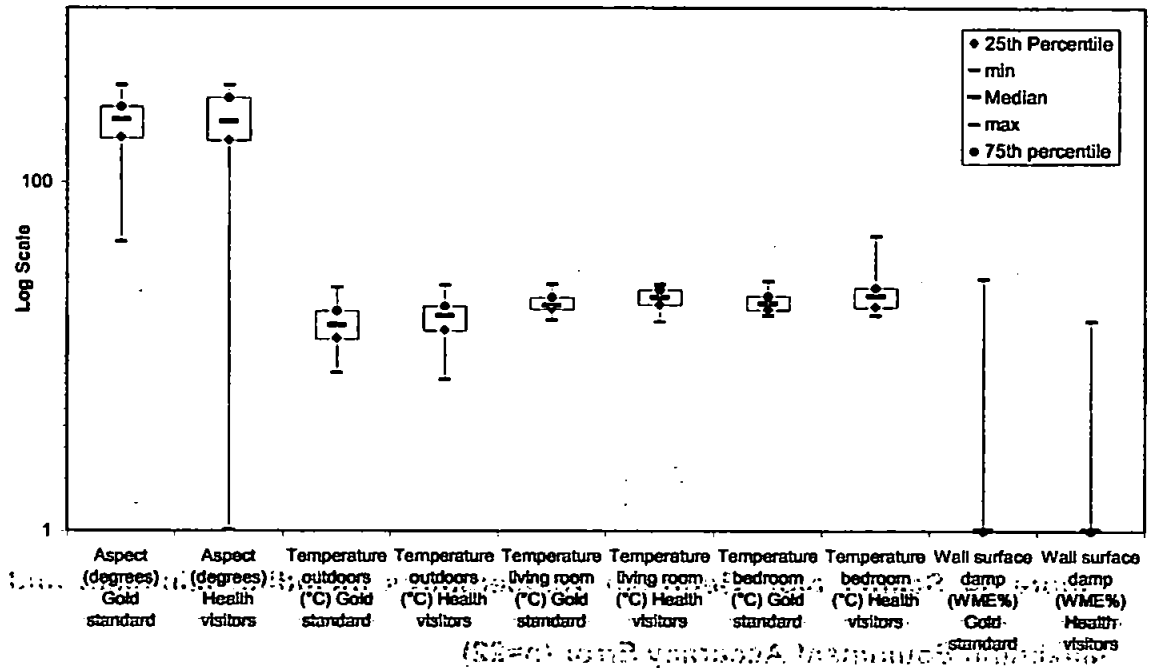


Figure 13 Boxplot: Aspect, Temperature, and Wall Surface Damp

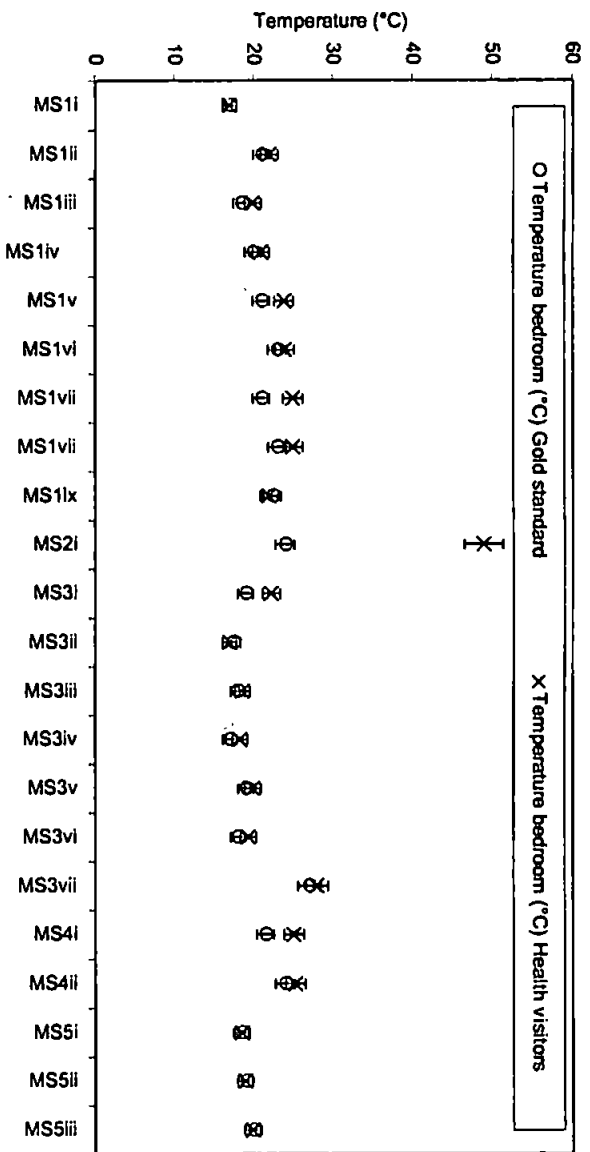


Figure 14 Scatter plot: Bedroom Temperatures Including Minimum and Maximum Equipment Accuracy Error (n=22)

Figure 14 Scatter plot: Bedroom Temperatures Including Minimum and Maximum Equipment Accuracy Error (n=22)

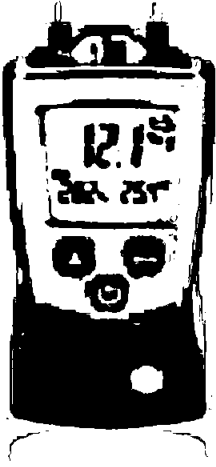
	<p>Testo 606-2 (Testo Ltd, Hampshire, UK) built-in moisture (damp) measurement and air thermometer</p> <p>Weight 92 g Length: 118 mm Depth: 22 mm Width: 45 mm</p>
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Figure 15 Recommended Instrument for Tool Kit

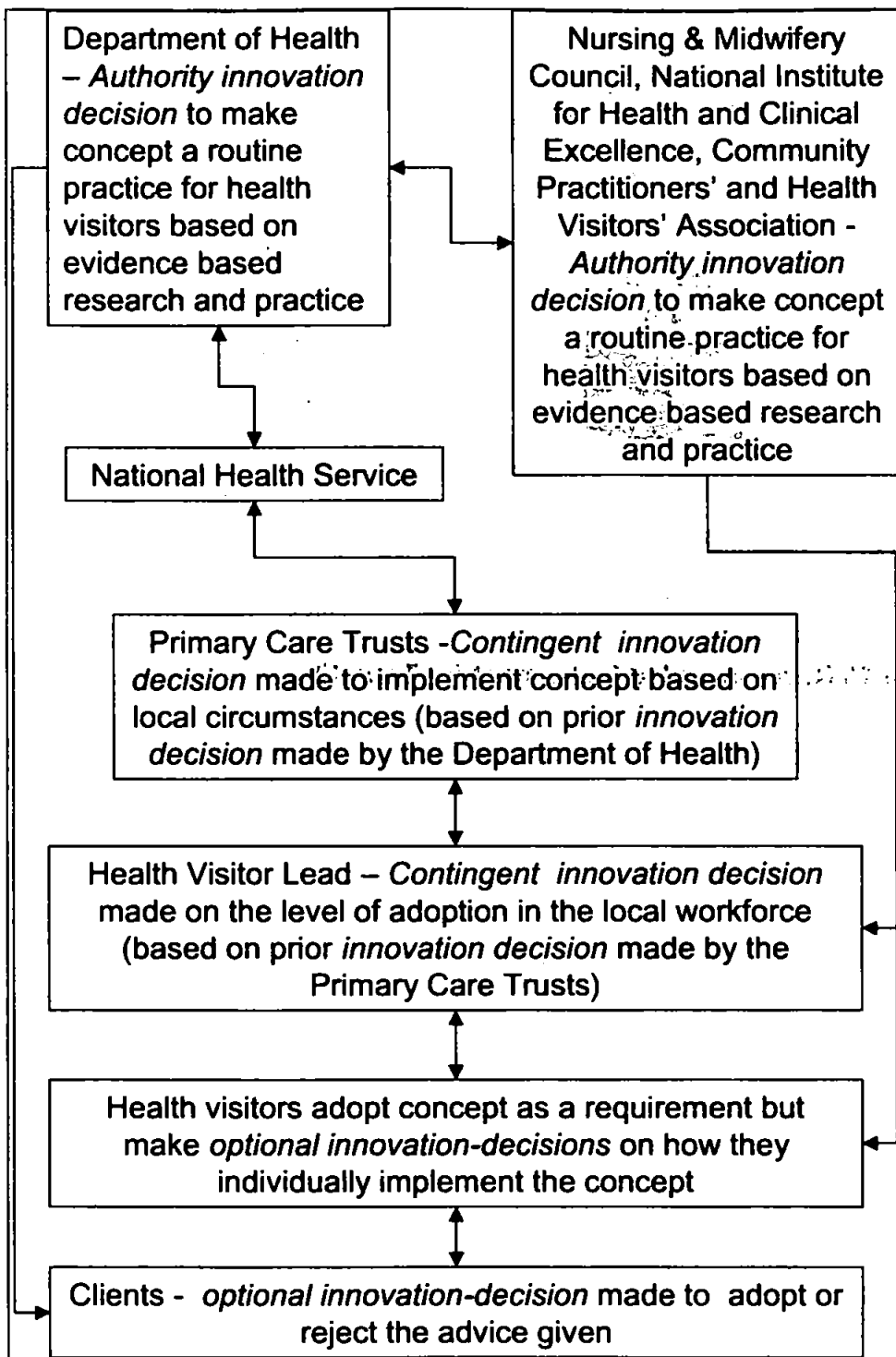


Figure 16 Diffusion of the Concept Innovation

APPENDIX II: TABLES

Pollutants	Sources	Health Effects
Animal allergens	Pets: cat (<i>Fel d 1</i>), dog allergen (<i>Can f 1</i>) and other furred/ feathered pets. Pests: such as mouse (<i>Mus m 1</i>) and cockroach allergen (<i>Bla g 1</i>).	Allergic symptoms, including irritation of the eyes and airways.
Bacteria and viruses	Human and pet sneezing, coughing, saliva, and dander. Food and standing water.	Viruses: for example, influenza and mumps. Bacteria: for example, pneumonia, bronchitis, and whooping cough. Gram-negative bacteria produce endotoxins [†] , associated with lung disease.
Carbon dioxide	Metabolic gas (exhaled breath). Combustion including smoking.	Causes health effects at high concentrations not usually found in homes.
Carbon monoxide	Heating and cooking appliances – caused by incomplete combustion and poor ventilation.	Combines with haemoglobin and reduces oxygen flow. High doses can affect cardiac activity, leading to death.
Humidity	Dependent on temperature, sources of water vapour, and ventilation.	High humidity decreases positive perceptions of air quality and increases the risk of mould, bacteria, and mites. Dry air affects people with breathing disorders.
Mites	Soft furnishings, pets, and stored food.	Mites produce allergens, which cause lung irritation and other allergic reactions.
Mould	Water damaged building materials caused by leaks or condensation leading to dampness, soil of potted plants, and outdoor air.	Allergic reactions. Some mould spores are highly toxic, for example, the mould <i>Aspergillus</i> causes the lung disease aspergilliosis.
Nitrogen dioxide	Heating and cooking appliances, especially from incomplete combustion, poor ventilation.	At high concentrations, it causes lung damage and interferes with blood transport.
Ozone	Heating and cooking appliances, especially from incomplete combustion, poor ventilation.	Irritation of the eyes and respiratory system.

Table 1 Major Health-Determining Indoor Environmental Variables

* Gram-negative bacteria – bacteria that do not dye purple according to Gram's method

† Toxin present in bacterial cell walls released after gram-negative bacteria have died

Pollutants	Sources	Health Effects
Fine particles (respirable)	Combustion, smoking, outside air, building materials for example, asbestos.	Cause serious irritation of the airways. In extreme cases leads to asthma and lung disease.
Coarse particles (inhalable)	Abrasion of fabrics and surfaces. Carried indoors on humans and pets.	Cause irritation of the upper airways and eye irritation.
Pollen	Outdoor and indoor plants.	Hay fever and other allergies.
Radon	Inert gas from soil and rocks. Seeps into a home through cracks.	The progeny of radon get into the lungs on particles and are carcinogenic.
Sulphur dioxide	Heating and cooking appliances, especially from incomplete combustion, poor ventilation.	Can cause broncho-restriction in asthmatics.
Temperature	Dependent on location, building, and heating.	Cardiac and respiratory problems increase below 16 °C.
Volatile organic compounds	Soaps, detergents, air-fresheners, paints, disinfectants, smoking, off gassing from new furnishings, building materials, pesticides, and cooking.	Irritation to the eyes and airways. Linked to lung cancer. Exposure to formaldehyde above 1 part per million can cause coughing and wheezing.

Table 1 Continued

Study Number	Neighbourhood	Completed at least one visit	Number of visits	Reason for not conducting visits
PS1	Southway	1	3	n/a
PS2	East End	1	3	n/a
PS3	Estover	0	0	New to health visiting
PS4	Estover	1	1	n/a
PS5	Stonehouse	1	6	n/a
Total		4	13	

Table 2 Health Visitor Participation (Pilot Study)

Instruments & questions (Q)	Item	Components	Size (mm)	Weight (kg)	Cost*
Digital temperature/humidity pen (model PTH-1XA, Omega Engineering, UK). Accuracy: humidity $\pm 5\%$ from 5-95% at 25 °C; ± 1 °C from -10 to 45 °C	1	1. Temperature (°C) and 2. Humidity (%)	175 x 42 x 16	0.053	£50.00
Damp meter (Surveymaster, Protimeter Plc, UK). Accuracy $\pm 1\%$ at -10 to 45 °C. Q. Is there any visible mould or damp in the home?	5	3. Damp (wood moisture equivalent WME%)	230 x 135 x 85	0.63	£150.00
Q. How many people were present before and during the indoor environment assessment?		4. Number of people who regularly sleep in house	n/a	n/a	£0.00
Q. How many pets are there and what type are they?		5. Number of pets	n/a	n/a	£0.00
Compact 700 W Vacuum Cleaner (Princess Turbo Tiger 2755, Netherlands) filter material 120 x 120 mm (Vilene, Vileda.), card squares 50 x 50 mm, cellophane bag, cello tape. Q. Does the home have carpets? Are there any anti allergen covers on bedding etc. Do your clients air their beds?	6 & 7	6. House dust mite allergen	270 x 160 x 120	1.5	Vacuum cleaner £40.00 Filter and storage material @ £0.07 Analysis [†] £32.00 per sample
Agar slides (Hygicult-TPC, Orion Diagnostica, Finland) Q. Is there any visible mould or damp in the home?	4	7. Airborne microbes			£1.50 per slide Analysis £5.00 per sample

Table 3 Specifications of the Simplified Tool Kit

* The cost of consumables and sample analysis are dependent on usage

† Mite allergen: detected using monoclonal antibody enzyme linked immuno-sorbent assays

Instruments & questions (Q)	Item	Components	Size (mm)	Weight (kg)	Cost
Q. Are there pot plants in the house, especially in the client's bedroom?		8. Plant related microbes	n/a	n/a	£0.00
Q. Is there any mechanical ventilation, passive vents, are any windows open?		9. Carbon dioxide	n/a	n/a	£0.00
Q. Are there new carpets and soft furnishings? Do they use lots of air fresheners and cleaning products?		10. Volatile organic compounds	n/a	n/a	£0.00
Q. How many smokers regularly smoke indoors?		11. Particles	n/a	n/a	£0.00
Rainfall, wind direction, wind speed, temperature		12. Weather data	n/a	n/a	£0.00
As for 9. Carbon dioxide		13. Ventilation	n/a	n/a	£0.00
Compass (for aspect) Q. How old is their home; what type of house; how is house heated	2	14. Information about the dwelling	85 x 50 x 10	0.029	£3.00
			Total	2.2	£243 plus £38.57 per visit

Table 3 Continued

* The cost of consumables and sample analysis are dependent on usage

Study Number	Neighbourhood	Classroom training session	Completed at least one visit*	Number of visits conducted	Number of completed sheets
MS1	Southway	One	1	9	9
MS2	Keyham	One	1	9	9
MS3	Stonehouse	One	1	1	0
MS4	Mutley/ Mount Gould	One	1	3	0
MS5	Stonehouse	None	1	2	0
MS6	Keyham	None	1	1	0
MS7	Compton/ Mannamead/ Efford	Two	1	3	3
MS8	Stonehouse	None	0	0	0
MS9	Tamerton Foliot	Three	0	0	0
MS10	Honicknowle	None	0	0	0
MS11	Southway	None	1	1	1
	Total	3	8	29	22

Table 4 Health Visitor Participation (Feasibility Study)

* A visit: when the health visitor was accompanied by the researcher and conducted an environmental assessment

Health Visitor	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
MS1			2	2	5								9
MS2	3				1		1			1		2	8
MS3											1		1
MS4			3										3
MS5							1			1			2
MS6						2							2
MS7						1						2	3
MS11						1							1
Total visits	3	0	5	2	6	4	2	0	0	2	1	4	29

Table 5 Spread of Visits by Month

Non-categorical	Polychotomous Categorical	Dichotomous Categorical
Aspect (°)	Number of smokers (0; 1; 2; 3 or more)	Presence of visible mould or damp? (1=Yes; 0=no)
Number of people present during measurements (n)	Type of pets (0=none; 1=fish/reptiles; 2=rodents/birds; 3=cats and dogs)	Microbial sample collected in the bedroom and outdoors? (1=Yes; 0=no)
Number of pets (n)	Heating (0=blank; 1=gas central heating; 2=electric & oil; gas central heating and back boiler; 4=electric & gas; 5=single gas fire; 6=calor gas)	Dust mite sample collected from the living room and the bedroom? (1=Yes; 0=no)
Relative humidity outdoors, living room, and bedroom	Age of house (0=blank; 1=<1920; 2=1920-1950; 1950-1960; 4=1960-1970; 1970-1980; 1980-1990; 7=1990 to date)	Are any windows open? (1=Yes; 0=no)
Temperature outdoors, living room, and bedroom	Type of house (0=blank; 1=mid-terrace; 2=end-terrace; 3=semi-detached; 4=ground floor flat; 5=upstairs flat; 6=bungalow)	
Wall surface and wall dampness (WME%)		

Table 6 Non-Categorical and Categorical Variables

Variable (n = 22 visits)	Gold Standard Median (Standard Deviation)	Health Visitor Median (Standard Deviation)	Differences[*] (Standard Deviation)
Aspect (°)	223 (71.1)	223 (119.8)	0 (114.6)
Number of people present (n)	3 (1.8)	3 (1.9)	0 (0.78)
Number of pets (n)	1 (1.0)	1 (1.25)	0 (0.43)
Outdoor relative humidity (%)	45.5 (10.7)	47.5 (9.7)	0 (5.8)
Outdoor temperature (°C)	15.0 (4.8)	16.5 (5.3)	-0.75 (2.29)
Living room relative humidity (%)	50.0 (10.8)	47.8 (8.9)	0.75 (7.72)
Living room temperature (°C)	19.5 (2.5)	21.8 (3.2)	-0.75 (2.34)
Bedroom relative humidity (%)	52.0 (8.2)	51.0 (9.37)	0 (5.76)
Bedroom temperature (°C)	20.0 (2.6)	21.5 (6.6)	-1.0 (5.57)
Wall surface dampness (WME%)	0.0 (7.6)	0.0 (4.4)	0 (7.29)
Wall dampness (WME%)	0.0 (9.8)	0.0 (9.8)	0 (0.43)

Table 7 Non-Categorical Data: Summary

^{*} A negative represents a higher measurement recorded by the health visitors

Variable (n = 22 visits)	Kendall's tau-b (τ) correlation coefficients ($p < 0.05$)	Wilcoxon signed-rank z scores ($p < 0.05$)
Aspect (°)	0.45 (0.01)	-0.6 (0.95)
Number of people present during measurements (n)	0.79 (<0.01)	-1.8 (0.07)
Number of pets (n)	0.99 (<0.01)	-1.0 (0.32)
Outdoor relative humidity (%)	0.72 (<0.01)	-0.6 (0.55)
Outdoor temperature (°C)	0.74 (<0.01)	-2.7 (0.01)
Living room relative humidity (%)	0.56 (<0.01)	-0.6 (0.55)
Living room temperature (°C)	0.52 (<0.01)	-2.3 (0.02)
Bedroom relative humidity (%)	0.53 (<0.01)	-0.1 (0.36)
Bedroom temperature (°C)	0.82 (<0.01)	-3.6 (< 0.01)
Wall surface dampness (WME%)	0.45 (0.03)	-0.7 (0.47)
Wall dampness (WME%)	0.88 (<0.01)	-1.0 (0.32)

Table 8 Non-Categorical Data: Significant Differences and Relationships

Variable	Accuracy error on gold standard median 5% upper limit (°C)	Median value (°C)	Accuracy error on gold standard median 5% lower limit (°C)
Relative humidity outdoors (Gold standard)	47.8	45.5	43.3
Relative humidity outdoors (Health visitor)		47.5	
Temperature outdoors (Gold standard)	15.8	15.0	14.3
Temperature outdoors (Health visitor)		16.5	
Relative humidity living room (Gold standard)	52.5	50.0	47.6
Relative humidity living room (Health visitor)		47.8	
Temperature living room (Gold standard)	20.5	19.5	18.6
Temperature living room (Health visitor)		21.8	
Relative humidity bedroom (Gold standard)	54.6	52.0	49.5
Relative humidity bedroom (Health visitor)		51.0	
Temperature bedroom (Gold standard)	21.0	20.0	19.0
Temperature bedroom (Health visitor)		21.5	

Table 9 Health Visitors' Temperature And Relative Humidity Medians Compared To Gold Standard Accuracy Errors

Variable	Frequency of agreement (%)	Kendall's tau-b (τ) correlation coefficient ($p < 0.05$)
Number of smokers	95	0.85 (<0.01)
Type of pets	100	1.00 (<0.01)
Type of heating	100	1.00 (<0.01)
Age of house	55	0.21 (0.29)
Type of house	41	0.49 (0.01)

Table 10 Polychotomous Categorical Variables: Frequencies and Associations

	Frequency of Agreement (%) Gold Standard vs. health visitors					
Variable (n=22)	22 visits	MS1 (9 visits)	MS2 (1 visit)	MS3 (7 visits)	MS4 (2 visits)	MS5 (3 visits)
Presence of visible mould or damp?	86	89	100	71	100	100
Microbial sample collected outdoors?	95	89	100	86	100	100
Microbial sample collected in the bedroom?	95	100	100	86	0	100
Dust mite sample collected from the living room?	86	67	100	100	100	100
Dust mite sample collected from the bedroom?	91	89	0	100	100	100
Are any windows open?	82	89	100	100	0	100

Table 11 Dichotomous Categorical Variables: Frequencies

Variable	Gold Standard vs. MS1 n=9 visits ($p < 0.05$)	Gold Standard vs. MS2 n=1 visit ($p < 0.05$)	Gold Standard vs. MS3 n=7 visits ($p < 0.05$)	Gold Standard vs. MS4 n=2 visits ($p < 0.05$)	Gold Standard vs. MS5 n=3 visits ($p < 0.05$)
Presence of visible mould or damp?	0.6 (0.04)	1.0	1.0 (0.01)	1.0	1.0 (0.08)
Microbial sample collected outdoors?	0.8 (0.02)	1.0	1.0 (0.01)	1.0	1.0 (0.01)
Microbial sample collected in the bedroom?	1.0	1.0	0.6 (0.09)	0	1.0 (0.08)
Dust mite sample collected from the living room?	-0.2 (0.57)	1.0	1.0 (0.01)	1.0	1.0 (0.01)
Dust mite sample collected from the bedroom?	0.7 (0.02)	0	1.0 (0.01)	1.0	1.0 (0.08)
Are any windows open?	0.8 (0.02)	1.0	0.7 (0.05)	0	1.0 (0.08)

Table 12 Dichotomous Categorical Variables: Kappa Values

Study no.	Number of Visits	Reason
PS1	3	n/a
PS2	3	n/a
PS3	0	Too soon out of training
PS4	1	n/a
PS5	6	n/a
MS1	9	n/a
MS2	8	n/a
MS3	1	Left service
MS4	3	Relocated three times within study
MS5	2	Too busy
MS6	2	Stand-in for MS2
MS7	3	Caseload increased
MS8	0	Not keen
MS9	0	Unknown
MS10	0	Pregnancy
MS11	1	Stand-in for MS1

Table 13 Reasons for Dropping-out of the Study

Rogers' Stages⁹⁴	Research diffusion	Future Concept diffusion
Agenda setting	The research was on the agenda of Plymouth Teaching Primary Care Trust after approval by the Ethics Committee and the Research Governance Unit.	The concept would have to meet the need for health visitors to have a structured assessment of housing issues. Health legislators are encouraged to accept the concept and make it part of the Department of Health agenda.
Matching	The health visitors tested the concept in a Feasibility Study, matching it with their needs and fitting it into their normal routines.	The legislators and managers look at problems their organisation face, such as the asthma and allergy pandemic and match it with the concept to determine how it might fit within the constructs of their public health agenda.
Redefining/ restructuring	During structured discussions, the Health Visitor Lead and other stakeholders suggested ways to redefine the research. Some changes were made by the health visitors to their own routines to accommodate the research.	The concept is reinvented to fit the organisations' needs and structures. The methods of the organisation might have to be changed to accommodate the concept. At this stage, it would be important to reassure adopters that the concept is an accepted idea. This is important for members of the system at the Primary Care Trust level who would have technical, financial, and social concerns about new concepts in their area. Redefining would continue at the Health Visitor Lead and health visitor level.
Clarifying	As more health visitors volunteered for the research, the more it became acceptable to those already involved and those thinking about joining.	As more health visitors adopted the concept, it would be discussed, corrected, and clarified. The importance of the concept would become more apparent as health visitors see the results and communicate these results to their peers.
Routinising	Although the research was not to be a routine part of health visitors' work, they incorporated it into their routines for the duration of the research as and when appropriate.	The concept of health visitors monitoring and advising on the indoor environment becomes part of their routine home visits (where appropriate). Formal structures fall into place for reporting and assessing the outcomes of the concept.

Table 14 Diffusion Of The Research And Concept

Lancaster's Criteria³⁰³	Consideration
How great is the change? How, much does it deviate from the current norm of expectations?	The research concept was adapted to be recognisable to health visitors in the context of their current practices The historic link between health visiting and the home environment was emphasised. The health visitors saw the concept as an extension of their usual practice.
How much emotional investment by the participants is there in the "old way"?	The research was slanted to the health visitors' traditional roles. Their working practices were taken into account when deciding on the research methods. They were resistant to having new activities added to their workload.
To what degree and in what manner are the people involved threatened?	The health visitors were empowered when taking part in the study. The health visitors were concerned that their clients felt threatened. The health visitors were threatened by increased workloads and stress.
How reasonable or profitable is this change?	The health visitors were provided with a strong evidence base to provide a reasonable justification for them to adopt the research. The concept was seen as very relevant to their role in child health.
Will new skills and procedures be executed?	The basis of the research was to introduce new skills and procedures to help with indoor environmental assessments.
How much involvement at each level of the implementation can be encouraged?	The Health Visitor Leads and health visitors were involved from the beginning of the research and had an input on the design of the methods
How do participants feel towards the change agent?	The health visitors had a good rapport with the change agent (the researcher), but some clients were disturbed by the change agent's involvement
How clear and well informed are the expected participants about the total change project and about what is expected of them?	The health visitors, clients, and other stakeholders were all given full information but there were some problems with understanding what was expected of each of them.
How effective is the communication network surrounding the change process?	It was difficult to maintain good communications with the spread of work bases in Plymouth. The management team were difficult to contact and keep updated.
What financial resources will be required?	Backfill pay was required to cover the hours the health visitors lost from routine work whilst participating in the Feasibility Study.

Table 15 Assessing the Potential for Resistance to Change

APPENDIX III: PRESENTATION PACK

PRESENTATION PACK: HEALTH VISITORS

TRAINING SESSION: INDOOR ENVIRONMENTAL ASSESSMENTS

DESIGNED FOR HEALTH PROFESSIONALS

**GEORGE RICHARDSON, FACULTY OF HEALTH AND SOCIAL WORK,
UNIVERSITY OF PLYMOUTH.**

RESEARCH QUESTION:

**CAN HEALTH VISITORS ASSIST CLIENTS TO OPTIMISE HEALTH-
DETERMINING ASPECTS OF THE INDOOR ENVIRONMENT THROUGH
PROVISION OF EVIDENCE-INFORMED MESSAGES?**

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**TRAINING SESSION: INDOOR ENVIRONMENTAL
ASSESSMENTS DESIGNED FOR HEALTH PROFESSIONALS
DATE:**

AGENDA

- ⇒ BRIEF INTRODUCTION TO GEORGE RICHARDSON, HIS RESEARCH AND YOUR ROLE AS A HEALTH VISITOR IN THE RESEARCH
- ⇒ OVERVIEW OF THE ITEMS IN YOUR INFORMATION PACK
- ⇒ DISCUSSION OF THE IMPORTANCE OF THE INDOOR ENVIRONMENT TO HEALTH
- ⇒ DESCRIPTION OF THE VARIABLES YOU WILL MEASURE AND WHY
- ⇒ INTRODUCTION TO AND DEMONSTRATION OF THE MONITORING EQUIPMENT
- ⇒ DESCRIPTION OF THE TIME AND PROCEDURE FOR CONDUCTING ASSESSMENTS IN A HOME
- ⇒ HOW TO UNDERSTAND AND WHAT TO DO WITH THE RESULTS FROM YOUR ASSESSMENTS
- ⇒ QUESTIONS AND DISCUSSION
- ⇒ PLAN VISITS

INTRODUCTION

WHO's WHO IN THE ZOO

Participants

Your trainer and researcher: George Richardson, Plymouth.

Health visitors already included in study:

I welcome you to join me in the zoo because it will be a great learning experience! The ZOO is a pseudonym for the research that I am suggesting. The research is supported by the University of Plymouth, the local Primary Care Trust, and the Exeter Research and Governance unit of the Exeter Primary Care Trust. Most importantly, the research is very dependent on your experience at the sharp end. You have been given a brief summary of the research (enclosed). I have asked you to voluntarily join the research.

A VERY BRIEF LITERATURE REVIEW

In his report, 'Purchasing of Community Child Health Service,' Prof. David Hall calculated that the State spends an average £22 in direct costs per child for health visitor services. I look upon health visitors as independent advocates for children, able to represent them when approaching both the State and a child's guardian. The Children's Charter for Health and Social Care published in September 2004 sets out the concept of ensuring 'personalised child-centred health and social care services'.[†] The charter suggests that 'standards should generate a step change in the quality of children's health and services'. The government is emphasising that it does want to secure good health for the whole nation.[‡] In the Health Visitors' Practice Development Pack,[§] 'Public Health' is defined as 'tackling the causes of ill health not just responding to health needs'. The pack suggests that working with other services builds strength and structure into health visitors' work, neatly expressed that it is better

^{*} Hall D. PSI 7-06 HALL: Purchasing of Community Child Health Services - How and How Much? London, UK: Department of Health, 2003.

[†] Department of Health, Department for Education and Skills. National Service Framework for Children, Young People and Maternity Services. London, UK: The Stationery Office, 2003.

[‡] Wanless D. Securing Good Health for the Whole Population. London, UK: The Stationery Office, 2004.

[§] Department of Health. *Health Visitor Practice Development Resource Pack*. London, UK: Department of Health, 2001.

for health visitors to join a multi-disciplinary team as against being a uni-disciplinary team. We have all seen many homes where children are forced to live in unsuitable conditions. My experience from investigating some 200+ homes is unambiguous. It showed that when working in concordance with children's guardians, it is possible to enhance children's surroundings, thereby reducing the call for medical treatment. The Sure Start movement assumes guardians' involvement in looking after children as a basis for success.

Presently health visitors annually report their findings in 'Profiling Health in Plymouth, Family health Needs'.^{*} Question 14 highlights that 7 % of your caseloads have difficulties with their home environment. Further health visitors report in question 18 that in ~ 29% of households somebody smokes.

The proposed indoor assessments and follow-up are intended to resolve many indoor environmental problems through unambiguous recording of variables related to the indoor environment. Health visitors and district nurses make approximately 10,000 visits per month in the Plymouth area, therefore housing conditions can be mapped consistently for a substantial number of houses. The interpretation of the assessments is directed towards health effects for young children. This briefing will give you some insight into what I hope we will be doing during the next month or two.

In the National Health Service's Health Technology Assessment Programme an extensive literature search identified that home visiting by health visitors was **associated** with *improvements in the quality of the home environment*, but **not associated** with reduced use of emergency medical services; reduced hospital admission rates.[†] Home visiting by health visitors has the potential to *produce net cost savings, in particular hospital cost savings*. The report concludes that evidence suggests that when home visiting is more broadly based on interventions that cover multiple needs of individuals and families the service is effective.[†]

^{*} Nelder R. *Health Visitor Data 2004 Plymouth Neighbourhood Report*. Plymouth, UK: Public Health Development Unit, Plymouth Teaching Primary Care Trust, 2006.

[†]Elkan R, Kendrick D, Hewitt M, Robinson JJA, Tolley K, Blair M, et al. The effectiveness of domiciliary health visiting: a systematic review of international studies and a selective review of the British literature. *Health Technology Assessment* 2000; 4(13).

BRIEF SUMMARY OF THE RESEARCH:

CAN HEALTH VISITORS ASSIST CLIENTS TO OPTIMISE HEALTH-DETERMINING ASPECTS OF THE INDOOR ENVIRONMENT THROUGH PROVISION OF EVIDENCE-INFORMED MESSAGES?

There is a substantial body of research acknowledging that the composition of the indoor environment in the home may be responsible for worsening respiratory conditions, especially for children. The indoor environment is a major source of pollutants e.g. environmental tobacco smoke and allergens. The home indoor environment is undergoing substantial changes in connection with a nationwide drive to increase energy efficiency whereby the indoor environment is changing from being characterised as 'cold and damp' to 'warm and humid'. These changes might further affect the pattern of childhood illnesses, especially breathing related. It is not known how reduced ventilation rates in 'new' energy efficient homes will influence health. There is currently no simple way of assessing the indoor environment in homes from a health perspective. There is a request to gather information about housing in the UK, whilst at the same time disseminating academic research on the risks from the indoor environment to members of the public who often require a personal approach to education. Self-reporting of indoor environmental conditions is notoriously fraught with difficulties and generally, householders are not able to understand or relate indoor environmental variables with health outcomes. These difficulties are accentuated because of the changing indoor environmental conditions as outlined above.

There are clear indications that a proactive role exercised by front line professionals has the potential to reduce the burden on the National Health Service. Potentially, health visitors re ideal professionals to perform simple environmental checks and work with clients to improve their indoor environment for the benefit of health. Empowering health visitors with additional information and providing them with suitable measuring equipment with which they could *quantify* critical indoor environmental variables will enhance their role towards their clients. It will also enable them to better justify their approach towards landlords, social service departments etc. to effect positive change for their clients.

The study aims to explore the acceptability and feasibility of health visitors working with their clients to assess health-determining aspects of their clients' home environments and to provide evidence-informed messages about the indoor environment. The health visitors will be taught how to use simple environmental monitoring equipment to measure indoor environmental factors and to assess actions that could be taken to make their client's homes more 'healthy'. The study will test health visitors' acceptability of carrying extra equipment, requiring new knowledge etc and to test the acceptability to clients of data recorded in their home, to test the acceptability of possible recommendations and to test the technical feasibility of health visitors using the equipment and giving accurate assessments. If this new role for health visitors appears acceptable and feasible, a randomised controlled trial will be designed for a future application, assessing health outcomes.

BACKGROUND

- > The Nursing and Midwifery Council (. 2002) suggested health visitors take an even more proactive role to influence public health
- > NHS promotes the idea that health visitors take on role of 'Public Health Practitioners'
- > Health visitors are in a unique position to help families provide the best possible home environments for children
- > Health visitors are advocates for children when facing the State and guardians
- > Diagnosed cases of asthma are rising inexorably

LINK WITH THE HOME ENVIRONMENT

- > Increasing evidence that the indoor environment affects health, especially the health of young children.
- > Young children spend 90% of their time indoors unable to influence their surroundings.
- > The latest Building Regulations (2005) reflect the importance of air quality in homes, with stricter controls of ventilation and building materials
- > >22% of families in St Peter's Ward, Plymouth have been referred to outside agencies by health visitors because their housing situation is detrimental to health (PCT, 2002)

LITERATURE REVIEW

There is sufficient evidence of an association between the following variables and asthma:

- > HOUSE DUST MITE ALLERGENS
- > PET ALLERGENS
- > ENVIRONMENTAL TOBACCO SMOKE

Mould, cooking emissions, humidity and particles have not been highlighted, mostly because of a lack of robust research to date.

CURRENT PRACTICE

Some indoor variables are already qualitatively assessed by health visitors:

- > VISIBLE MOULD.
- > PRESENCE OF SMOKERS.
- > GENERAL HOUSEHOLD CLEANLINESS.
- > COLD AND DAMP
- > STRUCTURAL DIFFICULTIES

Health visitors do not carry out quantitative assessments. Health visitors now unilaterally decide which household's indoor environment to mention in reports

CURRENT LIMITATIONS TO INDOOR ASSESSMENTS

Health visitors cannot forcefully address problems with the home environment because:

- > They have limited authority to approach landlords and no proof. Objective measurements carry more weight than subjective opinion
- > Their clients may not like hearing suggestions for lifestyle changes
- > Health visitors have limited knowledge of possible remedial actions.

HOW WILL THE ASSESSMENT BE MADE?

QUESTIONNAIRE:

- > Number of smokers & pets
- > Heating, ventilation and cleaning routines

TOOL KIT SUPPORTED MEASUREMENTS:

- > Temperature & humidity (thermometer/ hygrometer) in-and out of doors
- > Allergens (dust samples)
- > Airborne mould (agar slides)
- > Damp (damp meter)
- > Aspect of the house (compass)

TRAINING HEALTH VISITORS

HEALTH VISITORS WILL REQUIRE ADDITIONAL TRAINING TO BE ABLE TO:

- > Understand some of the scientific background of the variables that they are asked to measure
- > Handle the measuring equipment and evaluate the results from a quantitative assessment
- > Understand the captured information
- > Process the information

ADDITIONAL REQUIREMENTS

- > The health visitors tool kit needs to be cost effective, lightweight, and easy to use
- > The local Primary Care Trust needs to provide a suitable electronic data capturing/ processing system and initially some expert advice
- > The method of follow up measurements post remedial actions has not been addressed (11 November 2005)

CURRENT STAGE OF RESEARCH

- > Approval has been given by the LREC and the Research Governance Unit
- > Four health visitors signed up for research
- > The length of assessments has been limited to 32 minutes
- > Consent forms have been produced

FURTHER WORK

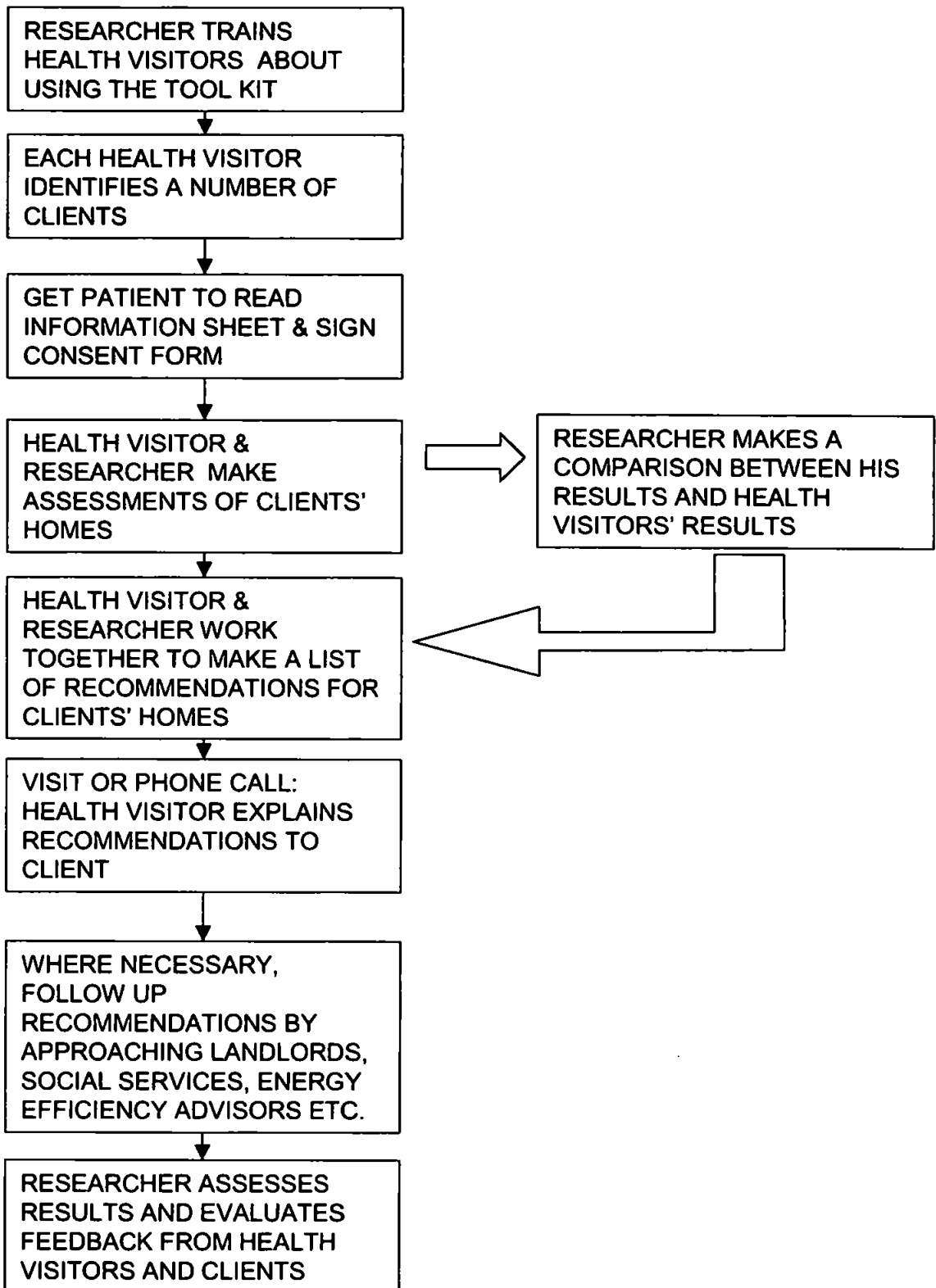
- > To conduct visits and conduct assessments
- > Assess health visitors' views on their suggested enlarged role in regard to the home environment
- > To carry out a large randomised control trial to assess feasibility and acceptability (and eventually effectiveness)
- > Complete PHD thesis

RESEARCH PROCEDURE

Prior to the start of the research, an extensive literature review of research concerning the indoor environment and health has been conducted, statistical analysis has been performed on existing housing and health data to develop a simple tool kit and protocol and suitable equipment has been sourced.

- ⇒ Recruit volunteer health visitors
- ⇒ Train recruited health visitors and provide information. Health visitors are trained to make an indoor environmental assessment of a client's home using observation and simple monitoring equipment. The training will continue during the visits
- ⇒ Health visitors recruit 10 clients each and explain the research to client. If possible, please select households where you suspect that the indoor environment may be a factor in your client's illness. Please explain the research to your clients and send them the information sheet. You could explain that your client will be getting a free-of-charge assessment of their home to encourage them to join the research
- ⇒ Health visitors arrange a visit with each client to carry out an environmental assessment. If your client is interested, explain that the researcher needs to accompany you as part of the study. Before the visit, you must ensure that all competent persons in the household have signed a consent form (with one copy to you, one to the client and one for the researcher). Book a time for the visit, preferably between 1000 –1500 to avoid the daily chaos when school-age children are at home
- ⇒ The researcher & health visitor visit the 10 households, collect data from the researcher's gold standard test and from health visitors' assessments made on the same day. Health visitors assign study numbers to their homes
- ⇒ The researcher & health visitor make an evaluation of the home and compare notes. Both decide on appropriate action for the client or an outside body such as an energy efficiency advice centre can take to make improvements to their home environment
- ⇒ The researcher makes a statistical comparison between the health visitor's results and the gold standard test
- ⇒ The researcher analyses statistics to determine the accuracy of the health visitor's measurements
- ⇒ Health visitors revisit their 10 households to discuss possible recommendations for changes to the client's home or life style
- ⇒ Independent interviewer will interview health visitors to gauge their views of the assessment and feedback process
- ⇒ The researcher to re-evaluate the health visitors tool kit and methods according to results
- ⇒ Decision made as to the suitability of conducting further research

RESEARCH PATH



INDOOR ENVIRONMENT FACT SHEET 1: TEMPERATURE

Temperature is related to how cold or warm you or something feels. We can decide the amount of warmth we feel by turning on fires, radiators etc. Warm air escapes from a home through poorly insulated walls, gaps around windows, through vents, and open windows. Leaky, draughty houses are more difficult to keep warm, because the warmth created by heating is lost quickly. This often makes it expensive to heat a home. Different temperatures are acceptable to different people, mainly depending on their level of activity. If someone is busy indoors, they can stand lower temperatures than someone who is still for long periods. We need to maintain certain temperatures indoors to help our body function properly. When a home is not properly heated, this can be uncomfortable and increases the chance of the elderly and people with breathing related problems becoming more ill. A cold home can be miserable. A cold home increases the chance of damp areas and mould growing (see Mould and Damp fact sheets). The effect of different temperatures is shown below:

- 21 + °C Recommended temperature in rooms where elderly people spend most of their time.
- 18 °C This is the minimum recommended temperature for all rooms but this may feel cold to people who are not moving around.
- 16 °C Under this temperature our resistance to breathing related illnesses is weakened.
- 9-12 °C If we are in a room at this temperature wearing light clothes for more than two hours our own core body temperature will drop, blood pressure will increase and there is a greater chance of a heart problem.
- 5 °C At this temperature there is a strong chance of suffering hypothermia.

Measurement

Temperature is measured using a thermometer. Temperature is normally displayed in degrees Celsius (°C). Many people measure temperature in degrees Fahrenheit (°F). If you need to convert a temperature from °F to °C use this formula: $^{\circ}\text{F} - 32 \times 5 \div 9 = ^{\circ}\text{C}$. If you need to convert a temperature from °C to °F use this formula: $^{\circ}\text{C} \times 9 \div 5 + 32 = ^{\circ}\text{F}$

Recommended temperatures

Living rooms, Dining rooms and bedsits = 21 °C
Bedrooms, hallways, kitchens and toilets = 18 °C
Bathroom = 22 °C

Advice

Temperature can be improved by:

- ❖ Installation of loft and cavity wall insulation where applicable. Contact your local Energy Efficiency Advice centre for help and possible grants (0800 512012)
- ❖ Try to reduce unwanted ventilation (=heat loss) through gaps and cracks using draught excluders. This will allow you to open windows to air the house when you want to. Reducing draughts will reduce the feeling of lack of control, discomfort and coldness

INDOOR ENVIRONMENT FACT SHEET 2: HUMIDITY

Humidity is water in the air. When humidity is high, you feel 'sticky' and the air feels 'close' or humid. Humidity is normally measured as relative humidity, which is the percentage (%) of solid water droplets in a given amount of air.

We all breathe out water droplets, sweat, wash clothes, do the dishes, and shower or bathe. All these activities release water into the air. In a household of two adults and two children, there can be as much as 10 – 15 pints (6-9 litres) of water added to the indoor air every day. This can cause high humidity indoors unless the humid air is replaced by fresh drier air from outdoors. Because we release so much water, the indoor humidity is often much higher than outdoors, apart from on very rainy or foggy days.

Humans like to live and breathe in air with a humidity of 40 – 60 %. Below 40%, the air is dry and we suffer dry throats, dry eyes and skin, and even static shocks. Above 60%, the air feels humid, sticky, and uncomfortable. Despite this, humans can live in most climates.

Although humidity is not directly bad for us, it can cause many other problems in a home. Bacteria and viruses like humid air, especially above 60%. This can increase the chance of catching colds and other airborne infections. When there is high humidity in the air, there is more chance of condensation on cold windows and walls and more chance of damp on walls, furniture, and fabrics. Mould thrives on damp surfaces (see Mould fact sheet). House dust mites like high humidity and cannot survive if the humidity in their immediate surroundings is less than 40%.

Measurement

Relative humidity is measured by a hygrometer. When measuring relative humidity keep the following values in mind, as ideally, humidity should be at or below these values. Warm air holds more water than cold air, so the relative humidity will reduce at increasing temperatures (if no more moisture is added to the air).

Temperature	16 °C	17 °C	18 °C	19 °C	20 °C	21 °C	22 °C	23 °C
Relative humidity	60 %	56 %	53 %	50 %	47 %	44 %	42 %	40 %

Advice

Humidity can be kept low by taking a number of actions:

- ❖ Try to air the house as often as you can. During and after cooking, washing, and showering open the windows (letting steam out) and keep the door to the room closed.
- ❖ Dry clothes outdoors if you can. If you cannot, do not dry them on radiators but air them on clothes horses in a room with a window or vent open and the door closed.
- ❖ If you have a tumble drier, make sure the exhaust pipe goes outdoors.
- ❖ If you have a humid house, you could buy a dehumidifier but remember they can be expensive to run and need emptying daily.
- ❖ Avoid using bottled gas fires.

INDOOR ENVIRONMENT FACT SHEET 3: DAMP

Damp is water that has soaked into walls, fabrics, and furniture. The effect of damp is often recognised by a musty or mouldy smell. Damp patches look like water stains, often with mould growth, which first appears as black spots. Damp patches often feel cold. Damp is caused by a number of things. The main reason is normally high humidity (water droplets in the air), which leads to condensation on cold windows and walls and soaks into furniture, carpets, curtains, clothes, and soft toys. Damp can also be caused by water getting indoors from outside. Damaged roofs, guttering and drainpipes, leaky windows, and cracked walls are all ways water can get indoors. Leaking water pipes indoors also lead to damp. Damp can rise from the ground (rising damp) if there is no damp course between your ground floor and the ground beneath your home. Rising damp is rare. Damp is unsightly and can damage the very fabric of your home. Bricks, concrete, and plaster will start to crumble if damp for long periods. Damp is the main reason for large patches of mould in a home because mould grows on damp patches causing more damage to wallpaper and paint (see Mould fact sheet).

Measurement

Damp is sometimes visible and very often can be felt on surfaces as cold wetness so you can report the presence of damp without an instrument. Damp (and mould) in certain areas of a home can mean different things. Mould and condensation on the lower part of windows and front and back doors is usually a sign of a combination of high humidity and cold surfaces. Water stains rising from the ground up may be a sign of rising damp. A large single patch of damp on a wall or ceiling is probably due to penetration damp and is a sign of broken or leaky pipes, blocked drains etc. Damp can be measured using a damp meter. A damp meter measures the percentage of water in the damp area between two metal prongs and gives values for degrees of dampness in wood moisture equivalent (WME) percentages. The percentage of moisture in any structure should be under 20%.

Advice

Condensation damp:

- ❖ Try to reduce indoor humidity (see Humidity fact sheet).
- ❖ Wipe off condensation on windowpanes and sills to prevent mould growth and to stop water soaking into wooden window frames and plaster. Use disposable paper towels or a cloth that you can wring out and hang outdoors to dry.
- ❖ Ensure that rooms not regularly used are aired and raise temperatures in cold rooms.
- ❖ Insulate walls and the loft space to prevent condensation forming.

Penetration damp:

- ❖ Repair broken pipes indoors and outdoors, guttering and roofing
- ❖ Regularly clear guttering and drains
- ❖ Repair internal and external cracks in walls

Rising damp:

- ❖ This is a serious structural problem and needs to be surveyed properly and if confirmed; professionals should rectify it as soon as possible.

INDOOR ENVIRONMENT FACT SHEET 4: MOULD

Mould and mould spores are everywhere. Mould is a fungus related to mushrooms and is naturally present indoors and outdoors. Mould patches indoors are sometimes visible in damp spots and many have a musty smell. Normally, mould patches start out looking like small black spots, which may spread to cover large areas of a wall or ceiling. Mould is often hidden behind cupboards, under carpets, in cavity walls and other places where you cannot spot the mould but still smell it.

Mould patches form because spores have found suitable living conditions. Moulds thrive in humid conditions and tend to grow on damp patches (see humidity fact sheet and damp fact sheet). Mould spreads by spores, carried by air movements in- and out of doors. The spores can cause an allergic reaction in people who are very sensitive. Unless there are very high concentrations of mould or the mould is a particularly nasty one, the amount of mould found in most homes is not harmful.

Mould is unsightly and will damage wallpaper and paint. Certain types of mould cause rot in wood and plaster. Mould roots go deep into the fabric it is growing on making it difficult to remove completely and permanently.

Measurement

Visible mould is easy to identify whereas hidden mould will be missed. The mould spores floating around in the air can be caught on special collector plates (slides). These slides have a surface that mould likes to grow on. The number of mould spores growing on the slides can be counted giving an indication of the presence of airborne mould spores. A more detailed look at a mould colony by a microbiologist will enable the identification of the mould.

There are no standards for mould indoors. The number of mould spores in the air indoors can be compared to outdoors. Mould is often a sign of damp problems, which should be dealt with.

Advice

Mould can be reduced by a number of actions:

- ❖ Try to reduce humidity indoors (see Humidity fact sheet)
- ❖ Try to reduce dampness (see Damp fact sheet)
- ❖ Remove existing patches of mould using a systemic fungicide (available from DIY stores). Bleach will remove surface mould but may not kill the roots!
- ❖ Allow air to circulate around furniture, try to avoid placing furniture against cold outside walls

INDOOR ENVIRONMENT FACT SHEET 5: ALLERGENS

Allergens can be anything that causes an allergy. You may be allergic to pollen, dust, animals, and food. Such allergies may cause mild reactions such as, sneezing and a runny nose but can also lead to asthma attacks and skin reactions. Inside our homes, we are often exposed to pets, house dust mites, mould, pollen, and insects such as cockroaches. Pollen come in from outdoors and pollen allergy (hay fever) is normally worse in the spring and summer. All pets can give off allergens. Cats and dogs cause the most common pet allergies. Pet allergens spread around a house on clothes, especially cat allergen, which is sticky and gets everywhere. House dust mite allergen is very common indoors and for some asthmatics, it can worsen (trigger) their illness. House dust mites are not visible to the naked eye. They live in our beds, soft furniture, and carpets. They eat skin cells and like high humidity. Cockroaches, rats, and mice cause allergies and are a health hazard.

Measurement

Allergens are in the air and in settled dust, and every home has allergens. If a home has any sort of pet, there will be pet allergens present. If a home is infested by rats, mice, or cockroaches you can see this from droppings and damaged woodwork/ walls. House dust mites are difficult to spot. A warm home with high humidity is likely to have large amounts of house dust mites. Dust mites can be reduced by using anti-dust mite covers on beds, feather filled pillows, and laminate or other non-fabric flooring. Allergens can be measured in collected dust samples from beds, carpets, and furniture using an adapted vacuum cleaner. The dust sample is checked at a laboratory for allergen in the sample. There are recommended levels of the house dust mite (*Dermatophagoide pteronyssinus*) allergen *Der p 1* measured as the amount of allergen in micrograms (1 μg = 1/1000th of a gram) in 1 gram of house dust.

Low (little chance of causing allergic symptoms)	Less than 2 $\mu\text{g}/\text{g}$
High (chance of increasing symptoms and a chance of becoming allergic to house dust mites)	2 – 10 $\mu\text{g}/\text{g}$
Very high (chance of triggering a severe asthma attack)	More than 10 $\mu\text{g}/\text{g}$

Advice

To reduce allergens (that you are allergic to) try:

- ❖ If you want to keep pets, keep them out of bedrooms at all times. If possible, keep pets in outbuildings (as long as they are warm, dry, and cared for daily)
- ❖ House dust mite allergen can be reduced by maintaining low humidity (see humidity fact sheet). Anti-dust mite covers can be put on mattresses and bedding to stop the allergen reaching you. Washing bedding, soft toys, and fabrics at 60 oC can kill mites. Soft toys can be put in the freezer (for two days) to kill mites. Sunlight kills mites so put bedding out in the sunshine if possible. Floors without carpets contain fewer mites but you need to clean the floor regularly to get rid of dust and fur. Dust-bunnies are allergenic!
- ❖ If a home is infested with cockroaches or other pests, you will need to contact your local environmental health department who will help find someone to remedy the problem

HOUSE DUST MITES – A BRIEF SUMMARY

What do they eat?	Where do they live?	How do you reduce house dust mites?
Skin cells which have been softened by the mould <i>Aspergillus</i>	Both the mites and the mould like warm, humid surroundings. Their ideal home is in mattresses, pillows, carpets and other soft furnishings	⇒ Air your beds to allow heat and moisture to escape ⇒ Fit non-allergenic allergen barriers on bed covers and mattresses ⇒ Vacuum clean beds and soft furnishings (when any allergic family members are out). Vacuum with windows open to help 'move' the dust out of the house ⇒ If possible use a vacuum with good filtration

INDOOR ENVIRONMENT FACT SHEET 6: TOBACCO SMOKE AND OTHER POLLUTANTS

The air indoors contains water, dust, allergens, and some chemicals. Some of the gases and dust in our air are normal but some are the result of man-made pollution. Some pollution comes from outdoors from traffic and factories but we also create pollution indoors. Some gases produced indoors can be dangerous. In a home with gas appliances or wood/ coal fires, if the home is not properly aired a gas called nitrogen dioxide can be found. Nitrogen dioxide in large amounts is bad for asthma and other chest illnesses. If gas appliances are badly fitted, there is a chance that the gas carbon monoxide may be found. Carbon monoxide is a health hazard, causing flu like symptoms. Being exposed to carbon monoxide for a long period is very serious.

Mould and other allergens (see fact sheets) are found in the air as particles. Particles are solid and vary in size. Particles cause health problems depending on their size. Big particles are caught in your nose and throat but very small particles go deep into your lungs. The small particles are the most harmful. Smoking gives off a mix of many small particles and gases. These are harmful to people in the same room as the smoker and *anywhere* throughout the rest of a home. Smoke gets into every room and certain chemicals stick to walls and fabrics, causing a yellow colour.

Other pollutants found indoors are gases called volatile organic compounds. They are given off by cleaning products, glues, wood products (for example medium density fibreboard) and pesticides (for example flea sprays). They can cause allergic symptoms, tiredness, and dizziness. These gases are called volatile because they are released into the air at room temperature, so you may get them from new carpets and furniture.

Measurement

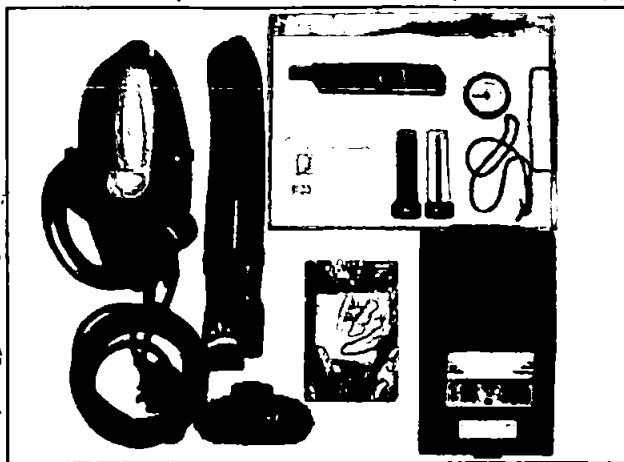
Chemical pollutants are difficult to measure without scientific instruments. Nitrogen dioxide might be present if ventilation is poor and vents are purposefully blocked. It is especially a problem if a gas cooker is used as the main source of heat. Carbon monoxide can be detected with simple monitors similar to smoke detectors.

Advice

- ❖ Try to air the house out when you can. If vents have been fitted, they should be clear of obstructions and left open
- ❖ If cooking or heating appliances are old, badly fitted or you are experiencing symptoms such as flu, dizziness and tiredness, get the appliances checked
- ❖ Do not smoke anywhere indoors
- ❖ If someone in your family is sensitive to chemicals try to avoid using too many different cleaning products, air fresheners, glues and paints
- ❖ If buying new furniture, wood products and paints, try to buy products with labels which say low volatile organic compounds and low formaldehyde
- ❖ Air cleaners can reduce particles with filters but they can be expensive to purchase and run, especially if they remove very small particles

HOW TO USE THE MONITORING EQUIPMENT

This picture shows the tools you will need to carry around with you.



Temperature and humidity

Equipment: Digital temperature/ humidity pen. (model.PTH-1XA, Omega Engineering)

Method: Press the ON/OFF button to turn meter on. Meter will show full digital display. Press C/F button to convert temperature reading to Centigrade. Pressing the MIN/MAX button will display the minimum and maximum readings since the pen was turned on (re-press MIN/MAX to get back to main screen).

Pressing the HOLD button will hold the data on screen until RESET is pressed.

Take measurements away from the body at about chest height. Avoid taking measurements close to hot or cold sources. When readings are complete press ON/OFF. Take an average of three measurements.

House dust mites

Equipment: Turbo Tiger Vacuum Cleaner, filter material 12 cm x 12 cm (Vileda Vilene), blank card squares cut to 5 cm x 5 cm, cello tape.

Method: For each sample taken, a fresh filter is placed over the vacuum hose and the brush head is pushed on to hold it in place. An area of one m² of the living room carpet/ rug or the mattress in the child's bedroom (with under sheets in place) is vacuumed for 1 minute. The sample is carefully removed from the vacuum cleaner and placed in a cellophane bag. A card is marked with the date, study number, and sample location and placed in the bag, which is then

sealed with cello tape. The samples are given to the researcher for allergen assay. Avoid contact with the samples!

Damp

Equipment: Protimeter Surveymaster Dual purpose moisture meter

Method: Plug in the two-pin probe to the top of the meter (inside lid). For wall surface damp: gently press the pins to the surface you are measuring without pressing the pins into the surface. Take another reading (wall dampness) by pressing the prongs through the surface (to get through paint, wallpaper etc. Take the reading from the bottom scale on the meter. Measurements reaching the solid green line are reasonably dry (<5%); in the green/ red hatched scale this is in excess of normal and should be investigated (5-15%), if readings are in red scale this is a sign that immediate action should be taken as the material you are measuring is water damaged. These measurements are normally taken in bedrooms but should also be taken if the clients highlight damp or you observe damp in a specific area e.g. window frames.

Microbial samples

Equipment: Hygicult TPC Total Bacterial Count agar slides

Method: Each agar slide is taken out of its protective container and left standing (sits with red cap on flat surface) for half an hour in the sampling location (in this case in the bedroom and outdoors close to the house). The slides are carefully collected and replaced in their respective container. The samples are then handed to the researcher and incubated in a warm room for a week. The numbers of microbial colonies, which grow, are counted and sent to the University of Plymouth for more detailed analysis. Avoid touching the agar on the slides!

Aspect

Equipment: Compass

Method: The compass is lined up with North and the compass direction of the front of the house is recorded.

HEALTH VISITORS' DATA COLLECTION SHEET

	Date:	Time:	Measurement	Result	Comment (superscripted capital letters refer to the Aide-mémoire page)	Total time elapsed (minutes)
	Weather data ^A		Rainfall, wind direction, wind speed			
OUTSIDE	Relative humidity outdoors		%			
	Temperature outdoors		°C			
	Leave microbial sampler outdoors		Y / N			
LIVING ROOM	Collect signed consent forms ^B		Y / N			6
	Ask to place microbial sampler in bedroom		Y/N			
	Relative humidity living room ^C		%			
	Temperature living room ^C		°C			7
	What direction does the front of the house face? ^D		Degrees °			
	How many people in house during visit? ^E		Number			
	How many smokers? ^F		Number			
	How many pets? What type of pet? ^G		Number & type			
	How is the house heated? ^H		Type			
	How old is the house and what type is it? ^I		Year & type			
	Are any windows open? ^J		Y/N			
	Is there any mould or damp in the house? ^K		Y / N			10 + (2)
	Collect dust sample from rug/ carpet ^L		Y / N			15
BEDROOM	Relative humidity bedroom		%			
	Temperature bedroom		°C			20
	Wall surface dampness ^M		WME %			
	Wall internal dampness ^M		WME %			24
	Collect microbial sample from bedroom		Y / N			
	Collect dust sample from mattress ^L		Y / N			27
END	Offer to discuss findings at next visit & double check you have your equipment (use photo as your reference)					
	Collect microbial sampler from outdoors					30 (32)
	Give samples to researcher and discuss results					

- A. Note down any adverse weather conditions on the day. Weather data for each hour can be gathered from <http://www.plymouth.ac.uk/pages/view.asp?page=7708> OR if you want previous data, click 'meteorological data archive'. Click year; click the file for the month you require, then click the file for the date you need.
- B. It is imperative that all consent forms are signed before any measurements are taken which are linked to the research. The local Ethics committee are ruthless on this point and will check the researcher's records.
- C. Note that early morning measurements may register more humidity from overnight, particularly if there is no ventilation. Well-ventilated or draughty houses will have low afternoon temperatures. Relative humidity and temperature are measured using the hygrometer. This unit will measure in °F and °C. Please record decimals for temperature and whole figures for relative humidity. Whilst 0.5 °C might not seem important at the time, there is a whole degree difference (7%) between 13.5 and 14.5 °C.
- D. A household with a living room window, facing either NW, NNW, N, NNE or NE will tend to have a cold house especially if poor heating and little insulation is present. Any room situated in similar compass directions will suffer low wall temperatures encouraging mould to grow and be damp from condensation, especially if the house is under heated. Use the compass to find the direction.
- E. This info allows us to understand the amount of humidity to expect from your measurements due to the number of people in the home before and during your visit.
- F. Please ask client if they smoke in the house – this means any member of the family and in any room. Do not rely on the fact that you cannot smell smoke, some people do ventilate well to hide the fact that they smoke. Do not differentiate between tobacco and or cannabis.
- G. Mark down all types of pets kept indoors, including rodents and reptiles. It is worth noting if cats and dogs are allowed in bedrooms.
- H. Note type of heating; central, individual gas, electric fires, open fires, storage heating etc.
- I. Estimate the general age of the house i.e. 1930s. House type; refers to whether it is a flat (state which floor), terraced (give position), semi-detached etc.
- J. This will give you an idea of the level of ventilation.
- K. Please ask your client about mould and damp but also look yourself. Check how fresh by feeling the mould spot. If cold and wet, it is fresh! If cold and dry, it maybe dead but still toxic.
- L. The dust samples are collected on a filter using your vacuum cleaner. These samples need to be sent to or given to the researcher. If you need to store the samples, put them in your freezer.
- M. Dampness is measured using the Protimeter. The best place to measure is on the external facing wall of the bedroom and around window frames. For the surface measurements just touch the surface lightly, for wall internal dampness, push the pins around 2-3 mm into the wall.

RESEARCHER'S DATA COLLECTION SHEET

STUDY NUMBER		Number	
QUESTIONS	What is the date?	dd/mm/yy	
	What time is it?	00:00	
	What direction does the front of the house face?	Compass °	
	How many people in house prior to visit?	Number	
	How many people in during visit?	Number	
	How many smokers?	Number	
	How many pets? What type of pet?	Number & type	
	Is there any mould or damp in the house?	Y / N	
	How is the house heated?	Type	
	How old is the house and what type is it?	Year & type	
	Are any windows open?	Y / N	
OUTDOORS	PRECIPITATION	mm H ₂ O	
	WIND SPEED	mph	
	WIND DIRECTION	Compass °	
	RH	%	
	TEMPERATURE	°C	
	COARSE PARTICULATES (3-7 µm)	particles L ⁻¹	
	FINE PARTICULATES (0.3-7 µm)	particles L ⁻¹	
Has a microbial sample been collected?	Y / N		
LIVING ROOM	RH	%	
	TEMPERATURE	°C	
	COARSE PARTICULATES (3-7 µm)	particles L ⁻¹	
	FINE PARTICULATES (0.3-7 µm)	particles L ⁻¹	
	CARBON DIOXIDE	ppm	
Has a dust sample been taken from the carpet/ rug?	Y / N		
BEDROOM	RH	%	
	TEMPERATURE	°C	
	COARSE PARTICULATES (3-7 µm)	particles L ⁻¹	
	FINE PARTICULATES (0.3-7 µm)	particles L ⁻¹	
	WALL SURFACE DAMPNESS	WME %	
	WALL DAMPNESS	WME %	
	Has a dust sample been taken from the mattress?	Y / N	
Has a microbial sample been collected?	Y / N		
COMMENTS			

REFERRALS AND ADVISING CLIENTS ON ACTIONS

When a problem in a client's home is highlighted by your assessment, there may be a number of actions that can be taken to mitigate the problem. You can advise the client on possible actions or refer the client on to another organisation who may be able to help.

Referrals

Part of the importance of the tool kit is that you will now have quantified evidence to approach outside bodies to get problems rectified. Of course, you will have your own referral system in place for cases, which need to go to social services, landlords etc. We have a commitment from the Plymouth City Housing office, Kay Booth (private and public sector housing kay.booth@plymouth.gov.uk phone 01752 307176) that she will personally respond to each follow-up from your work in this area. You have a similar situation with the Devon Energy Advice Centre, (contact Graham Horler or ask for a Warm Front advisor info@devon-energy-advice.co.uk 0800 512012) who are independently funded and committed to resolve similar situations. Central Government is committed to reduce energy wastage and has set aside massive funds to modernise housing whether privately or communally owned. You might have been to presentations made by the Devon Energy Advice Centre explaining how they work and inviting you to follow up poor housing conditions with them (see enclosed information from the healthy homes scheme).

NOTE:

You will need permission from the householder to contact a third party.

Client based actions


Not all problems require structural changes to a home, as you have learnt, a person's habits and lifestyle play an important role in the quality of the indoor environment at home. There are many actions clients can take themselves to alleviate indoor environmental problems, many of which are inexpensive. The

following pages highlight some of the actions, which could be suggested to your clients.

There are other referrals that can be made:

- Advise your client to see a Welfare Rights advisor from social services to get a 'Benefit entitlement claim'
- If your client is having problems with landlords or finances get them to visit their local Citizens Advice Bureau
- If your client owns their own property which needs repairing and a member of their household can be considered vulnerable, they can contact Carol Rows on 01752 307076 (Housing Strategy and Renewal) to possibly access a grant.

POSSIBLE INTERVENTIONS AND COSTS OF INTERVENTIONS

	Intervention	Second hand smoke	House dust mites	Pet allergens	Mould
Low cost  High cost	House cleaning & maintenance		Effective	Some effect	Effective
	Lifestyle modification	Effective	Some effect	Effective	Some effect
	Non-mechanical ventilation	Some effect			Effective
	Bedding		Effective	Some effect	Some effect
	Mechanical moisture control		Effective		Effective
	Filtration of air/ air cleaners		Some effect	Some effect	Some effect
	Physical changes to the indoor environment		Effective	Some effect	Some effect
	Insulation				Some effect
	Mechanical ventilation	Some effect	Some effect	Some effect	Effective

All costs highlighted are financial. All the interventions require time commitment.

House cleaning and maintenance

- ❖ Clean furniture, shelves, hard flooring, sills, and appliances with a soft cloth dampened with water. This will remove dust and allergens without moving the dust around (as is the case with dry dusters). **COST: £0.**
- ❖ Use cleaning products, air fresheners, toiletries, and insecticides (for example, flea or fly spray) very sparingly. Try not to use these products if there is someone with breathing related problems in the room. **COST: £0.**
- ❖ Air your duvet in the sunshine to dry it out and to kill mites. **COST: £0.**
- ❖ Regularly put soft toys in the freezer for two days to kill mites. **COST: £0.**
- ❖ Try to avoid potted plants in bedrooms. In the rest of the house wipe the pots down and watch out for mildew on the soil. **COST: £0.**
- ❖ Clean out blocked guttering, down pipes, and drains. **COST: DIY £0, professional cleaning £50 upwards.**
- ❖ Try not to use your vacuum cleaner when anyone with an allergy is in the house. Vacuum clean the whole house straight away when they leave the house (for example to go to school) to give dust in the air a chance to settle before they come home. It will help if windows are open to help ventilate the house during vacuuming. **COST: 2p per 15 minutes vacuuming.**
- ❖ Vacuum clean mattresses when changing bedding to remove dust and allergenic material. **COST: 2p per 15 minutes vacuuming.**
- ❖ Wash curtains and other fabrics regularly. If it is not possible to remove the fabric (i.e. on a sofa), vacuum or clean with a damp cloth. **COST: 20p for a 40 °C wash.**
- ❖ Wash sheets, duvets, and blankets at 60 °C if possible to kill house dust mites. **COST: 30p extra per wash.**
- ❖ Regularly wash pet bedding, no less than weekly. Wash at 60 °C to remove mites. **COST: 50p for a 60 °C wash.**
- ❖ Wipe up condensation on windows to stop mould growth using disposable paper. Flush the used paper down the toilet. **COST: 2p per m of toilet paper.**
- ❖ Remove pet hairs from fabrics and clothing with a damp cloth or a special velvet hair removal brush. **COST: £4.00 for brush.**
- ❖ Clean mould growth away from walls, tiles, and other surfaces using a systemic (kills all of the mould including its roots) fungicide (buy from a DIY store). **COST: £4.00 upward.**

- ❖ Wash duvets and blankets. Because of the difficulty of drying heavy fabrics, they can be dry-cleaned. **COST: £14 per item to dry-clean.**
- ❖ Repair all broken pipes and guttering or damage to walls that are causing water leaks. **COST: Rented accommodation (please pester landlords to make repairs to the dwelling as it their duty and beneficial to protect their property £0; private accommodation DIY £cost of parts; Professional £50 per repair plus parts.**
- ❖ If replacing a broken vacuum cleaner consider buying one with HEPA filtration. **COST: £80 upwards**
- ❖ If a tumble dryer is used, please ensure that the exhaust goes outdoors through a proper vent or put pipe through a window (note: tumble dryers cost about 35p a load)

Life style modification

- ❖ Ban all smoking indoors. Reduces the amount of second hand smoke indoors. **COST: £0.**
- ❖ Avoid having pets in the house. If you have, do not allow them into bedrooms at any time. **COST: £0.**
- ❖ Do not remake bed after getting up. Fold back covers/ duvet and allow the bed to air. **COST: £0.**
- ❖ Try to remove unnecessary clutter from all rooms. The more items there are in a room the more surfaces are available to get dusty and it becomes more difficult to clean around them. This can lead to a build up or 'reservoir' of allergens. **COST: £0.**
- ❖ Keep soft toys to a minimum in children's bedrooms. **COST: £0.**
- ❖ Try not to place furniture against external facing walls (especially North facing). Cold damp air spaces will form behind the furniture allowing mould growth. Make sure to check behind furniture regularly for mould patches and treat any mould found. **COST: £0.**
- ❖ Open window and close door after showers and baths and open kitchen window and close door during cooking to remove steam. **COST: 22p per day for lost heat whilst window is open for 8 h.**

Non-mechanical ventilation

- ❖ If you have vents in your walls, along the top of windows, particularly in bathrooms and kitchens make sure they are in an open position. Do not block the vents with tape, scrunched up paper or anything else. The vents are essential for fresh air and for gas / solid fuel appliances.
- ❖ Try to air out the whole house whenever possible by opening all the windows for 1-2 h. **COST: 22p per day for lost heat whilst window is open for 8 h.**

Bedding

- ❖ Cover duvets/ eiderdowns, pillows, and mattresses in allergen impermeable covers. Ensure that they are anti-dust mite barriers not ones labelled as hypoallergenic or anti-allergic. In addition, feather pillows tend to reduce exposure to allergens than foam pillows due to the tighter weave on the encasing material. **COST: £9 upwards for single and £14 upwards for a double mattress cover; around £5 for a pair of pillow covers or £8 upwards for a pair of new pillows; £14 upwards for a duvet cover or £24.99 for a new single and £34.99 for a new double duvet.**

Mechanical moisture control

- ❖ In cases of severe damp or humidity problems dehumidifiers can be used. Dehumidifiers have to be emptied regularly. **COST: £80 for a dehumidifier with a 3.5 litre tank (will need emptying around 3 times a day). If on constantly the running cost will be 25p per day (for 150 W).**

Filtration of air/ air cleaners

- ❖ Some air cleaners will remove airborne allergens and dust but a good quality air cleaner with the capacity to clean a room can be expensive. Chose one with HEPA filtration, ioniser, carbon filter and with a capacity to clean the area you want. **COST: £50 to clean a room under 34 m². Running cost will be 1p per day (50 W).**

Physical changes to the indoor environment

- ❖ Avoid too many fabrics and soft furnishings, which hold dust. Where possible buy non-fabricated furnishings and hard flooring. **COST: for**

laminates and vinyl are similar in price and sometimes cheaper than carpet for a 4 m x 5 m room £150 upwards for laminate flooring and accessories.

- ❖ **When redecorating avoid wallpaper. Paint the walls with a water based washable paint. COST: price of paint**

Insulation

- ❖ **Improving the heat retaining properties in a house will make it easier to retain heat and lower fuel bills. The cost for all insulation works will depend on the eligibility for a grant, which may be 100%, depending on age, receipt of benefits and tenancy. Before commencing on any works, contact your local energy efficiency advice centre (0800 512012).**
- ❖ **Loft insulation. COST: For a loft space of 35 m² approximately £140 for DIY fitting, £250 for professional fitting.**
- ❖ **Cavity wall insulation can only be installed by specialists. COST: for a 3 bedroom semi detached house = £400**
- ❖ **If the walls of a house are solid, the walls can be dry lined indoors. This means putting a new false wall over the old one with insulation in between. COST: get a free estimate from a builder.**
- ❖ **Draft proof doors, windows and loft hatches. COST: £1.80 per 1m strip.**

Mechanical ventilation

- ❖ **The most effective ventilation in terms of energy efficiency is balanced whole house Mechanical Ventilation and Heat Recovery (MVHR). Other forms of mechanical ventilation including extract fans exhaust all the heat from indoor air outdoors. MVHR recovers 50% or above of this heat and returns it to the house. COST: installation and capital costs; approximately £2000. Annual running costs (including cost of lost heat and electricity for a fan) = £80.**



INFORMATION SHEET

CAN HEALTH VISITORS ASSIST CLIENTS TO OPTIMISE HEALTH-DETERMINING ASPECTS OF THE INDOOR ENVIRONMENT THROUGH PROVISION OF EVIDENCE-INFORMED MESSAGES?

You are being invited to take part in a research study. Before you decide whether to take part, it is important for you to know why the study is being conducted and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Please ask us if it is not clear or if you would like more information. Please take time to decide whether you wish to take part.

WHAT IS THE PURPOSE OF THE STUDY?

The home environment may affect health by the presence of pets and house dust mites, tobacco smoke, and household dust. Everyone spends a lot of time indoors, especially in their own homes, so it is important to try to provide a healthy home environment, especially for children. It is difficult to assess the home environment, which is why we have asked health visitors to take part in the study as they have regular contact with you in your own home. We have taught your health visitor to take some readings in your home and note down some details about your household. They can then make some suggestions that might make your indoor environment better for your health.

We are interested in what you think of the idea of health visitors taking readings and making suggestions about your home. We will also be asking the health visitors whether they like the idea and whether they think they can manage the extra work. We need your involvement for an extra 15-20 minutes on top of the usual visiting time of your health visitor.

We are inviting you to help us with the first part of this research. *If you agree, George Richardson, from the University of Plymouth will come with your health visitor to your home for one visit. Both your health visitor and George will take similar readings during their visit. This will allow George to check how well your health visitor has done in taking readings.*

The health visitor will take these readings:

- *Temperature – to see how warm or cold your home is*
- *Relative humidity – how much moisture is in the air*
- *Dampness –to check if there is any damp in your walls*
- *Presence of house dust mites – a dust sample will be collected using a vacuum cleaner from your living room carpet and from a mattress (in a bed where someone with breathing problems regularly sleeps)*

The health visitor will also ask you some questions including whether or not you have pets, if you smoke indoors, if there is any mould in your home and if there are any other problems that you wish to mention.

WHY HAVE I BEEN CHOSEN?

You have been chosen for this study because your health visitor feels that someone in your home has a breathing problem that may be related to your home environment. In total, 40 households and four health visitors in the Plymouth area will take part in this study.

DO I HAVE TO TAKE PART?

It is up to you if you wish to take part. If you take part, you will be given this information sheet to keep and will be asked to sign a consent form. This is a legal requirement. If you decide to take part, you are still free to withdraw at any time and without giving a reason. A decision to withdraw at any time, or a decision not to take part, will not affect the standard of care you receive in the future. Taking part in the study will not cost you anything.

Before or during the visit by your health visitor and George, we would not expect you to change your routines. Do not try to prepare your home for the visit. After the visit, a list of suggestions will be made based on the information from your home. Your health visitor will then revisit you to give you the suggestions, which they will explain to you. The suggestions might be based on your lifestyle or in some cases problems with the building. We would like you to follow any suggestions for lifestyle changes and where possible follow any suggestions for structural changes. For example, we may suggest that you should reduce condensation in your bathroom by opening windows or getting an extractor fan installed.

Your health visitor will contact you when you have finished your part in the study. We would then like you to fill in a questionnaire that will ask you:

- *What you thought of the study and measurements*
- *If you would like to see your health visitor assess your home environment during their normal visits*
- *If you found the suggestions helpful*

WHAT IF SOMETHING GOES WRONG?

Both the health visitor and George are fully insured against causing any accidental and non-accidental damage in your home. Further the health visitor and George have indemnity and/or compensation insurance in the event of a claim by, or on behalf of a participant for negligent and non-negligent harm caused through any action associated with the study. Regardless of this, if you wish to complain, or have any concerns about any aspect of the way you have been approached or treated during the course of this study, the normal National Health Service complaints service is available.

WILL MY TAKING PART IN THIS STUDY BE KEPT CONFIDENTIAL?

All information that is collected about you during the course of the research will be kept strictly confidential. Only the health visitor will have access to your medical records. George Richardson will have access to your names and addresses because he will enter your home. The information he collects will be

assigned a special identity number before it is analysed and your name and address will be removed.

WHAT WILL HAPPEN TO THE RESULTS OF THE RESEARCH STUDY?

The results of this research study are to be used by George to determine how easy and acceptable it is for health visitors to take readings of the indoor environment. The study will form part of George's Doctor of Philosophy degree (PhD). Every effort will be made to publish the results in scientific journals. None of your personal details will ever be published so no one will be able to identify your home.

WHO IS ORGANISING AND FUNDING THE RESEARCH?

This research study is organised by George, based at the Faculty of Health and Social Work, under the supervision of Professor Ray Jones at the University of Plymouth and Plymouth Primary Care Trust. No one in the study will receive any payments, including the clients, health visitors, and the researcher. George is funding his own research.

WHO HAS REVIEWED THE STUDY?

A review was conducted by the South and West Devon Research Ethics Committee, Room 101B, ITTC South Building, Tamar Science Park, Davy Road, Derriford, Plymouth PL6 8BX.

CONTACT FOR FURTHER INFORMATION

If you would like more information or would like to talk further about the study, please contact:

<i>Researcher:</i>	<i>George Richardson</i>	<i>Health visitor:</i>	
	<i>01752 795633</i>		

MANY THANKS FOR THINKING ABOUT TAKING PART IN THIS STUDY

If you wish to take part, please read and sign the consent form provided. The form will be collected by your health visitor.

Faculty of Health & Social Work



Centre Number:
Study Number:
Patient Identification Number for this trial:

CONSENT FORM – MINORS

A COPY TO BE SIGNED BY ALL COMPETENT MINORS LIVING IN THIS HOUSEHOLD.

Title of Project: CAN HEALTH VISITORS ASSIST CLIENTS TO OPTIMISE HEALTH-DETERMINING ASPECTS OF THE INDOOR ENVIRONMENT THROUGH PROVISION OF EVIDENCE-INFORMED MESSAGES?

Name of Researcher: GEORGE RICHARDSON, UNIVERSITY OF PLYMOUTH.

Please initial box

My Parent/ Guardian and George or the health visitor has explained to me the measurements that George and the Health Visitor wish to take where I live. I think that is OK. I have been given a chance to ask questions.

I want to take part. If I don't want to continue I know I can give it up without my medical care or legal rights being affected.

I would like to be part of the project and I know that my Parent/ Guardian has signed a similar form.

_____ Name and age of participant	_____ Date	_____ Signature
_____ Name of health visitor taking Consent (if different from researcher)	_____ Date	_____ Signature
_____ Researcher	_____ Date	_____ Signature

COPIES: 1 for each participant; 1 for researcher; 1 to be kept with health visitor's notes

Faculty of Health & Social Work



Centre Number:
Study Number:
Patient Identification Number for this trial:

CONSENT FORM – ADULTS

A COPY TO BE SIGNED BY ALL ADULTS LIVING IN THIS HOUSEHOLD.

Title of Project: CAN HEALTH VISITORS ASSIST CLIENTS TO OPTIMISE HEALTH-DETERMINING ASPECTS OF THE INDOOR ENVIRONMENT THROUGH PROVISION OF EVIDENCE-INFORMED MESSAGES??

Name of Researcher: GEORGE RICHARDSON, FACULTY OF HEALTH & SOCIAL WORK, UNIVERSITY OF PLYMOUTH (tel. 795633).

Please initial box

I confirm that I have read and understand the information sheet dated 3 October 2006 (version HVIE: Info 1) for the project and have had the opportunity to ask questions.

I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my medical care or legal rights being affected.

I agree to take part in the above project

Name and age of participant

Date

Signature

Name of health visitor taking

Date

Signature

Consent (if different from researcher)

Researcher

Date

Signature

COPIES: 1 for each participant; 1 for researcher; 1 to be kept with health visitor's notes

APPENDIX IV: INTERVIEW SCRIPTS

Interview script: Health visitor version

NOTES FOR THE INTERVIEWER (in italics)

Before you book an interview make sure you are clear about the suggested interview procedure, the interview script and that you understand the non-specific open statements. You are asked to follow this script closely; please make notes during the interview and send each tape with your notes by recorded mail to the person responsible for transcription following each interview. Please inform the interviewee that you will be recording the interview and taking notes. If the interviewee asks for a copy of the transcript, say 'yes' and alert the researcher to your promise. Please explain to the interviewee the purpose of the research and this interview. Be positive - what you are about to do is FUN and highly interesting for the researcher! Please give the interviewee a copy of the topic list.

THE INTERVIEWER TO SUGGEST TO THE INTERVIEWEE THAT:

You (*the health visitor*) are taking part in this interview to give your opinions on the research you participated in as part of a PhD study by George Richardson (Faculty of Health & Social Work, University of Plymouth). Your cooperation in the research was greatly appreciated. Your help is still needed to clarify the research question 'Can health visitors assist clients to optimise health-determining aspects of the indoor environment through provision of evidence-informed messages?'. There are no right or wrong responses to the statements that I will read to you. Please accept that I do not know what response the researcher is looking for. Your responses will be anonymised by me and

transcribed independently. By taking part in this interview, you are consenting to its use in the research.

The interviewer can remind the health visitors that the objectives of the study were:

- **To develop a cost effective, simplified tool kit with which health visitors can assess the indoor environment**
- **To assess the feasibility of health visitors quantifying and qualifying environmental variables**

Generally throughout this interview, I am going to ask what you thought of certain aspects of the research. I will mention different topics.

*You can enquire about the topics by asking; 'What did the health visitor think of?' each topic thereby stimulating a response from the interviewee. In addition, you can use the prompts in brackets if the interviewee is unsure of what to say or what the topic implies. **Please note down the date, time, and place for each interview and mark your tape and notes with this information.***

Topics

Topics 1 – 3 refer to your involvement in the research and 4 – 5 refer to your opinion on the future implementation of the idea of health visitors monitoring the indoor environment. These topics are about your personal involvement in the research

1. Recruitment (*how did you hear about the research, reason for joining*)
 - a. How did you hear about the research?
 - b. What was your initial reaction to the idea?
2. Training and information
 - a. Classroom training (*amount of training, understanding, relevance, technical language used*)
 - i. What did you think of the training?
 - ii. Was it easy to understand?
 - iii. Did it all seem relevant?
 - iv. What did you think of the length of time it took?
 - v. Were you allowed extra time out from work to undertake this training, or did you have to fit it into your schedule?
 - vi. If you had to fit it into your workload, was this a problem?
 - b. Health visitors' information pack (*amount of information, relevance of the variables chosen for you to measure, could you make use of the information sheets*). A copy of the information pack can be shown to the interviewee
 - c. What was it like working in the field with the researcher, in front of your clients?

- i. What was the field training like?
 - ii. What did you think of the length of time it took?
 - iii. What did you think of its usefulness?
 - iv. Were there any problems related to taking an 'outsider' into one of your clients. (Embarrassment)
 - v. Did you understand the data from the instruments?
 - vi. Did you understand about completing protocols?
 - vii. Having done the training, do you think you would feel confident to undertake the testing procedures alone?
- d. Advice & recommendations given during/ after visits to the client
- i. Did the clients think this testing relevant?
 - ii. Did clients understand what was going on?
 - iii. If clients did not understand, how did you deal with this problem?
 - iv. What was it like to for you to give advice on the indoor environment?
 - v. What did clients think of having their house monitored?
 - vi. What did the clients think of the advice given?
 - vii. Did they use the advice?
 - viii. Were the fact sheets (on dust mites, damp etc.)used by you with the clients?
 - ix. If yes, were they useful?
 - x. If you did not use them, why didn't you?
 - xi. Did you make referrals to other organisations?
 - xii. If you did, what were the results of these referrals, can you give me some examples?

- xiii. Have you seen any other results or outcomes?
- e. Client's feedback (reactions, acceptance, usefulness, long-lasting)
 - i. What was the reaction of clients to the intervention?
 - ii. Can you give me some examples?
 - iii. Did they understand why you brought George?
 - iv. Did clients follow any of the recommendations made because of the tests?

The following topics are about your opinion of the future implementation of the concept of health visitors monitoring and advising their clients about the indoor environment.

- 3. Do you think that it is acceptable for health visitors to do this kind of work during their routine visits? Is this what health visiting is about?
 - a. Do you think the follow up work involved took, or could take up too much time?
 - b. If you think follow up work would take up too much time, can you tell me why you think that?
 - c. Do you think doing this kind of work might intimidate clients?
 - d. Do you see any problems occurring related to ethics if you take more of an interest in the indoor environment? (E.g. growing cannabis, hazardous living conditions, too many pets in a house resulting in dangers to a child e.g. lots of birds)
- 4. Can you see this kind of work (monitoring the quality of the indoor environment and relating the outcomes to health) becoming a part of your regular routine?

- a. If yes, can you tell me how you found it useful?
- b. If no, why? Are there negative aspects to doing this work?
- c. Would this be something you would recommend?
- d. If yes, to whom?
- e. Have you talked to other people (colleagues) about this process?
- f. If yes, what did they think about this idea?

Would you like to add any other comments?

Many thanks for your help and taking time to complete this interview with me.

George sends his best regards.

Please note down time interview stopped.....

Interview script – health visitor management version

Instructions to interviewer the same as above

Topics

1. Initial reaction to the research proposal

- a. *Clarity of the proposal*
- b. *Did this research meet your needs for research in the local setting?*
- c. *Applicability to the local situation – Plymouth has a high number of council homes and areas designated as areas of deprivation. So, would this mean that this might be of particular benefit here?*
- d. *Will this research be something you could use in reports to show the kind of innovations in your area?*

2. Implementation of the research

- a. *What did you think of the method of recruitment of health visitors?*
- b. *Have you any comments on the timing of this research?*
- c. *Have you any comments on the time taken for this research?*
- d. *What information were you given about the research?*
- e. *Have you any comments to make on the information you were given?*
- f. *If this practice, (the use of the tool kit) were to carry on, are there possible changes that you think should be made?*

3. Management views of the Health Visitors' specific training

I would just like to find out how much you know about the training the health visitors received. Do you know anything about:

- a. *The amount of training*
 - b. *The appropriateness of the training*
 - c. *The health visitor understanding of the training*
 - d. *The relevance of the training*
4. Feedback from the health visitors
- a. Have you had any feedback from the health visitors about:
 - i. The research practices,
 - ii. Comments about the idea in general,
 - iii. Comments about the clients' responses
 - iv. The impact the testing process had on their work
 - 1. Related to time constraints
 - 2. Related to the help it might have been for their understanding of client problems.

Questions

1. What do you think of health visitors giving advice & recommendations on how to manage the indoor environment in their clients' homes?
(Appropriateness, acceptability, how does it fit into the National Health Service strategy for the role of health visiting, health visiting/ public health role, should sets of tools be provided for individual health visitors or for groups of health visitors)
2. What do you think about having a predetermined referral network, in the form of the support organisations in Plymouth City Council and Devon Energy Efficiency Advice Centre for the health visitors to refer their clients to for housing issues? (Appropriateness, usefulness, time considerations, possible useful outcomes)

3. a) Are these departments responsive to your health visitors when they flag up problems?

3. Do you think this kind of work (monitoring the quality of the indoor environment related to health outcomes) could become a part of the health visitors' regular routine? (Reasons)

Please add any further comments that you would like to make

(If no comments, interviewer possibly to mention 'difficult time at the moment' for health visiting.)

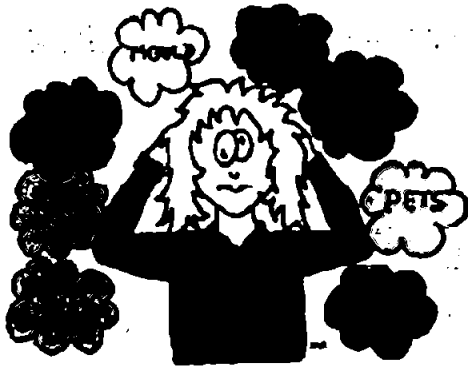
Many thanks for all your help and taking time to complete this interview with me.

George sends his best regards.

Please note down the time the interview stopped.....

APPENDIX V: COPY OF PUBLIC HEALTH DEVELOPMENT UNIT BOOKLET

YOUR HOME AND YOUR HEALTH



What am I supposed to do?

A booklet of tips about keeping your home healthy.

COULD THIS BOOKLET HELP YOU?

1. Do you or any of your family members have breathing difficulties or regular colds and coughs?
2. Do you use lots of cleaning products?
3. Do you have any mould and damp in your home?
4. Do you keep your windows shut to keep the house warm and save energy?

If you answer yes to any of these questions then you may find this booklet helpful for you and your family.

Please keep this booklet as a handy reference for your home. Feel free to talk about this booklet with your friends and family.

2

YOUR HOME AND YOUR HEALTH BOOKLET

Poor indoor air quality is bad for your health and can leave your family feeling unwell. The home is where people spend most of their time.

In your home, you may face problems such as damp, mould, cold, odours, dust mites, and cigarette smoke. The quality of the air in your home is important to you and your family.



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1

HOUSEWORK!!

There are some things you can do around your home to make it a healthier place for your family.



Decipher!! Piles of things around the house make it difficult to clean and allows dust (where dust mites live) to build up

- Regularly clean work surfaces, sinks, basins, and toilets to prevent the build up of bugs and mould
- Vacuum clean regularly to reduce dust mites and pet allergens. Use a vacuum cleaner that has a good filter on the exhaust air outlet and regularly clean out the bag or cylinder
- Dust all surfaces with a damp cloth. Wet mop all hard floors regularly. Remove pet hairs
- Use chemicals for cleaning, sparingly and make sure they are stored in a locked cupboard away from children. Advice on safety locks is available at Children's Centres



3

HOUSE DUST MITES



House dust mites cannot be seen by the naked eye. They live in everybody's home in fabrics where you sit and sleep.

What can you do to get rid of dust mites?

- (8) Wash bedding at 60 °C to break down mite droppings and kill the mites. Normally it is advised to try and use low temperature washes to save energy however, when you are washing to get rid of dust mites you should choose 60°C
- (8) If you have things that would be damaged by washing at 60 °C like teddy bears, then put them in the freezer for 24 hours to kill the mites. Afterwards wash the items at about 40 °C and dry thoroughly
- (8) Feather filled pillows contain fewer mites than pillows filled with synthetic materials

4

MOULD AND DAMP

Mould grows in damp areas such as bathrooms, kitchens, windowsills and around water leaks.



Damp occurs mainly when there is too much moisture in the air.

The moisture forms condensation on cold surfaces like walls and windows, a bit like steam from a kettle running down a window.

All the condensation in your home comes from washing, cooking, drying clothes, breathing, and sweating!

Damp patches also occur because of water leaks.

6

- (8) If you replace your carpets, you may want to consider hard flooring instead, as dust mites find it easier to live in carpets
- (8) Make sure your home is well ventilated. See page 9 for advice on ventilation
- (8) Leave beds unmade until bedtime. This will reduce moisture and dust mites hate light



- (8) Vacuum clean your mattress when you change the sheets
- (8) If you replace your soft furniture you may want to consider replacing items with leather, vinyl or easily washable covers

5

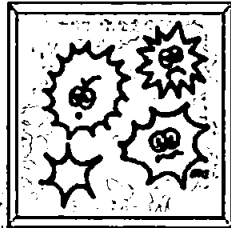
What can you do to get rid of mould and damp?

- (8) Ensure that your home is well ventilated. See page 9
- (8) Fix leaks or other sources of water as soon as possible. Dry things that were made wet by the leak within 1-3 days to avoid mould growth
- (8) Dry clothes outdoors if you can. If you cannot, do not dry clothes on radiators. Dry clothes on clothes horses in a room with a window open and the door closed
- (8) If you use a tumble dryer, make sure the exhaust pipe goes outdoors. If you replace your tumble dryer and have nowhere to put an outdoor vent, make sure you buy a condensing dryer
- (8) Avoid using bottled gas fires - they give off lots of water
- (8) Keep lids on saucepans when cooking, this will reduce steam and shorten cooking time
- (8) Get your cavity walls and lofts insulated

7

- ☞ If you still have condensation problems, you could buy a dehumidifier although they work really well they can be expensive to run and need emptying daily

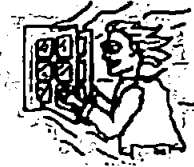
- ☞ When you get condensation on windows, wipe it off with a sheet of kitchen roll to prevent mould growth



- ☞ Condensation on windows overnight may be a sign that you are not ventilating your home enough
- ☞ Rising damp (water rising up from the ground into floors and walls) is very unusual. Rising damp can be seen as a 'tide' watermark all the way round ground floor walls. If you suspect you have rising damp make sure you get expert advice

VENTILATION

Moving air around your home and bringing fresh air indoors helps to reduce smells, dust, condensation, mould and pollutants. Your home needs to breathe whatever the weather!



What can you do to ventilate your home?

- ☞ Open windows as often as possible. Make sure trickle vents are left open above your windows
- ☞ Make sure vents that were put in at the same time as gas heating are kept open at all times. Gas appliances need a good supply of air to work properly
- ☞ Open a window for a while after cooking, showering, and bathing to let out steam. Close the door to the room so you do not cool the whole house. Use extractor fans if you have them
- ☞ Try to avoid net curtains! Although they give some daytime privacy, they quickly get dirty and stick on wet window sills inviting mould to grow. Further, they reduce ventilation and prevent sunlight from entering your home

SMOKING AT HOME



If you smoke (or breathe in other people's smoke), you increase your risk of health problems. Children's lungs are especially vulnerable.

Protect your family from tobacco smoke

- ☞ Try not to smoke in your home or car. Ask family members and friends to smoke outdoors
- ☞ Smoking in one room does not restrict the spread of smoke into other rooms
- ☞ Avoid smoking if you are pregnant

KEEPING WARM

When a home is cold, it is uncomfortable and bad for people with heart and chest problems. Also, the cold increases the chance of condensation with damp and mould forming.

A home gets cold because warmth escapes through walls, roofs, windows, and doors. If a house is very draughty, it becomes more difficult to keep warm and very expensive to heat.



Temperatures indoors should be kept above 16 °C (61 °F). The ideal temperatures to have are:

- ☞ 21 °C (70 °F) in living rooms, dining rooms, and bedrooms
- ☞ 18 °C (64 °F) in bedrooms, hallways, kitchens, and toilets
- ☞ 22 °C (72 °F) in bathrooms

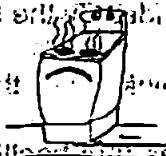
What can you do to keep your home warm?

- ☞ Get cavity walls and lofts insulated and dry line solid or single block walls

... ..

0800 222 1100

- 11 If you have a hot water cylinder make sure it is covered with an insulating jacket
- 12 Reduce draughts through gaps and cracks by using draught excluders. Remember to keep vents open that were installed with your heating system
- 13 Do not use your gas cooker hob to heat the kitchen. The fumes can harm your health
- 14 Make sure you understand your heating controls. Ask your landlord or heating manufacturer if you are not sure. Overheating your home will waste money
- 15 Make sure you keep warm - wear many thin layers of wool or cotton, especially if you are often still, poorly or elderly
- 16 You can save money on your bills by switching your energy supplier and taking actions such as:
 - o Turn down your heating thermostat by 1 °C
 - o Do not leave appliances on standby
 - o Avoid electric fan heaters which use about 3 units of electricity for one hour of warmth



USEFUL CONTACTS



- Gas Emergency Service. If you smell gas anywhere call (free phone): 0800 111 999
- Western Power Distribution. If you have a power cut call (free phone): 0800 389 900
- Fire Safety. For 24 hour fire safety advice call (free phone): 0800 358 1899
- South West Water. For problems with your water supply call (free phone): 0800 169 1144
- Floodline. If you are worried about flooding call: 0845 988 1188
- Plymouth City Council
 - o For pest control call: 01752 304147
 - o For advice on heating call: 01752 305980
 - o For repairs on council properties call (free phone): 0808 2306500
 - o For problems with a private rented or owner occupied home call: 01752 307078

MORE USEFUL CONTACTS

- Plymouth Care & Repair. For advice and help for home owners over 60 and disabled people about maintenance call: 01752 221833
- NHS Direct. For 24 hour health advice call: 0845 48 47
- For advice on quitting smoking call the Plymouth Smoking Advice Service on 01752 316040 or the NHS Smoking/help line (free phone): 0800 022 4 332
- West country Energy Action. For free advice on insulation and energy efficiency in your home call (free phone): 0800 812 018
- uSwitch. For advice on switching your energy supplier call (free phone): 0800 404 7908
- National Debtline. For FREE advice about debt call (free phone): 0808 808 4000
- Citizen's Advice Bureau. For legal advice and help with forms call 0844 828 9117
- Age Concern. For issues affecting older people call: (free phone): 0800 00 89 68

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 Susan Eick, 01823 841163
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 This booklet is provided for information purposes only. AC & T Ltd or the other contributors will not be held liable for any loss or inconvenience however caused or suffered which may arise directly or indirectly because of the use of this booklet.

Paper 1: Richardson G, Eick SA, Jones R. How is the indoor environment related to asthma?: literature review. *Journal of Advanced Nursing* 2005; 52(3): 328-339.

Abstract

Aims. This paper reports a review conducted to identify the factors in the indoor environment that have an evidence-based link with the exacerbation or development of asthma and to identify measures that healthcare professionals can promote to reduce exposure to these risk factors in the home.

Background. The indoor environment, particularly at home, has been recognized as a major source of exposure to allergens and toxic chemicals. Exposure to allergens and toxins is thought to exacerbate respiratory conditions, in particular, asthma.

Methods. Searches were made of health and indoor environment databases, including Cochrane Library, National Health Services Centre for Reviews and Assessment Reports, British Medical Journal, CINAHL and Ovid library, MEDSCAPE/ MEDLINE, EMBASE, INGENTA, Science Citation Index, Web of Science. Searches were also made of other Internet-based resources, including those of international and government bodies. The following keywords were used: allergens; allergen avoidance; asthma; asthma prevention; cat; damp; Der p 1; dog; environmental control; house dust mites; indoor air quality; indoor environment; meta analysis; mould; pets; remedial actions; respiratory illnesses; and systematic reviews.

Findings. There is evidence of a link between asthma and a small number of indoor environmental factors. There is currently only reasonable evidence for one causative factor for asthma in the indoor environment and that is house

dust mite allergen. Although there are many studies of different remedial actions that can be taken in the home, often these give evidence of reduced risk of exposure but not clinical improvement in asthma. Although there is a lack of medical evidence for the reduction of known sensitisers such as mould, this is because of a dearth of research rather than evidence of no association.

Conclusions. There is some evidence of a link between the indoor environment and asthma. There are measures, which could be promoted by healthcare professionals to alleviate asthmatic symptoms.

Paper 2: Richardson G, Eick SA. The paradox of an energy-efficient home: is it good or bad for health? *Community Practitioner* 2006; 79(12): 397-399.

Abstract

This article highlights changes to the indoor environment that arise following the introduction of energy efficiency measures in houses. It compares these changes with the indoor environment in unimproved houses and discusses the varying effects of each on health. The article argues that householders need to adapt their lifestyles and house management methods to their new indoor environment. It discusses a range of ways in which health professionals can help.

Paper 3: Richardson G, Eick SA, Shaw SR. Designing a simple tool kit and protocol for the investigation of the indoor environment in homes. *Indoor & Built Environment* 2006; 15(5): 411-424.

Abstract

Monitoring indoor environments can be complicated, time consuming and expensive. The objective of this study was to pinpoint indoor environmental variables that are essential for providing an assessment of the condition of the indoor environment in homes. The Statistical Package for Social Statistics was used to conduct principal component analysis on data from three existing housing and health studies – two UK studies using 38 (n=124 homes) and 49 (n=88 homes) variables and one Swedish study using 104 (n=60 homes) variables. The analyses highlighted 18 components, which represented the variables from all three studies. The 18 components were further reduced to 14 because of considerations of expense and time. The 14 components were: temperature; humidity; dampness; number of people; number of pets; dust mites; airborne microbes; plant related microbes; carbon dioxide (CO₂); volatile organic compounds; particles; weather data; ventilation; and information about the dwelling. These components form the basis for an indoor assessment that can be used in environmental studies of people's homes by non-environmental scientists.

Paper 4: Richardson G, Eick SA, Jones RB. Simplified measurement techniques for health visitors to assess indoor environments. In: *Proceedings of the AIVC BETEC 2003 conference, Washington DC. 12th October 2003.*

Abstract

There is research acknowledging that the home environment may be responsible for worsening respiratory conditions, especially for children. The indoor environment is a substantial source of exposure to pollutants e.g. environmental tobacco smoke. Apart from conducting specialised, costly and complex studies a method was needed to understand and assess indoor environments in the UK and how people could be encouraged to improve their indoor environment. In the UK, health visitors have traditionally visited homes and from September 2003, the UK government will require health visitors to take an even more preventative approach to their work. Potentially, health visitors are the ideal candidates to perform simple checks and work with clients to improve their indoor environment. This paper highlights some of the initial work conducted as part of this research. Analysis of existing housing and health data revealed a number of indoor environmental variables that were the most influential on the indoor environment. Analysis showed that the number of variables could be reduced to around 17 out of an original 33 variables. A simplified tool kit will be more cost-effective and less time consuming than the original tool kit and will be suitable for use by health visitors on routine home visits.

Paper 5: Richardson G, Eick SA, Ashton JS. An exploration of health visitors' views of conducting indoor environmental assessments. *Public Health Nursing* 2009; submitted.

Abstract

Objectives: Exploring the views of health visitors about using a method for monitoring and advising clients about their indoor environments in relation to health issues. Examining the abilities of health visitors to conduct environmental assessments. **Design:** Between 2004 and 2007, a proof of concept study was conducted in Plymouth, England. **Sample:** A convenience sample of eight health visitors participated in assessments, five of which were interviewed. **Measurements:** The health visitors were taught to make indoor environmental assessments in clients' homes, using a tool kit. Their assessments were then compared with parallel assessments conducted by an environmental consultant. The health visitors' views of the concept were explored using participant observation and face-to-face interviews. **Results:** The health visitors were able to make reasonably accurate measurements using the tool kit and advise clients on their indoor environment. The health visitors found the concept of monitoring the indoor environment relevant to their role. **Conclusion:** Health visitors lacked knowledge on the indoor environment, highlighting a need for more training. Using a quantified monitoring system increased the health visitors' confidence in dealing with indoor environmental issues.

**Paper 6: Richardson G, Eick SA. How can I quit passive smoking?
Community Practitioner 2005; 78(10): 356-357.**

Abstract

Passive smoking is a topical subject and there is a concerted movement to increase public understanding of the dangers of passive smoking. Although it looks likely that smoking could be banned in public places in the UK by the year 2008, it will still be difficult to enforce smoking bans in the last bastion for the smokers – their homes. Many smokers are aware of the risk their smoking causes their families through passive smoking but do not realise that the only true method for them to reduce exposure for their family is to smoke outside the home. This is partly because of a lack of understanding of the behaviour of environmental tobacco smoke and how smoking in restricted areas alone will not eliminate passive smoking for other family members in their homes.

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