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Aims and Scope

The Journal of Environmental Health Research is a peer reviewed journal published in three formats; printed full journal, printed abstracts and electronic journal.

The JEHR publishes original research papers, review articles, technical notes and professional evaluations covering the diverse range of topics which impinge on environmental health including; occupational health and safety, environmental protection, health promotion, housing and health, public health and epidemiology, environmental health education, food safety, environmental health management and policy, environmental health law and practice, sustainability and methodological issues arising from the design and conduct of studies.

The JEHR provides a communications link between the diverse research communities, practitioners and managers in the field of environmental health and aims to promote research and knowledge awareness of practice-based issues and to highlight the importance of continuing research in environmental health issues.

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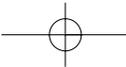
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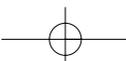
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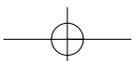
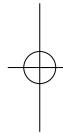
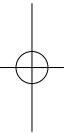
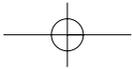
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Editors: Harold Harvey (left) and Paul Fleming

Editorial

In previous editorials we have expressed concerns about two issues of fundamental importance to the creation of an environmental health research evidence-base – funding and reporting.

The reporting of environmental health research is an obvious necessity to the development the evidence-base – we are pleased to recount that the flow of papers to the JEHR has increased substantially over the past year.

The world of research has become an increasingly complex environment where a number of research paradigms strive for recognition, credibility and resources. In this competitive environment it is encouraging to see that all of the papers in this issue of the Journal are based on funded research.

The substantive research papers in this issue cover the range of core environmental topics – food safety, environmental protection, housing and occupational health.

Fairman and Yapp, reporting on research funded by the Food Standards Agency, examine enforcement as an external motivator to small and micro food businesses in complying with the food safety legislation. Their findings suggest challenges to the strategy for food businesses to adopt a more self-regulatory approach through hazard analysis.

Calin *et al* were funded by the US Geological Survey, NATO and the Romanian Ministry of Health to compare the organic and inorganic geochemistry of drinking water samples collected in Romania from Balkan endemic nephropathy-affected locations. Balkan endemic nephropathy is a slowly evolving kidney disease affecting several areas of the Balkan Peninsula the etiology of which is unknown. This paper contributes to our understanding of this disease.

The London Borough of Southwark commissioned Stewart *et al* to seek the views of homeowners in the Bellenden Renewal Area on alternatives to maintenance and repair grants. This research suggests that the government driven options of more closely targeted grants, equity release and loans are not necessarily what homeowners would find most acceptable.

Jordan *et al*, in research partly funded by the Chartered Institute of Environmental Health, presents occupational motorcyclists – such as couriers, paramedics and police motorcyclists - as an important occupational population at risk of developing noise induced hearing loss from the very high levels of aeroacoustic noise generated around their helmets. All occupational motorcyclists in this investigation had LEP,d's above the second action level of the Noise at Work Regulations, presenting a challenge to their employers.

Each of these papers has been subject to "double-blind" peer-review, a procedure designed to assure the independence and objectivity of the reviews and to ensure that published papers meet the discipline's expected standards of expertise. We hope they will make a further contribution to the development of the dynamic, credible evidence-base which is increasingly recognised as important to the effective practice of environmental health and the enhanced recognition of the profession as a partner in delivering the new public health.

Harold Harvey and Paul Fleming

Compliance with food safety legislation in small and micro-businesses: enforcement as an external motivator

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Abstract

This paper builds on the "Compliance Process Model" developed by Henson & Heasman (1998). It argues that many of the steps in the compliance decision process are not made internally and independently by small and micro businesses but are influenced by external factors. Many small businesses display a lack of food safety knowledge and skill. This leads to a lack of awareness of hazards that the business might pose to the consumer and a lack of confidence in dealing with food safety issues. Without awareness of hazards within their own businesses, the primary motivation to improve food safety conditions will not come from within, but will be provided by external drivers such as personal contact with enforcement agency staff or by trade association information. The reliance of the business on the enforcer to identify and direct compliance decisions will provide fundamental challenges for the moves within food safety legislation for businesses to adopt a more self-regulatory approach through hazard analysis.

Keywords: Environmental health; law enforcement; law compliance; food safety; small business; SME.

Introduction

Small and medium sized enterprises (SMEs) account for 99.8 per cent of all food businesses within the catering, hotel and retail sectors (Department of Trade and Industry, 2001). Micro-businesses dominate these sectors in terms of the number of enterprises (*ibid*). The Food Standards Agency (FSA) recently stated that 45 per cent of all businesses inspected in 2000 were "found to have breached some food regulations in some way" (FSA, 2002, p.11). This means that a significant proportion of SMEs do not meet the requirements of the food hygiene legislation. This paper concentrates on small and micro-businesses².

It is accepted that small businesses face particular challenges in their business operations. These include: short track records; heavy reliance on niche markets; lack of specialist skills; low cash flow; small asset base and the need to make changes in structure and

ownership at various stages of growth (Confederation of British Industry, 1996). These characteristics of small and micro-businesses impact upon their ability to comply with legislative requirements, in terms of time, skills and resources required to implement improvements.

The difficulties of small firms in responding to regulation has been extensively investigated. From the review of literature across environmental protection, health and safety and food safety it is clear that the attitudes of SMEs, the nature of SME operations, and barriers to improving conditions are similar (see for instance Hillary, 1995; Petts et al, 1999; Petts, 2000; FSA, 2001; HSE, 1998a). There are two main factors that make it difficult for SMEs to comply with regulation and improve environmental health conditions. These are interrelated and are: the nature of SMEs themselves, and the nature of regulation with which they are expected to comply (Fairman and Yapp, 2002).

The Food Standards Agency Task Force report on the burdens of food regulations on small businesses (FSA, 2001) found that whilst small businesses commonly complain that they are excessively affected by regulations, they do not feel that the requirements of food regulations are particularly onerous. The SMEs and their representatives highlighted a number of problematic areas: the demands of Hazard Analysis Critical Control Point procedures (HACCP), enforcement, and keeping up-to-date. HACCP systems were initially designed for food manufacturing (Panisello et al, 2001). According to Mortlock et al (1999) food manufacturers were five times more likely than retailers and caterers to be using HACCP.

Important barriers to food safety improvements and compliance identified by the FSA Task Force are:

- Lack of understanding of the principles of HACCP (see also Taylor, 2001)
- Lack of technical knowledge to identify hazards (see also Taylor, 2001; Rakel et al, 1998)
- Record keeping (fundamental in many risk management systems such as HACCP) is seen as burdensome and overcomplicated (see also Genn, 1993; Hillary, 1995; Taylor, 2001).

² As defined by the European Commission single definition – a small business is one with less than 50 employees and meeting defined financial criteria and a micro business has less than 10 employees within defined financial criteria (EC, 1996)

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- Inconsistent enforcement (see also Petts, 1999),
- Lack of knowledge of enforcement officers (see also Cabinet Office, 2000),
- Difficulties in keeping up to date with legislation (see also Cabinet Office, 1999),
- Limited availability of specialist consultancy-based intermediaries (see also Genn 1993: HSE, 1998b; HSE, 1999), and
- Trade associations may be a useful food safety information intermediary but many food SMEs are not members.

The barriers to SMEs implementing HACCP have been examined by Taylor (2001). She identifies a major barrier to HACCP implementation as the resistance to implementing a completely new system of managing food safety. This lack of motivation to change can be attributed to:

- The belief that existing procedures are safe,
- The remoteness of enforcement, and
- The lack of conviction that HACCP is effective or practical in their businesses.

Instead of focussing on why achieving compliance is difficult in small businesses, this paper concentrates on how small businesses respond when faced with regulation. In particular it aims to examine the decision-making process that takes place within the organisation. By concentrating on the decision-making process, the role of the various actors in the process and the potential of different interventions can be examined.

Henson & Heasman (1998) developed a compliance process model that describes the decision-making process carried out within a business when faced with a legislative requirement. They base their analysis of the compliance process within companies on work carried out by French et al. (1991). The French work also forms the basis of work by Loader and Hobbs (1999) on understanding the response of companies to regulation. Neither work is specific to SMEs. Henson and Heasman (1998) based their model on a questionnaire survey of food business (67 responses) that was then developed into 24 interviews with technical directors. Their model of the compliance process is shown in Figure 1.0.

This paper examines the applicability of this model to small and micro-businesses. It describes part of the work being carried out on behalf of the FSA on evaluating enforcement interventions in SMEs. The external interventions that impact upon the SMEs decision-making process in relation to food safety legislation are investigated and the potentially most effective local authority interventions are discussed for each relevant stage of the compliance process. The first part of the paper describes how data was collected in order to develop a model of compliance in small businesses. The second part concentrates on how the qualitative data gathered enabled the Henson and

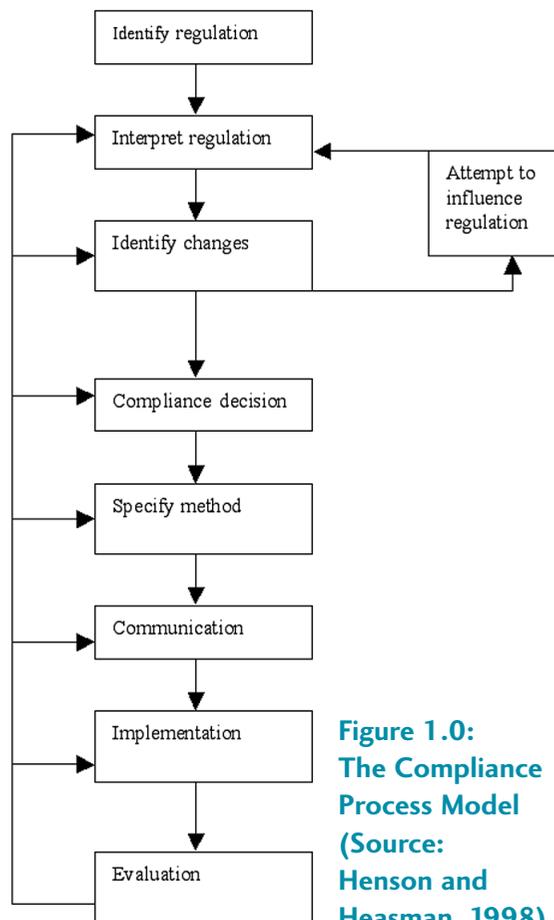


Figure 1.0:
The Compliance Process Model
 (Source: Henson and Heasman, 1998)

Heasman (1998) model to be adapted for small businesses. The final conclusions examine the importance of the enforcement process in the compliance decisions of small businesses.

Part one: data collection

Data on the nature and meaning of compliance in small businesses, the motivating factors, the resources available to small businesses in relation to food safety and the effect of intervention were gathered through semi-structured, qualitative interviews³. These interviews were held with small businesses, trade associations, regulators, enforcement bodies, and consumer groups. These organisations were selected from various sources, including the attendees at a DTI Enforcement Conference in November 2001, the FSA's standard list of consultees, and businesses registered on the Internet – www.brainstorm.co.uk/TANC. Several further groups were contacted as a result of information obtained from these gatekeepers⁴. Small businesses were contacted through the gatekeepers of trade associations, community and business development projects and enforcement bodies. Selection of interviewees was carried out purposively. All major food business and enforcement gatekeepers were

³ A copy of the interview protocol is available upon request.

⁴ A full list of the organisations contacted, and those participating in the interview process is available upon request.

contacted. SME selection was not random and there is likely to be bias in the ones interviewed as these were ones with links either to trade associations or enforcement agencies. It is likely therefore, that the SMEs interviewed would make up the "best" and the "worst" in food safety terms. Eighty five groups and businesses were contacted and full interviews were held with fifty.

The interview responses were coded and analysed in relation to the topics covered in the interview protocol. The compliance process model adopted by Henson & Heasman (1998) was considered in the light of the qualitative data gathered and adapted to specifically relate to small businesses. This adapted compliance model will form the basis of an evaluation of enforcement approaches used by local authorities. The following section outlines the model of the compliance process in small businesses based on that of Henson and Heasman (1998).

Part two: Findings and interpretation – The development of a compliance process model in small businesses

The qualitative data gathered allowed the development of an SME-specific compliance process model. This consisted of five stages; identification and interpretation of the legislative requirements; specifying the method of compliance; making a decision to comply; implementing this method, and

monitoring and evaluating the changes.

There are three main differences between the model developed here and that of Henson and Heasman. First, the stages of identification and interpretation are merged as we found no evidence for distinct steps. Secondly, the compliance decision step is altered.

In the original model, companies will make a decision to comply with regulation based upon economics, feasibility or market reasons. They may choose to fully comply, exceed regulatory requirements, partially comply or fail to comply. In our model developed for SMEs, the step of specifying the method of compliance comes before the making of the compliance decision.

From our initial research it appeared that small businesses will make decisions whether to comply based upon what exactly is being required of them. Finally, the separate step of communication is merged with implementation as it appeared that in many small businesses formal communication routes are not used.

The compliance process model for SMEs is shown in Figure 2.0. It also indicates the main actors in the process and types of intervention that may influence decision-making.

Stage one of the process – Identify and interpret Regulations

Henson and Heasman (1998) divide this stage of the process into two distinct phases – the identification of regulations, followed by their interpretation. From the data gathered it appears that small businesses feel little responsibility to carry out this stage of the compliance process themselves. There is a complete reliance on others for information about regulations and their effect. The predominant source of information comes from the local authority Environmental Health Practitioner during the regular food safety inspection, although targeted information from trade associations was cited as an important source from those small businesses that belonged to one.

Confirming previous research (FSA 2001; Cabinet Office 2000; Cabinet Office 2001), the quantity of legislation, not only food safety but also employment law etc, was identified by small

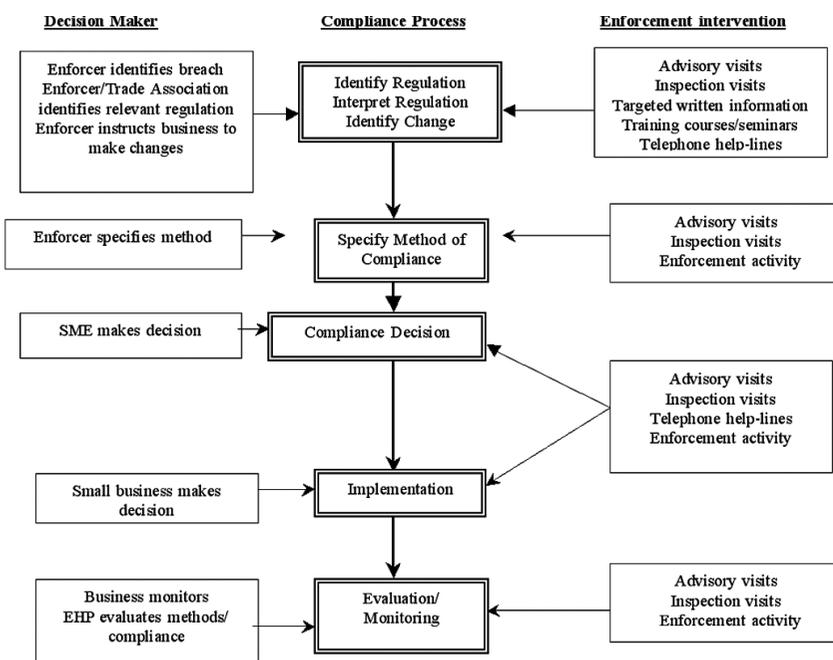
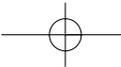


Figure 2.0: The Compliance Process Model for SMEs (adapted from Henson & Heasman, 1998)



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businesses as a reason for their not being able to identify legislative requirements.

"There is so much else to think about"
District Council

"Food hygiene legislation is impossible to keep up with"
Takeaway shop staffed by proprietor.

The consensus was that the enforcer would advise them of any legislative requirements during the inspection visit, or would even "drop by" to the business to notify them of changes in the legislation. The other sources of information noted by the expert groups were not mentioned by the small businesses. One of the most rapidly developing sources of information – the Internet – was dismissed by small businesses as irrelevant to the day-to-day running of their business:

Henson & Heasman (1998) also note that in smaller

Source of information	Type of information provision
Local Authority	Leaflets Websites Newsletters Inspection visits Advisory visits Training courses
Trade Associations	Newsletters Briefing sessions Websites Individual advice
Other sources	DTI Small Business Service information (website and personal advice) Business Link network Food Standard Agency website Environmental Health Consultants (visits, training, briefing notes, reports)

Table 1.0: Information sources identified by experts, enforcers and trade association to assist small businesses in identifying and interpreting regulations

Source of information	Type of information provision
Local Authority	Inspection visits Advisory visits
Trade Associations	Newsletters Individual advice
Other sources	Environmental Health Consultants (visits, training, briefing notes, reports)

Table 2.0: Information sources identified by small businesses as assisting in identifying and interpreting regulations

firms the responsibility for these stages usually rests with one individual, often supported by a trade association. Table 1.0 shows the range of information sources available to small businesses as identified by experts, enforcers and trade associations. Interestingly, when asked where they obtain information to assist in identifying and interpreting regulations, small businesses only identified two main sources - both providing tailored and specific information. These are shown in Table 2.0.

Total reliance on local authority enforcement staff was commonly cited by small businesses, trade associations and enforcers themselves:

"It's the only option we have"
Caterer, <10 staff

There appeared to be a belief among small businesses that identifying and interpreting regulations is not something in which they need to take an active role.

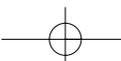
"We don't use the Internet"
Caterer, <10 staff

[There is] no time to go on the Internet
Caterer, <10 staff

This lack of impact of the Internet as an information source to small businesses confirms other work (HSE, 2000a; HSE, 2000b).

Stage two of the process – Specify the Method of Compliance

The data from gatekeeper groups and the small businesses highlights an overwhelming reliance on the enforcer to assist in specifying what the business needs to do in order to comply. Advice from the local authority Environmental Health Practitioner is sought at the time of the inspection visit, where a range of options may be discussed. Ultimately the small business determines the method of compliance. However, comments from the business



Fairman, Yapp

owners/managers indicate that the Environmental Health Practitioner is responsible for guiding this decision:

"We do everything that we are told to"
Caterer, <10 staff

"Frequently they won't have a full understanding of quite why they're doing it"
District Council

Although other information sources are available (for example industry guidance notes, trade association advice), small businesses do not access this information themselves. Other "proactive" methods for seeking out information were mentioned by some groups, including telephone helplines and training courses:

[Training courses] "are very good but time consuming"
Retailer, <50 staff

[Telephone helplines] "take the sting out of the tail"
Retailer, <50 staff

Whilst some of the small businesses thought that these were helpful, there was an inference from some of the responses that they would just rather be told exactly what was needed for that business at the time of the inspection (for example the above quote on training courses – it is too time consuming to find out the information for themselves). Businesses appeared reluctant to take on any responsibility for making decisions about compliance which involved going out and getting hold of the information for themselves:

"HACCP doesn't fill me with horrors...provided that someone can show me a straightforward way of following it through"
Retailer, <50 staff

Stage three of the process – the compliance decision

Whilst external bodies can influence this stage of the process, it is ultimately the small business that makes this decision. Henson & Heasman (1998) recognised that the compliance decision is more complex than simply deciding whether or not to comply, and break this stage down into a number of options. The company may decide to act above and beyond minimum legal requirements "opportunism". The company may choose to comply fully or partially with the requirements or may choose not to comply at all. The company may decide to "exit" and cease trading as a result to imposed legal requirements.

The nature of the compliance decision differs between large and small companies. Large companies with their access to internal expert advice will base any decision upon legislative requirements:

"large businesses have the resources and personnel who are specifically dedicated to enable them to comply with all legislation"
Trade Association.

Small companies, in contrast, base their decision on the requirements set down by the enforcer at the time of the inspection, rather than on a knowledge of the legislative requirements:

"We do everything we're told"
Takeaway shop, staffed by proprietor

By relying on information and guidance from the enforcer, the small company is effectively shifting the responsibility for identifying problems within their business onto the enforcer. Whilst it is apparent that the decision is heavily influenced by external interventions, it is ultimately the small business that makes the final decision.

There appears to be significant differences between large and small companies in the decisions that they make. Small companies are very unlikely to act above and beyond the minimum legal requirements although "professional award schemes" recognising high standards and good practice by trade organisations (eg Seafish and Guild of Quality Butchers) may act as an incentive. Local authority hygiene awards are also offered by some authorities, but do not appear to encourage small businesses to raise standards further than is necessary:

"It wouldn't encourage us"
Takeaway shop, staffed by proprietor

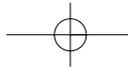
"We should do it [food hygiene] anyway"
Retailer, <10 staff.

Full compliance:

Two related themes emerged from the interviews with small businesses: they believed that they were fully compliant with the law and that their operations were not capable of harming the public. The businesses believe that they are fully compliant if they have done what the enforcer has told them to do when an inspection is undertaken, rather than because they are aware of the legislative requirements that apply to the business. From the interviews it is evident that the majority of small businesses are striving to be fully compliant. The general consensus from the expert, trade and enforcement bodies is that this is not what is actually being achieved. Where full compliance is the aim of the small business they will have a commitment to food hygiene in that they will be prepared to allocate resources – in terms of staff, time and money – in order to comply with legislation:

"We comply with everything"
Caterer, <10 staff

Whilst none of the businesses stated that their business was not capable of harming the public, it was noted that few of them stated that prevention of causing harm was the reason for complying with the law. The main reason for compliance with food



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safety legislation is the fear of being prosecuted and the adverse publicity accompanying such action:

"They don't want to be prosecuted or closed down"
Muslim Council of Britain

"I worry about being prosecuted"
Retailer, <10 staff

"People are frightened of prosecution..... the fear is not governed by the prosecution but the effect on the food business you lose your livelihood and your future"
Takeaway shop, Staffed by proprietor

Another reason given was to reduce the amount of attention from the enforcer:

"We don't want to be caught"
Caterer, <50 staff

[SMEs] *"don't like being pestered"*
Health and Safety Executive

One interesting point from the small business interviews was that none (with the exception of the butchers) believed that their business was capable of causing a food poisoning outbreak. The small businesses did not appear to associate food poisoning, and trying to minimise the likelihood of it occurring, with the existence of food safety legislation:

"HACCP doesn't help me... the legislation is too complicated and irrelevant"
Takeaway shop, Staffed by Proprietor

"They don't think food hygiene is relevant to them"
District Council.

This paints an anomalous picture with small businesses believing they comply, not perceiving food risks within their businesses and but still appearing to be afraid of prosecution.

Partial compliance:

Whilst small businesses consistently believed that they fully complied with food safety legislation, the gatekeeper groups firmly believed that there was actually only partial compliance with legislation. Henson & Heasman (1998) also recognised that *"small firms are more likely to adopt partial or non-compliance as a strategy"*.

It is clear that prestige bias may have been a factor in small businesses asserting their compliance with the law. A number of the interviews with small businesses were carried out in the businesses premises and it was apparent that the businesses did not fully comply. For example, interviews were conducted with a retailer whose shop ceiling had partially collapsed and a restaurateur who believed that consideration of

hazard analysis was "not necessary" for the business. When confronted with the obvious non-compliance the business owners asserted that they believed they had complied because the enforcer had not identified the defect or omission as a contravention. This exposes the difficulties in defining the meaning of compliance to small businesses. A theme emerged from the business interviews that small businesses believed they complied because they had not been told they did not. This is not a view of compliance held by enforcers or regulators and has important implications for enforcement.

Where small businesses rely on others to tell them whether they comply with food safety legislation, they will have little motivation to improve further unless they are told to do so by the enforcer. This, together with a belief that their business does not pose any real threat to public health, introduces fundamental obstacles to the improvement of food safety conditions within small businesses. This research reinforces that of Henson & Heasman (1998) and highlights a reliance on the enforcing officer to identify areas of non-compliance. Unless and until these breaches are noted by the officer, the small business will believe that they comply with the law and will continue running a business that only partially complies with food safety legislation.

Non-compliance:

Whilst some small businesses rely entirely on the advice of the enforcer, other small businesses have a high level of knowledge and may disagree with the 'experts' view. Several small businesses interviewed stated that they have not always followed the requirements of the enforcer:

"I comply unless it is not feasible or not going to improve the food safety"
Takeaway shop, Staffed by proprietor

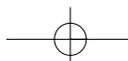
Small businesses may well have adequate knowledge and commitment to food hygiene but feel that the law is "irrelevant" to them. These businesses need a different enforcement approach to those with a more limited knowledge.

It was generally accepted by enforcers and experts that there will always be a sector of business that will not comply with food safety legislation, either due to a lack of knowledge or because it is simply not a business priority:

"They have different priorities"
City Council

[They are interested in] *"buying the product, selling the product. Anything else is secondary"*
Muslim Council of Great Britain

Several groups commented on the importance of educational background in influencing the level of compliance:



Fairman, Yapp

"Food safety is a basic skill learnt from my mother"
Takeaway shop, <10 staff

"The attitude is dominated by the way they've been brought up"
Muslim Council of Great Britain

Stage four of the process – Implementation

Once a method of compliance has been specified, it must be implemented. Unlike the Heasman and Henson (1998) model, the data from small businesses did not support a separate stage of formally communicating the compliance strategy. In very small businesses management structures are usually very simple with the owner or manager taking responsibility for all management issues. In such structures, top-down communication of proposed changes are likely with the actions of the owner/ manager being important. This implementation step is likely to be the second and final "proactive" step to be taken by the business in the compliance decision process (the first being the actual compliance decision). Visible and active enforcement action is seen by businesses as a primary motivator to ensure that the new activity is implemented within the small business.

Stage five of the process – Evaluation and Monitoring

As small businesses appear to believe they comply until they are told they do not, monitoring and evaluation of changes is unlikely to occur. Where legislation attempts to force businesses to monitor (for instance the monitoring documentation required with HACCP or temperature controls), there appears to be a belief that it is unlikely that small businesses carry out this activity unless they are continually and consistently reminded to by the enforcer. Several comments were received by groups about the fact that small businesses believe:

"if they have the paperwork they're OK"
Trade Association

This was also seen in pest control contracts. Once a contract was in place, no further action was taken by the business - they did not read the contractor's report advising of a rodent infestation, let alone instruct the contractor to take any action to deal with it.

Part three: conclusions; the impact of enforcement on the compliance process model for small businesses

Small businesses have particular characteristics, and the process through which they make decisions as to whether to comply with legislative requirements will differ from those in larger businesses. For large

companies, the entire process is an "internal" one, with external influences maintaining the pressure on them to continue with the process. The main motivator to comply will be fear of negative publicity and subsequent impact on trade. In contrast, in small businesses the whole process is driven by external interventions, predominantly by the enforcer during the inspection visit. From the interviews carried out it can be seen that the small business will only be involved proactively in the process when it has to make a decision whether or not to comply, and when it has to implement a chosen compliance method. What small businesses mean by compliance is particularly interesting and has major implications for enforcement policy. Small businesses appear to believe that unless an enforcer has identified a problem that needs rectifying they are in compliance with the law. They believe that responsibility for identifying problems rests with the enforcer, not themselves.

This is exactly the situation identified in the UK in the early 1970s that existed in businesses in relation to health and safety law, which led to goal-based, non-prescriptive regulation (Robens, 1972). With identifying non-compliance and specifying the necessary action seen as the enforcer's responsibility it is clear that for small businesses the external actions of an enforcement body will be crucial in improving food safety conditions. Figure Two summarises the compliance process in small businesses, it highlights the main decision-maker in each stage, and the potentially most effective local authority intervention for each step.

Whilst such attitudes prevail within small businesses the self-regulatory culture being encouraged in the use of hazard analysis and HACCP approaches will be difficult to achieve. Small businesses appear to lack the skill and knowledge necessary for them to be able to identify hazards within their premises. This leads to confidence problems in identifying and rectifying problems. It can also lead to over-confidence and a belief that no hazards exist and that the public will not be exposed to food safety risks. This lack of knowledge contributes to the mistaken belief by many small businesses that they comply with the law.

Discussions within the professional community involved in enforcing food safety legislation often concentrate on whether education of small businesses or strict formal enforcement is the most effective approach in interventions. Clearly, the fear of prosecution expressed by small businesses might indicate that prosecutions within a local authority area would motivate other businesses to comply. However, for such a deterrence strategy to succeed, small businesses would have to relate the reasons for a prosecution in another business to the problems that exist in their own. When the lack of knowledge and awareness of hazards within businesses is considered and the general belief that they comply, it is clear that deterrence may not be effective.

The perceived need to be told what to do by an "expert"

Compliance with food safety legislation in small and micro-businesses: enforcement as an external motivator

reinforces the educational role of the enforcer. If businesses are relying on a visit from the local authority, then it is vital that visits are carried out on a frequent basis. Advisory visits – of either short or long duration – focuses the small business owner or manager’s attention on food safety issues and the necessary measures within the business operation. Further, any type of physical reminder of the existence of enforcers will maintain pressure on businesses to implement compliance decisions, for example advisory visits, press releases, newsletters, and formal enforcement activity.

Advisory visits, particularly those of short duration, will keep businesses focused on the need to undertake these activities. Without these, requirements may be overlooked until the next inspection is carried out. Several ‘drop by’ visits throughout the year may remind small businesses that food safety legislation needs to be adhered to consistently, and ensure that there is not a “slackening off” between inspections.

Leaflets and newsletters may be useful to remind of enforcement activity in the area and to remind businesses of their continuing obligations. Local authority enforcement action should educate small businesses as to their responsibilities about food safety hazards, inform them of the necessary action within the business, and take appropriate formal enforcement action against those businesses that cannot be persuaded to improve conditions. As such both education and enforcement play an important role.

Acknowledgements

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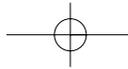
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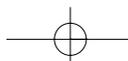
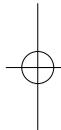
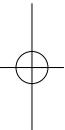
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Identification and Environmental Significance of the Organic Compounds in Water Supplies associated with a Balkan Endemic Nephropathy Region in Romania

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Abstract

Balkan endemic nephropathy (BEN) is a slowly evolving kidney disease affecting several areas of the Balkan Peninsula and whose etiology is still unknown. The purpose of our study was to compare the organic and inorganic geochemistry of drinking water samples collected in Romania from Balkan endemic nephropathy-affected locations, referred to as endemic locations, and nonendemic locations. The inorganic parameters (pH, conductivity, total dissolved solids, metals, nitrates) did not show significant differences between the water samples that were collected from the endemic and the nonendemic areas.

For many endemic and nonendemic locations, however, nitrates exceeded the maximum admitted concentrations for ground water and their potential role as a cofactor in BEN pathogeny should not be overlooked. In contrast, several classes of aromatic (including heterocyclic molecules with nitrogen and oxygen) and aliphatic organic compounds have been found in larger numbers and higher concentrations in the endemic vs. the nonendemic samples, suggesting a possible role for organic contaminants in the etiology of Balkan nephropathy. Many of these compounds are still unidentified, or only tentatively identified, but a likely candidate for a BEN-causing molecule could be among them. The absolute concentrations of the organics are nevertheless low, which might account for the long time required for the kidney lesion to reach a critical threshold and the clinical phase of the disease to develop.

A source of contamination is suspected, the proposed culprit being Pliocene lignite deposits located close to or underlying the endemic locations.

Key words: Balkan endemic nephropathy; drinking water; ground water; environmental health; geomedicine; medical geology; Pliocene lignite.

Introduction

Balkan endemic nephropathy (BEN) is a chronic and irreversible kidney disease, whose etiology is unknown. It was first described in the medical literature in the late 1950s, as a progressive and fatal renal failure occurring in discrete rural areas of Bulgaria, Croatia, Bosnia and Herzegovina, Romania and Serbia (for reviews, see Tatu *et al.*, 1998, Radovanovic *et al.*, 2000) (Figure 1.0). Several thousand people are currently diagnosed with BEN and, in the absence of a specific cure, a fatal outcome is inevitable. Although the causes of BEN are not known, a strong environmental implication is suspected, acting in synergy with the genetic background of the susceptible population living in the affected areas. Among environmental factors, heavy metals, radioactive elements (uranium), oligoelement (selenium) deficiencies, and mycotoxins (ochratoxin A), have all been suggested as possible factors, but none is supported by convincing evidence. Live biological agents (viruses, bacteria) have also been suggested, but were subsequently excluded as causative factors for BEN (Radovanovic *et al.*, 2000). Moreover, the disease is also frequently associated with upper urinary tract (urothelial) tumors (Ceovic *et al.* 1992), suggesting the action not only of a nephrotoxic, but carcinogenic factor, too.

All the villagers in the BEN-affected areas in Romania rely entirely on ground water (springs and shallow well water supplies) as their only drinking and cooking water supply, suggesting that water might be the carrier for the agent causing the disease. Moreover, the geology of the endemic areas is dominated by Tertiary sediments, including Pliocene lignite deposits that are a source of many potentially toxic organic compounds (Feder *et al.*, 1991, 2002; Tatu *et al.*, 2000a). Based on these observations, an alternative hypothesis has been formulated, suggesting that such compounds, leached from the Pliocene lignite through natural or anthropogenic (mining activity) processes into the aquifer system, could contaminate the springs and well water supplies and cause BEN and the associated upper

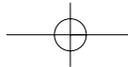


Figure 1.0: Map showing the geographical distribution of the known Balkan nephropathy areas.



Figure 2.0: Water sample location sites (X) in Romania (based on a 1:1,500,000 scale map).

urinary tract tumors in a timeframe of several decades.

To explore this possibility, we compared the organic and inorganic geochemistry of water samples from endemic and nonendemic locations, collected during two separate fieldtrips in year 2000. If the observations developed from the “Pliocene lignite hypothesis” are correct then an organic contamination of the drinking water supplies would be expected in the endemic compared to the nonendemic areas. However, other contaminant sources (eg, anthropogenic or geogenic) would not necessarily be excluded.

Materials and methods

Because the geochemistry of ground water can vary during dry versus wet seasons, samples were collected in several BEN endemic and nonendemic locations in Romania, in spring (wet season) and summer (dry season) of 2000 (Figure 2.0). As the current epidemiological situation of the BEN-affected villages in Romania is incomplete, the selection of the endemic sites was mainly based on historical records, which described BEN in that particular area (village). The nonendemic sites represented villages where no BEN cases have been diagnosed in either the past or present day. The collection sites are described in Table 1.0.

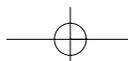
All water samples were collected and stored in precleaned bottles. For metals we used plastic bottles soaked overnight in 10 per cent nitric acid and rinsed with Milli-Q water. For the organics, amber glass bottles rinsed three times with analytical grade dichloromethane, were used. Conductivity, pH, total dissolved solids (TDS) and temperature were determined on site. Before collection, water was passed through 0.4 µm pore size polycarbonate filters (for metals) and 1 µm pore

size glass fiber filters (for dissolved organic compounds). Immediately after collection, the samples for organics were stabilized with 60 ml of analytical grade dichloromethane. The organic compounds were subsequently extracted with an additional 180 ml of analytical grade dichloromethane at the USGS laboratories in Reston, VA, USA. The glass fiber filters used for sample collection were also extracted with 60 ml of analytical grade dichloromethane.

The extracts from both the water samples and the glass fiber filters were analyzed by gas chromatography-mass spectrometry (GC-MS) using a method described in detail elsewhere (Orem *et al.*, 2002). Appropriate field and laboratory blanks were run to correct for contamination. Instrumentation was a Hewlett Packard (HP) 6890 gas chromatograph, interfaced with HP ChemStation software and connected to a 5973 HP mass selective detector operated in scan mode (50-650 Da detection). For quantitation an external EPA610 standard (containing a mixture of PAHs) was used, injected under the same conditions as the samples. Identification of the organic compounds was carried out by computer matching against the mass spectral databases, combined with visual interpretation of each individual peak.

Results are reported as a list of compounds that are reliably and tentatively identified. Match factors of 90 per cent or greater against the mass spectral databases are assumed to provide reliable identifications. Match qualities between 50 per cent and 90 per cent provide a tentative identification, while match qualities of less than 50 per cent are referred to as unknown (unidentified) compounds.

Metals were analyzed by a commercial laboratory (Columbia Analytical, Tacoma, WA, USA), using inductively coupled plasma-mass spectrometry (ICP-MS).



Organic compounds and Balkan endemic nephropathy

Sample id	Name	Latitude (N) Longitude(E)	Elevation (m)	Collection Date	Type	Description
RO1212	Erghevita Village	+44.60388890 +22.78305560	140	8/24/00	E/E	Spring used as public water supply
RO12	Erghevita Village	+44.60388890 +22.78305560	140	3/31/00	E/E	Spring used as public water supply (same water supply as RO1212)
RO9-4	Pietris Village	+44.54341390 +22.85999440	160	8/24/00	E/E	Spring used as public water supply
RO4	Pietris Village	+44.54341390 +22.85999440	160	3/28/00	E/E	Spring used as public water supply (same water supply as RO9-4)
RO1AUG00	Husnicioara Mine	+44.67361110 +22.76666670	275	8/23/00	NE/E	Spring sipping from Pliocene lignite layers; clear water, not used as a water supply
RO4-1	Bistrita Village	+44.58222220 +22.78000000	100	8/23/00	E/E	Private well in endemic household
RO1	Bistrita Village	+44.58222220 +22.78000000	100	3/27/00	E/E	Private well in endemic household (same water supply as RO4-1)
RO2-10	Husnicioara Village	+44.67194440 +22.84000000	330	8/23/00	NE/E	Private well
RO10	Husnicioara Village	+44.67194440 +22.84000000	330	3/30/00	NE/E	Private well (same water supply as RO2-10)
ROB2	Buces Village	+46.21333330 +22.95916670	460	8/29/00	NE/NE	Spring used as public water supply

Table 1.0: Description of the water samples collected in spring and summer 2000 in BEN endemic and nonendemic locations in Romania. E/E –endemic site in endemic village; NE/E –nonendemic site in endemic area; NE/NE –nonendemic site in nonendemic area. RO1AUG00 does not represent a water supply used by the villagers; we took this sample into our study as a natural experiment of the coal extraction process, being water residential in the Pliocene lignite layers.

Results and discussion

In most cases, the water samples collected from the endemic locations were found to contain a larger number of organic compounds and at higher abundances compared to the nonendemic samples (Figure 3.0).

The dissolved organic content and abundances also seem to have a seasonal variation, being higher in the wet, rainy season (usually spring), compared to the dry season (usually summer) (Figure 4.0). A seasonal pattern was also described in BEN incidence and mortality, these being apparently higher during the wet seasons (Radovanovic *et al.*, 2000). Whether this is linked to the variation in the organic content of the water supplies remains to be established. It is known that during wet/cold seasons some concurring factors (like infection/flu, *etc.*) can lead to an aggravation of a kidney disease that until that moment has evolved undiagnosed, making the patient to report to the clinician. In a similar manner, the higher organic concentrations in the drinking water occurring during the wet seasons can decompensate an established renal failure and make BEN to evolve from the subclinical (undiagnosed) to the clinical (diagnosed) phase.

A higher amount of organics in endemic vs. nonendemic water samples was also shown in previous

studies by Goldberg *et al.* (1994) using excitation-emission matrix fluorescence spectroscopy (EEMFS). This technique was employed for providing a gross characterization and screening method for water samples in the BEN affected regions. Using this method, a far greater fluorophoric activity was observed in endemic samples from Bulgaria and Yugoslavia compared to similar ones collected from nonendemic regions. Although the nature and structure of the fluorophoric compounds was not known at that time, aromatics with molecular weight less than 600 daltons were suspected, but higher molecular weight compounds, like humic acids, were also possible candidates.

Table 2.0 provides a synopsis of the organic compounds identified in the analyzed water samples. Aliphatic hydrocarbons (linear and cyclic) and their functional derivatives (fatty acids, ketones, alcohols, *etc.*) represent a large number of the organic components found in the endemic and the nonendemic water samples. They are most likely of natural origin although an anthropogenic source (motor oils, fossil fuels) can be invoked for the long chain alkanes.

Phthalate esters are ubiquitous environmental contaminants used in a very large number of products (as plasticizers in PVC, as a concrete additive, in vacuum pump oils, *etc.*), and their presence in shallow

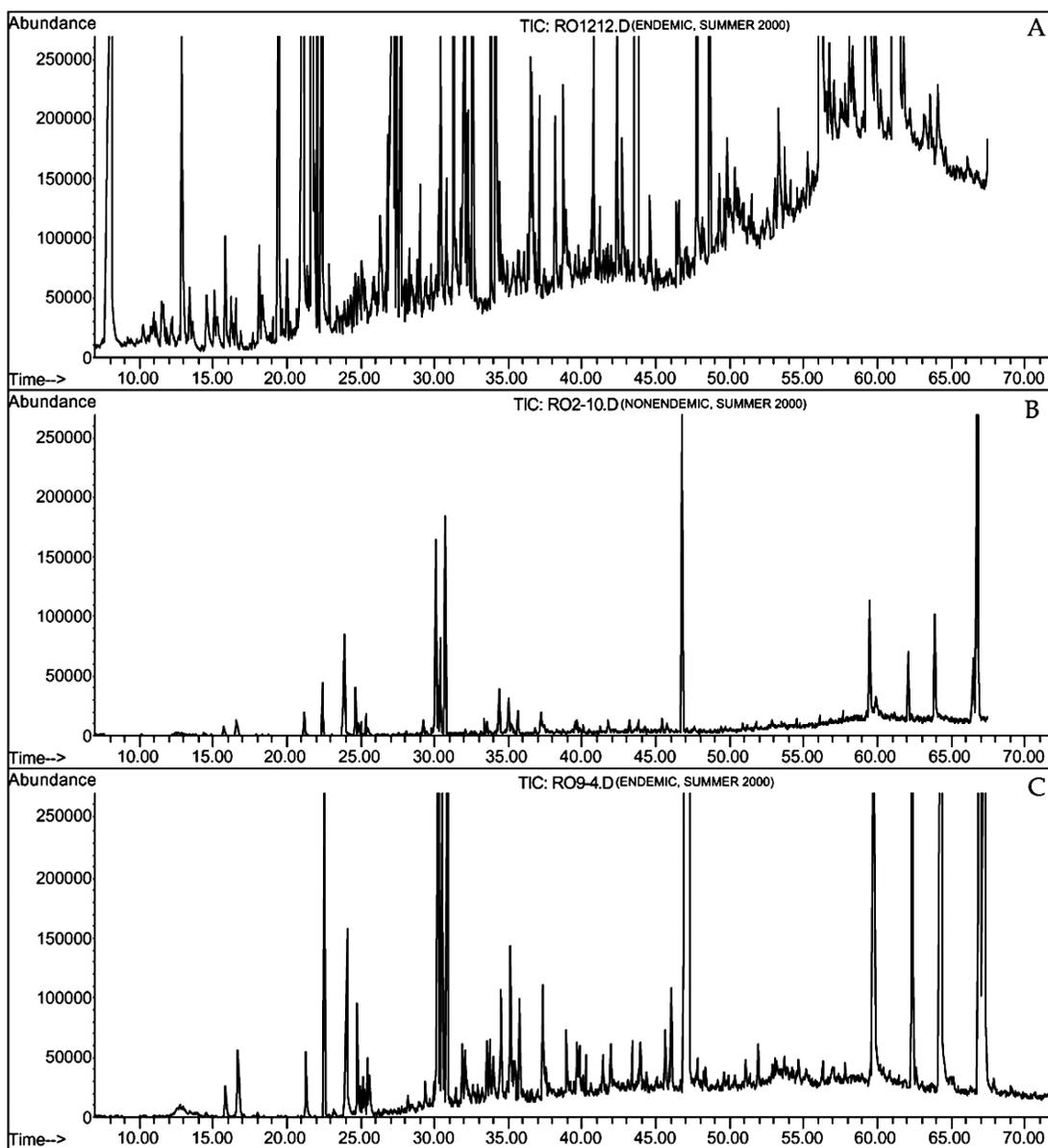


Figure 3.0: Total ion current (TIC) chromatograms from two endemic area and one nonendemic area water extracts. A higher number of organic components and higher abundances can be observed in the endemic samples (panels A and C) compared to the nonendemic (panel B) sample.

ground water systems is ubiquitous. The mining activity, although limited in extent, occurring in the BEN areas could also be a source of such contaminants in the ground water system. The presence of phenolic compounds and alkyl-benzenes can also be due to anthropogenic pollution, but a geologic source (ie, Pliocene lignite) cannot be ruled out.

It is interesting that very few polycyclic aromatic hydrocarbons (PAHs) were positively detected in the analyzed samples. This could be due to their low solubility in water, being retained by the sediments, and to the lack of industrial facilities in the investigated areas. The apparent lack of PAHs in the coal mine water sample (RO1AUG00) also points to their origin from sources other than the Pliocene lignite in the endemic water samples where these

compounds have been detected.

Another curious fact is that in spite of the rural location of the water supplies, no herbicides from the triazine family were detected. However, such compounds were detected by us in similar water samples collected in rural areas in Romania (data not shown); their limited use or lack of use in the BEN affected villages in Romania, reflected in their absence as a ground water contaminant, could be explained by the poor economical status of many of these villages. Chlorinated aromatics like DDT and TCDD (dioxin) were also found to be absent from the assessed water samples.

None of the reliably identified (match quality ≥ 90 per cent) organic contaminants could be directly and unambiguously linked to BEN etiology, many of them being currently detected in both endemic and

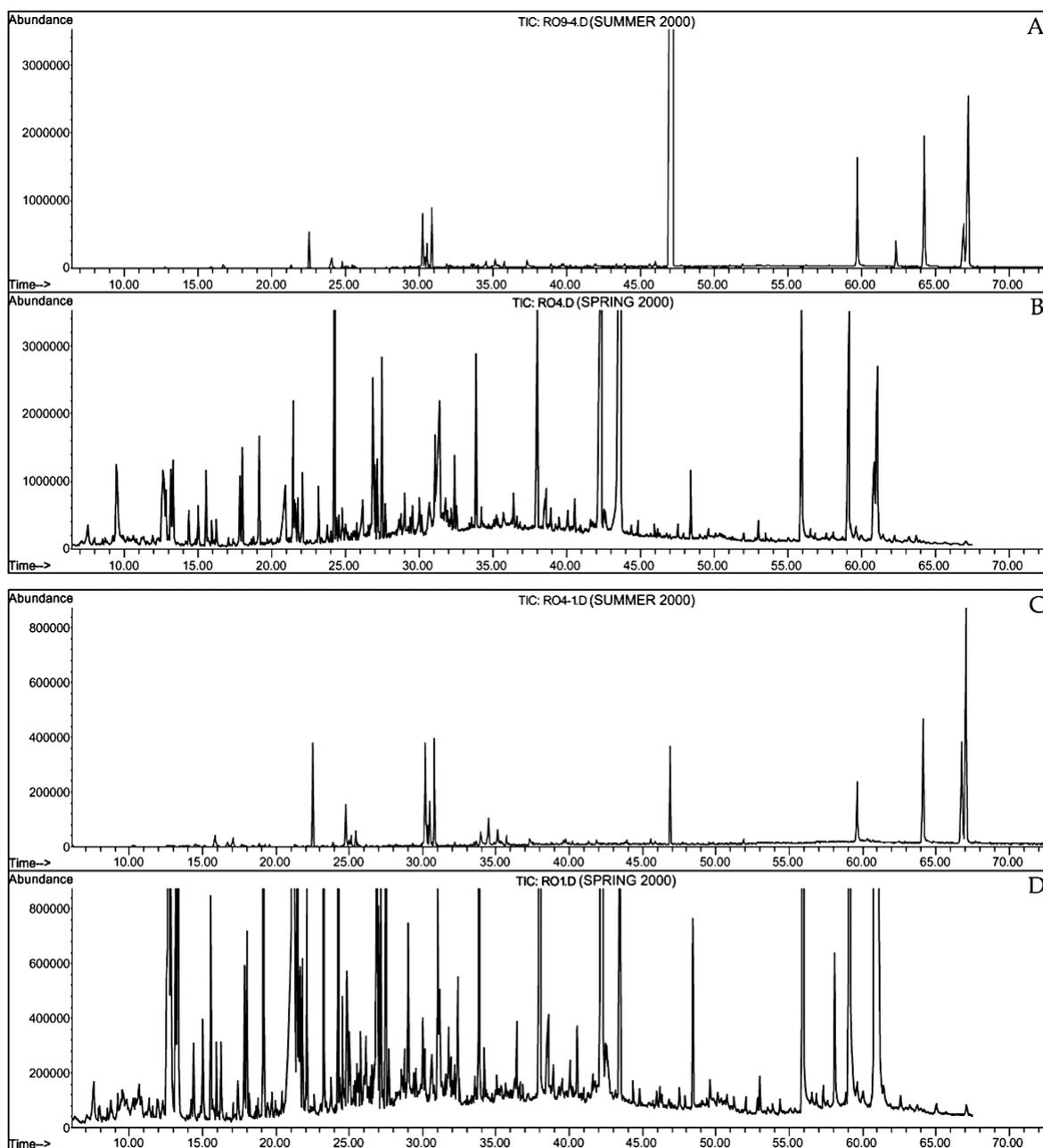


Figure 4.0: Total ion current (TIC) chromatograms of water extracts, showing the seasonal variation in the organic content observed in two sets of endemic samples (RO9-4/R04 and RO4-1/R01) collected in a dry (summer 2000) (panels A and C) and a wet (spring 2000) (panels B and D) season, respectively. The organic components number and abundances are higher in the wet season.

nonendemic water samples. However, the seasonal variation in the number and amount of the compounds, in some cases showing much higher figures during the wet season, may be a risk factor for the populations in the affected villages.

The difference in elevation between the endemic and the nonendemic places has been noticed since the first studies on Balkan nephropathy but how does this connect to the differences found in the organic content of the water supplies is debatable. All the assessed endemic locations are at lower elevations (usually below 250 m) compared to the nonendemic ones (see Table 1.0). This situation is encountered

not only in Romania but as well in the BEN areas in Serbia, Croatia and Bosnia and Herzegovina (however, in Bulgaria there have been some reports stating that certain BEN villages are at higher elevations, between 500-600 m) (for a review, see Radovanovic *et al.*, 2000). It is possible that the compounds carried by the ground water accumulate in higher concentrations in the lower (“terminal”) parts of the aquifer (where the springs/wells used as water supplies are found), making the lower elevation places more susceptible to the occurrence of BEN compared to the villages located at higher altitudes. As most of the organic components are unidentified or only tentatively identified (more than 100 in

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Sample id	RO1212	RO12	RO9-4	RO4	RO1AUG00	RO4-1	RO1	RO2-10	RO10	ROB2
Type	E	E	E	E	NE*	E	E	NE	NE	NE
No. of organic compounds isolated	166	232	58	307	286	28	238	24	45	34
No. of organic compounds reliably identified (match \geq 90%)	52 (31%)	58 (25%)	31 (53%)	55 (18%)	88 (31%)	16 (57%)	82 (34%)	14 (58%)	19 (42%)	21 (62%)
No. of organic compounds tentatively identified (match=50-89%)	65 (39%)	98 (42%)	16 (28%)	67 (22%)	67 (23%)	7 (25%)	77 (32%)	6 (25%)	18 (40%)	6 (18%)
Aliphatic hydrocarbons										
Saturated short chained	√(6) ?(10)	√(6) ?(14)	√(5) ?(1)	√(7) ?(12)	√(15) ?(12)	?(1)	√(18) ?(14)	?(1)	√(3)	√(2)
Unsaturated short chained	√(25) ?(16)	√(21) ?(11)	√(14) ?(1)	√(18) ?(22)	√(31) ?(14)	√(9) ?(2)	√(31) ?(10)	√(7) ?(1)	√(4) ?(2)	√(5) ?(1)
Long chained (\geq C34)	?(3)	?(4)	?(2)	?(1)	√(1) ?(1)	-	√(1) ?(4)	-	√(2) ?(1)	√(3) ?(2)
Functional derivatives (fatty acids, alcohols, esters, ketones, aldehydes, etc.)	√(11) ?(17)	√(18) ?(41)	√(4) ?(3)	√(17) ?(15)	√(20) ?(20)	√(1) ?(1)	√(15) ?(29)	√(3) ?(2)	√(5) ?(10)	√(6)
Phthalate esters										
Dibutyl phthalate	√	√	-	√	√	√	√	-	-	√
Diethyl phthalate	-	√	-	√	√	-	√	-	-	-
Diethyl-hexyl phthalate	√	√	√	√	√	√	√	√	√	√
Other phthalates	√(1) ?(8)	√(2) ?(7)	√(1) ?(3)	√(1) ?(7)	√(5) ?(8)	-	√(2) ?(5)	?(1)	?(3)	√(1)
Phenols										
Butyl nitrophenols	?(1)	-	-	√(2)	-	-	-	-	-	-
Alkyl-phenols	√(4) ?(2)	√(5) ?(1)	√(5) ?(3)	√(3) ?(4)	√(6)	√(3) ?(1)	√(4) ?(4)	√(3)	√(2) ?(1)	√(2)
Nonyl phenols	√(1)	-	-	√(2)	√(1)	-	√(3) ?(3)	-	?(1)	?(1)
Polycyclic aromatic hydrocarbons (PAHs)										
Naphthalene and/or its derivatives	-	-	-	-	-	-	-	-	-	-
Phenanthrene and/or its derivatives	-	?(1)	-	-	-	-	√(2)	-	-	-
Other aliphatic compounds										
Steranes and derivatives	√(1) ?(2)	?(6)	-	?(2)	√(1) ?(1)	-	?(2)	-	-	?(1)
Tributyl-phosphate	?(1)	√	-	√	-	-	√	-	√	-
<i>Terpanes and functional derivatives</i>	?(1)	?(1)	-	-	√(1) ?(2)	-	?(1)	-	-	-
Other aromatic compounds										
Alkyl-benzenes	?(2)	?(2)	?(3)	-	?(1)	?(1)	?(2)	-	-	-
Alkyl-benzenes with functional groups other than hydroxy- (methoxy, -COOH, etc.)	?(2)	√(1) ?(2)	-	√(1) ?(1)	?(1)	√(1)	√(2) ?(1)	-	√(1)	-

Table 2.0:
Synopsis of the organic compounds found by GC/MS in the analyzed water samples.
 *see Table 1.0 for sample description (this sample was expected to bear a large number of compounds due to the leaching process from the Pliocene lignite); √-compound reliably identified; ? -compound tentatively identified. Compound classes suspected to be involved in BEN causation are represented in italics.

certain endemic samples), a BEN-causing molecule could be among these compounds. Trying to positively define these chemicals can be a challenging task, due to the complex composition of the samples and partly to the lack of reference spectra or

standards. Such compounds were also tentatively identified, based on their mass spectra ionic composition, in aqueous extracts of Pliocene lignite samples collected from Romanian and Serbian endemic areas, the lignite being a possible source for

Organic compounds and Balkan endemic nephropathy

Sample id	RO1212	RO12	RO9-4	RO4	RO1AUG00	RO4-1	RO1	RO2-10	RO10	ROB2
Type	E	E	E	E	NE	E	E	NE	NE	NE
Concentration*	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Aliphatic hydrocarbons										
Saturated short chained	0.1	0.12	0.08	0.43	0.31	-	0.33	-	0.009	0.05
Unsaturated short chained	1.24	0.55	0.42	1.43	2.9	0.2	0.77	0.09	0.07	0.07
Long chained ($\geq C_{34}$)	-	-	-	-	0.11	-	0.01	-	0.02	0.02
Functional derivatives (fatty acids, alcohols, esters, ketones, aldehydes, etc.)	1.07	1.78	0.32	5.78	3.74	0.14	3.62	0.07	0.6	0.02
Phthalate esters										
Dibutyl phthalate	0.26	0.35	-	0.94	1.3	0.06	0.33	-	-	0.03
Diethyl phthalate	-	0.13	-	0.3	0.22	-	0.23	-	-	-
Diethyl-hexyl phthalate	3.2	0.83	0.04	15.03	2.75	0.14	1.71	0.13	0.2	0.18
Other phthalates	0.05	0.06	26.84	0.3	0.3	-	0.03	-	-	0.008
Phenols										
Butyl nitrophenols	(0.01)	-	-	0.4	-	-	-	-	-	-
Alkyl-phenols	1.5 (0.03)	0.83 (0.03)	0.82 (0.04)	2.82 (1.17)	3.65	0.16 (0.004)	1.45 (0.16)	0.06	0.1 (0.03)	0.27
Nonyl phenols	0.02	-	-	0.2	0.24	-	0.2 (0.09)	-	0.006	0.003
PAHs										
Phenanthrene and/or its derivatives	-	-	-	-	-	-	0.05	-	-	-
Other aliphatic compounds										
Steranes and derivatives	0.09	-	-	-	0.2	-	-	-	-	-
Tributyl-phosphate	-	0.04	-	0.38	-	-	0.38	-	0.006	-
Terpanes and functional derivatives	(0.02)	(0.04)	-	-	0.05 (0.24)	-	(0.1)	-	-	-
Other aromatic compounds										
Alkyl-benzenes	(0.12)	(0.02)	(0.03)	-	(0.06)	(0.01)	(0.03)	-	-	-
Alkyl-benzenes with functional groups other than hydroxy- (methoxy, -COOH, etc.)	0.004	0.03 (0.02)	-	0.34 (0.007)	0.03 (0.11)	0.3	0.045 (0.02)	-	0.02	-
Heterocyclic with Nor O (pyridine-derivatives, imidazo-derivatives, furan-derivatives, quinoline-derivatives, etc.)	0.04	0.15 (0.05)	0.03	(0.06)	0.33 (0.14)	(0.006)	(0.05)	(0.005)	-	(0.01)
Lignin degradation products (vanillyl group containing compounds)	-	-	-	(0.03)	0.07 (0.07)	-	-	-	-	-

Table 3.0: Concentration values of the compounds reliably identified in the water samples. For potentially nephrotoxic compounds like aromatic heterocyclics, alkylated benzenes, lignin degradation products, terpanes and functional derivatives, and phenols, concentrations of tentatively identified compounds are also shown in brackets. *for groups of compounds only the highest concentration value is specified.

their presence in the endemic water supplies (Tatu *et al.*, 2000b; Orem *et al.*, 2002).

The concentrations of the organic components are generally low, in the microgram/l and submicrogram/l range, in the endemic samples (Table 3.0); however, they can provide an explanation for the long

“incubation” period (usually 20-30 years) needed for the kidney failure to develop.

Compared to the corresponding water samples, the glass fiber filters extracts showed much fewer components in much lower concentrations, with no remarkable distinction between the endemic vs. the nonendemic samples. In consequence, if the organic

Sample id	RO1212	RO12	RO9-4	RO4	RO1AUG00	RO4-1	RO1	RO2-10	RO10	ROB2
Type	E	E	E	E	NE	E	E	NE	NE	NE
pH	6.78	6.82	6.98	7.84	7.74	6.87	7.54	7.22	7.22	7.60
Conductivity (µS)	370	463	899	848	746	1928	713	2170	1664	244
TDS (mg/L)	177	219	434	406	360	950	340	1070	807	115
Temperature (°C)	16.0	12.8	17.2	11.2	26.0	16.4	11.4	15.7	11.5	12.8
Metals	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
Arsenic (As)	0.7	0.7	ND	<0.5	0.8	0.6	2.3	0.5	1.9	0.5
Cadmium (Cd)	0.07	0.07	ND	0.1	0.05	0.05	<0.05	0.05	0.27	0.05
Chromium (Cr)	0.2	<0.2	ND	0.2	1.6	3.8	3.5	2.0	2.1	0.3
Cobalt (Co)	1.12	1.07	ND	0.16	0.32	0.44	0.29	0.36	0.2	0.08
Copper (Cu)	0.2	0.2	ND	0.8	0.4	1.5	1.6	1.0	0.9	0.3
Lead (Pb)	0.17	0.06	ND	0.06	0.06	0.20	0.31	0.41	0.85	0.06
Manganese (Mn)	145	231	ND	41.2	1.68	0.82	0.35	3.78	0.45	0.27
Nickel (Ni)	3.1	3	ND	7.9	3.3	3.8	4.9	3.0	3.7	0.6
Uranium (U)	0.50	0.54	ND	6.41	10.6	15.7	18.8	30.3	34	0.18
Vanadium (V)	1.0	<0.2	ND	0.2	2.1	3.0	1	5.9	0.5	0.2
Zinc (Zn)	0.9	1	ND	4.1	2.2	7.2	11.5	3.0	114	0.9

Table 4.0:
Inorganic geochemical parameters of the water samples. The values do not show significant differences between the endemic (E) and the nonendemic (NE) samples, except for an increased manganese concentration in sample RO1212 (and RO12). The metal concentrations showed little or no seasonal variation in the water samples collected from the same source. TDS-total dissolved solids; ND-not determined

compounds are indeed involved in the etiology of BEN, the critical role could be attributed to those found in the dissolved phase, rather than to those adsorbed on the particulate matter.

Because the metal levels were within the range of typical background levels for ground water (except for manganese, increased in samples RO1212 and RO12) (Table 4.0), they could not be incriminated as a cause of BEN.

Some organic contaminants in the endemic water supplies seem to be of anthropogenic origin but a natural source is likely for many others. If these organics are involved in BEN etiology or if the Pliocene lignite deposits topographically and hydrogeologically connected to the endemic areas are their source, are still facts that need confirmation. However, as many of the drinking water supplies in the endemic zone are contaminated with high levels of nitrate (Orem *et al.*, 2002) as well as with organic contaminants, the use of alternative, cleaner water supplies (like deep wells or treated water) should definitely be considered for these villages, irrespective of the source of contamination of the shallow groundwater supplies. Such an approach was used in certain BEN areas in Yugoslavia (Nis region) and in the main endemic area in Bulgaria (Vratza region), where water pumped from deep (80 m) aquifers or from the mountains and treated by filtration and chlorination has been supplied to the affected villages starting in the early 1960s. A decrease in BEN incidence has been noted in these regions since then (Dimitrov *et al.*, 2001). In the absence of other major alterations in the lifestyle of those villagers, the use of tap water instead of untreated shallow ground water could be a key factor responsible for the decreasing incidence of the disease.

Conclusions

The etiology of Balkan nephropathy remains unresolved, however, our findings point to a possible role of organic compounds present in the drinking ground water in the causation of the disease. Indeed, dissolved organic compounds with aromatic and aliphatic structure are present in higher numbers and higher concentrations in the endemic compared to the nonendemic water samples. A possible, but still unconfirmed, source for these organics are the Pliocene lignite deposits located in the endemic regions. Many of the compounds are unidentified or tentatively identified and some of these could be likely candidates for the BEN-causing molecule. The absolute concentrations of the organics are nevertheless low, which might account for the long time required for the kidney lesion to reach a critical threshold and the clinical phase of the disease to develop.

Other types of organic compounds could also be present in the water samples from the BEN areas but the intrinsic constraints of our analytical procedures, limited to molecular weights <600 Da, do not allow for their detection. Of particular interest in this regard are the humic substances, high molecular weight compounds present in ground water, that have been recently implicated in the etiology of blackfoot disease (Wang *et al.*, 2003). This is an endemic peripheral vascular disorder occurring in rural populations in Taiwan, a higher incidence of upper urinary tract cancers being also noted in the affected people (Lee *et al.*, 2002). A similar involvement of such compounds in the etiology of BEN (and of the associated urothelial

tumors) cannot be excluded, the presence of the humic acids in the ground water from the BEN areas being very likely. These compounds can also be leached from low rank coals like Pliocene lignites and we plan to isolate and identify them by tangential flow ultrafiltration and liquid chromatography-mass spectrometry in subsequent experiments and assess their toxicity and carcinogenic potential in cell culture systems.

The potential role of the nitrates in BEN pathogeny should also not be overlooked. Although unlikely to be a direct causing factor for the disease it is possible that the nitrates could chemically modify certain organics *ex vivo* or *in vivo* and enhance their toxicity, further investigations being required on this topic.

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Maintenance and repairs: an exploratory study into homeowners views on alternatives to grants

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Abstract

The Regulatory Reform (Housing Assistance) (England and Wales) Order 2002 subsumed earlier private sector housing grant legislation and provided local housing authorities with a new power to provide assistance. This heralded a major change in emphasis from provider to enabler, with new opportunities for interventions. Local authorities need to see this as part of a wider change encouraging homeowners to take more responsibility for their properties, which presents opportunities as well as threats, particularly as increasing numbers are becoming homeowners.

Although some options to assist homeowners have been put forward, they have not been rigorously tested. For this research, focus groups were convened to explore what homeowners might find helpful in supporting them to maintain, repair and improve their homes in the context of options already put forward by the government and against a background of declining capital grant expenditure as the state shifts further from provider to enabler.

This research suggests that government driven options of more closely targeted grants, equity release and loans were not necessarily what homeowners would find helpful. Respondents appeared to centre their choice of option around what would give them the most flexible approaches to maintaining their homes, whether or not this might fit into what a local authority may require under housing legislation and policy. Respondents tended to favour options which focused around their individual needs and aspirations, rather than wider housing and community regeneration. They did, however, indicate that they would like more assistance to empower them to make better choices, particularly through training in home maintenance to enable DIY and/or an understanding of works needed to confidently instruct reliable and competent builders to carry out necessary (and not unnecessary) works. However, there was still something of a gap in the approach of those unable to afford any works themselves, as equity release and local authority loans were not generally favoured,

possibly because these schemes are still in the very early stages and such attitudes may change longer term.

In addition, the current move toward personal responsibility must be seen in the context of the public health agenda, particularly where health inequalities are at their most acute. It was unclear from this research whether the Regulatory Reform Order may be able to make real inroads into improving housing and health (physically and emotionally) both on an individual and area level and further appropriately timed research will be necessary to explore this further.

Key words: Environmental health; home owners; home maintenance and repair; housing grants; personal responsibility and housing; private sector housing renewal.

Introduction

The Regulatory Reform (Housing Assistance) (England and Wales) Order 2002 (RRO) (DTLR, 2002) brought the most fundamental and sweeping change to what had been an interventionist grant policy in the private housing sector over a period of decades to help preserve the nation's housing stock. Despite this fundamental change, there has been very little written about what alternatives to housing grants might help owner-occupiers to maintain, repair and improve their homes, what they might find helpful from local authorities in enabling them to do this, and indeed how successful such new approaches might be.

The RRO is part of a wider change in encouraging a new approach to housing and community regeneration in line with the Labour government's vision of a return to personal responsibility, wider community involvement and new partnership relationships between the statutory and voluntary sectors. Such partnership based approaches – with communities at the centre of regeneration – are now

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politically favoured as a new way forward and may be seen to end some of the culture of dependency on grants that has arguably played some role in preventing homeowners themselves from investing in their own homes (DETR, 2001; Mackintosh and Leather 1992).

However, there are some problems in making assumptions that homeowners are willing and able to carry out maintenance, repairs and improvements to their own homes and, indeed, in assuming that homeowners will wish to spend their income on housing issues that meet statutory requirements and therefore a local authority's objectives. For example, homeowners may choose to spend their money on largely cosmetic features such as a new paved front garden that may have a higher "feel good" factor, as opposed to a new (or overhauled) roof, which would be in keeping with a local authority's housing renewal objectives. The withdrawal of grants – and grant conditions – also removes some level of local authority control over what they are able to require in the nation's private sector housing stock.

In addition, the English House Condition Survey (ODPM, 2003) continues to report that it is low-income households (commonly lone parent and ethnic minority) who occupy the worst housing, and this is a very important point. It is also of course such households who are likely to find most difficulty in accessing alternative financial or resource options in being able to carry out works to their homes. This is particularly important at a time when homeownership continues to be politically favoured. Clearly, options need to be found to assist such homeowners, who are likely to suffer multiple stresses of poverty and inequality in all aspects of their lives, not just their housing.

Although grants have been able to help maintain housing stock over a period of decades, it has been suggested that grant policy for homeowners has increasingly lost its way (Leather, 2000). Whilst many welcome the potential for change and shift of strategic emphasis potentially provided by the RRO, others regret the potential loss of grants as an interventionist option. It remains for local authorities to develop and implement strategies that are appropriately tailored and able to offer homeowners realistic options to assist them in maintaining, repairing and improving their properties.

This paper reports on recent research in a low income renewal area in South London, which investigated ways of encouraging and enabling owner-occupiers to maintain their homes within a rapidly changing policy environment. It particularly extends the earlier reviews of policy options and their context (Stewart, 2003a; Stewart 2003b). It further seeks to present evidence based options that homeowners may find helpful as part of state expenditure withdrawal from private sector housing

renewal and a renewed emphasis on homeowners themselves taking more responsibility through an innovative range of options, with or without the support of local authorities.

It is emphasised that this paper is an exploratory study using focus groups to investigate what low-income homeowners would find helpful in maintaining and repairing their homes. It does not seek to offer options to replace grants, but an indication of possible ways forward as provided by respondents in this particular study.

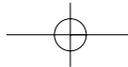
Research objectives and methods

Many local authorities have been investigating alternatives to an interventionist grant approach to help preserve private sector housing stock for some time, although very few options have been rigorously tested. There is a risk that assumptions may be made around untested options unless they remain under regular scrutiny and review. Many local authorities have been promoting home maintenance through a variety of initiatives to help arrest inevitable decline in older housing stock. However, there are advantages and disadvantages to such an approach and it is important to consider how likely it is to harness private sector funding as local authorities adopt a more enabling approach to private sector housing renewal, addressing this issue in a systematic manner based on the needs of local residents. A South London Renewal Area's team therefore commissioned the Centre for Health Research and Evaluation (CHRE) at the University of Greenwich to carry out an exploratory study to ascertain the most effective means of assisting people to maintain their houses adequately and to develop new approaches to tackling the problem of disrepair.

The overall aim of the exploratory study was to support the development of new policies for helping homeowners to take more responsibility in achieving effective home maintenance. Objectives were to:

- Ascertain homeowners' perceptions of the problems they encounter in maintaining their properties in a good state of repair;
- Investigate which support mechanisms homeowners would find useful in facilitating effective home maintenance;
- Identify practical methods / solutions that the local authority are able to incorporate into their private sector housing renewal strategy; and to
- Ascertain whether homeowners can take a more proactive role in maintenance and repair of their homes.

Focus groups were considered the most appropriate way to conduct this study in order to ensure data collection from a group of people more quickly than individual interviews; to enable the researcher to



interact directly with the respondents to probe and clarify responses; and an open response forum to obtain large and rich amounts of data from the perspective and needs of the respondents in their own words. Although a disadvantage of focus groups is that they cannot provide a generalised response relative to a wider population, they nevertheless help to reveal the respondent's problems and solutions and thereby facilitate the development of policies that are able to meet the needs of homeowners.

Options selected for consideration by the focus groups were drawn from a review of the literature (in particular Leather and Younge 1998; Mackintosh and Leather 1992; DoE, 1996; Davidson et al, 1997; DETR, 1998; Davidson and Leather, 2000) and included:

- Council Home Improvement Loan
- Equity release scheme
- Handy person services
- Subscription based Emergency repair services
- Subscription based maintenance service
- Money advice
- Advice and information
- Home maintenance surveys
- Tool loans
- Home maintenance training
- Volunteering schemes
- Builders list
- Maintenance strategy
- Do-it-Yourself (DIY)

Results

Each focus group engaged in a group discussion around key issues followed by individual consideration of what respondents felt would be helpful to them in carrying out work to their homes. Discussion centred around perceptions of, and the value placed on, home maintenance and disrepair in a "real life" scenario of competing priorities on homeowners financial and other resources. It particularly focused on homeowners' perceptions of what would be of value in supporting them to prevent their property getting into a state of disrepair and/or putting it back in order and their views on a range of possible solutions.

The table of options for future home maintenance, repairs and improvements they were asked to consider was based on those that had already been established in the literature. These were placed into three categories of 1) financial; 2) subscription; and 3) services from the local authority, for clarity. Respondents in the focus groups were each asked to individually and without discussion select which they felt were the five highest and five lowest useful options for them. The focus group also allowed time for further discussion around each of the options where appropriate. Relevant comments are included.

Results – presented in the relevant three categories

below – tended to be very individual, although some stood out as having very high or very low priority for the majority of respondents. Interestingly, the list appeared to be fairly exhaustive as no one suggested any other options.

1) Financial

The following illustrates what the focus groups as a whole ranked as most useful (high priority) and least useful (low priority) financially to them in carrying out works to their properties. Respondents were asked to rank the following financial options:

- Home Improvement Loan from the council at reasonable rate of interest
- Using capital (equity) from home as a type of loan toward works without affecting your income
- Money advice to help make better use of your income toward maintenance and repairs.

Although several rated home improvement loans highly, more rated this as a low priority. It should be noted here that this is a key option put forward by the government, alongside more closely targeted grants (which the groups generally seemed to accept, although reasons behind this were not clear) and equity release.

Generally, equity release was not favoured by respondents, possibly because of bad publicity in the past about such schemes, and newer schemes such as HouseProud (to which many local authorities have signed-up) have not perhaps had enough time to run to re-build confidence. It is difficult at this stage to see any reasoning from the respondents behind this, and comments varied from those who thought that with equity release:

"You can't go wrong."

To those who were suspicious of the nature of equity release:

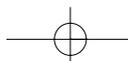
"No, I don't like the sound of it."

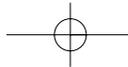
And those who felt that it was not a sensible option at their age:

"Yes, well, at the moment, at this age which I have now reached, I wouldn't agree to take out nothing."

There were some concerns about commercial equity release schemes, whether people would lose their homes and the issue of 'inheritance' after interest and administration had been charged on the costs of equity release.

There tended to be more discussion in the groups about very individually based alternatives that were appropriate to meeting particular needs, and generally the groups reported a willingness to carry out maintenance and repair to their homes, as the following quote illustrates:





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"Because you have got to live somewhere and to keep up the house the right and proper way that is ... you should concentrate on the house and make sure that the house has everything which it needs anyway."

However, the question of what a "house needs" is subjective and depends on the perspective of the owner's needs, and the local authority's legal, policy and strategic objectives which may not be the same.

A lot of disagreement, and misunderstanding was expressed around schemes on offer, and a lot of mind changing went on as the respondents discussed issues and found out more from each another. However there was general agreement that low-income homeowners would have problems in being able to afford home maintenance and repairs. The following commentary illustrates what the group were thinking:

"...And low income people can't afford to do that regular maintenance I think that is one of the problems so they tend to put it off until they can afford it but then ..."

"...Its worse".

"...Yes that's right."

Money advice and how to manage budgets was equally divided as being high and low priority. There was no specific commentary from respondents to explore this further, despite it being a key issue concerning personal responsibility.

2) Subscribing to schemes

The following summarises what the focus groups as a whole ranked as most useful (high priority) and least useful (low priority) through subscription to schemes to them in carrying out works to their properties. Respondents were asked to rank the following subscription schemes:

- Subscription to emergency repair services, with works done by recommended builders
- Subscription to a maintenance service – cover includes exterior survey and maintenance plan, with free emergency call out
- Handy person services – free or low cost service for minor works / repairs only
- Sharing builders costs – council arranges for a builder to visit an agreed area on a set day, to reduce the builder's overheads, making costs less to all
- Volunteering schemes – voluntary help from other local residents, mutual co-operation.

Subscription to emergency repair services was divided between being seen as high priority and low priority and issues were raised in discussion. This was possibly because there was already a culture of subscribing to schemes and enabled closer budgeting, seen by many in the group as offering a good service when *"things went wrong"*, particularly in things needing a regular service and some provision for repairs, such as gas boilers.

Interestingly, subscribing to a maintenance based service generally received far higher priority than emergency based schemes and the following quote illustrates the general feeling of the groups:

"Well because you are likely to need repairs"

The group generally suggested that they would pay a *"reasonable"* annual cost, although there was no agreement as to what this amount might be, possibly around *"£20 per month"*.

Having access to a handy person service stood out as rating highest priority of all during the study. This is possibly because it could help alleviate some of the earlier concerns raised around trust, cost and quality of works *etc.* The following comment illustrates the general feeling of the group:

"If you know you can get hold of someone fairly quick, especially for anybody who can't do it for themselves."

And this service was seen as having the potential to offer a range of works, including plumbing, electrical works, which many were anxious about trying themselves, and even very minor issues (but high priority to some individuals) such as changing a plug.

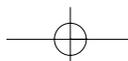
Sharing builders costs was also favoured overall. It was explained to the group that the local authority could arrange for a builder to visit on a pre-arranged day and reduce the builder's overheads, making costs less to all, although there was no specific commentary on this to support why people held this view.

Volunteering schemes were not favoured overall, with most people saying that they would not mind helping neighbours out for a favour, but would not expect any payment, and would not relish the idea of it becoming a more *"formalised"* scheme.

3) Services from the local authority

The following illustrates what the focus groups as a whole ranked as most useful (high priority) and least useful (low priority) as services from the local authority to them in carrying out works to their properties. Respondents were asked to rank the following potential services from the local authority:

- Home maintenance training – groups to discuss common problems, DIY, *etc*
- Inexpensive tool loans - including loan of specialist or expensive items *e.g.* cement mixers, scaffolding, ladders, power tools – helping to save money on overall cost
- Builders list – to help ensure a trustworthy and competent builder for a quality, value for money service
- Advice and guidance on repair and maintenance issues and wider issues *e.g.* on basic construction
- Reduced cost building materials (with free delivery where necessary)
- Home maintenance surveys (free from the council);



written or verbal survey plus report on short and long term repair and maintenance requirements. Home maintenance training was generally positively viewed so that people could learn and share knowledge. The group generally favoured some form of home maintenance training both to be able to do works themselves, but also to check on what builders were saying needed doing, whether it actually did, and the quality of their work (women found this particularly relevant and important). The following quote illustrates this point:

"...I have often thought it would have been so useful to have had a kind of home maintenance course just to sort of prepare you for how to do simple things like electrics."

This tied in closely to providing advice and guidance on repair and maintenance issues, and was seen as being more proactive and akin to a 'health check'.

"...in a way we are talking about home maintenance rather than repairs, its more that you don't know need doing and I suppose. Ideally its just like yourself, you know you ... ideally you'd sort of go off and have a health check every 5 years or whatever and I suppose you should do the same thing with you home but I mean you don't..."

Generally, the issues discussed were about empowerment for homeowners to be able to confidently make their own decisions based on sound technical knowledge, anticipate and proactively carry out routine, appropriate home maintenance and ensure that works done were both necessary and represented value for money.

This was both in terms of accurately anticipating necessary works in a more proactive way and ensuring that builders did a good job. The following comments show the general thinking of the groups towards home maintenance training:

"It's a good idea because a lot of people don't realise something has gone wrong until it happens."

"...And also that someone with more experience may have picked up maintenance needs earlier, but..."

"...that is the drawback, would it be someone who was very thorough and would it be someone very experienced..."

"...When you need anything doing and then if you are not sure you can ask someone."

Several members of the group stated that they had done works themselves in the past (DIY) but this had become more difficult as they got older. Several reported that they would try most things themselves, and ask for technical assistance where necessary, or find things out for themselves from the library, Internet and other information sources. Some reported that they would rather do the works themselves than have a builder

doing it badly, and having to pay for poor work. However, most respondents suggested that they would not attempt to do electrical or plumbing works, because they lacked the skills and were concerned about safety.

The issue of contracting decent and trustworthy builders raised several issues. The following quote supports some of the group's feelings around why they may or may not get works done based on their experiences of builders, which showed a regional bias:

"Could I just mention my experience of being an owner occupier because the first house that I owned was in an Oxfordshire village and the thing there was that if you needed jobs done whether it was electrical or plastering or whatever, there was somebody there who knew who would do that. They wouldn't always do it terribly well but at least you knew who they were."

"...And you know that you could get hold of them again."

"...When I moved to London I mean that doesn't exist. I think that is one of the difficulties."

This point was reiterated several times, largely related to increasingly dispersed communities and not having so much contact with neighbours, particularly as people tend to move house more regularly now. The groups clearly favoured personal recommendation for builders.

Although local authorities have tried to respond to this by providing a 'Builders List', this received a mixed response in this study. Most people saw it as high priority, yet concerns were expressed about how builders actually got onto this list, and whether the list could be trusted, even where the local authority had compiled it. Those ranking builders list as a high priority made comments such as:

"I think that it is very important when you want something done unless you know a builder."

and

"Well it's not something you really look forward to even though you might need it at times, if the occasion arise then you say 'Oh, let's try this one'."

Generally the group's comments suggested that they would be prepared to wait for someone who was reliable, even if this would take some time.

Inexpensive tool loans and reduced cost materials (with free delivery) were seen as low priority.

Discussion

Three major themes emerged from the research – the changing policy environment; personal empowerment (and 'withdrawal' of the state from grant-led housing intervention); and familiarity with the schemes (invariably this study represents snapshot in time only in relation to grants and maintenance issues).

Changing policy environment

The shift from the state as provider to the state as enabler has been evolving for around the last two decades. It is only really since the Local Government and Housing Act 1989 that legislation heralded a shift toward personal responsibility (and therefore a withdrawal of state expenditure), furthered by increased local authority discretion in grant expenditure in the Housing Grants, Construction and Regeneration Act 1996. By 2002, the Regulatory Reform Order had subsumed earlier grant legislation and provided a new power for "assistance", set within a personal responsibility context for homeowners. Grant expenditure will continue to decrease, and local authorities will need to look to owners themselves investing more of their own funds and other resources into their homes.

A fundamental question to ask is whether the new approach can help. In the past grants have been able to help ensure that homeowners have been able to repair and improve their homes, yet grants have acted in a similar way to homeowners, in that they responded to disrepair, rather than help prevent more expensive disrepair in the first place. The new approach could arguably help promote a new ethos in home maintenance and encourage owners to take a more proactive role in home maintenance, which would be more economic for all.

However, this is not as straightforward as it might seem. The focus groups clearly showed that people do not generally make provision for maintaining their homes, individuals have their own priorities regardless of any perceived "community need", older people are less able to participate in DIY, younger people are more able and willing to, but may or may not have the required skills. In addition, house prices in some parts of the country rise so rapidly that some may see it as a "false economy" to invest time and resources in their homes if they are thinking of moving. Lifestyle issues (e.g. a foreign holiday or new car) can be far more appealing than overhauling the roof, particularly when it is the middle of summer. Also, even where available money was spent on housing, the focus groups suggested that people may prefer to spend their money on, for example, an extension, which might not meet the local authority's strategic renewal objectives.

Another factor is that many homeowners simply cannot afford to carry out any works at all to their homes if they have a low income, or even a reasonable income, but high mortgage repayments or other financial commitments. Eligibility to participate in options offered by local authorities needs to be able to take this on board to help ensure maximum options for homeowners. This research was carried out within an established Renewal Area, and there may be different findings where there is not such intensive local authority renewal activity.

Additionally, just because local authorities may be interested and motivated by Home Maintenance Strategies, it does not follow that local homeowners will be. There appear to be some assumptions being made by government, that are not necessarily supported by this research.

Personal empowerment

Much of the rhetoric surrounding the proposed changes hinges on homeowners being given more choice in respect of how they resource maintenance and repairs to their homes. This research generally backed up the idea that homeowners would like more say, but the reality of this is that it leads to less "local authority control" over what can be delivered in housing strategy, and indeed whether the needs of the individual home owner mirror the local authority's objectives to ensure that legal housing standards are met. Loss of grants as an interventionist policy option also leads to some loss of influence.

In addition, while personal and community empowerment may be key to the social side of the public health agenda (which in itself has importance housing/health relationships) physical housing conditions remain key to health. Local authorities need to ask serious questions about whether the options they promote under the Regulatory Reform Order are really able to make inroads into housing conditions, particularly where they are at their most acute.

Many respondents favoured having more advice, training, skills and knowledge in helping them to help themselves in maintaining their own homes and making their own decisions. It is perhaps here that local authorities can be much more pioneering and innovative in encouraging a more proactive approach to home maintenance, repair and indeed improvement, in ways that are more sustainable. Most local authorities already have qualified staff (legal, technical, practical) who would/could be able to offer courses, seminars etc which could help homeowners to understand more about the physical side of their homes, and what to do about conditions.

Although not the subject of this particular research, the issue of the decline in social capital was reported overall as having a negative impact on trust locally, and therefore on the extent to which neighbours and communities might help each other with building works. However, as a result of intense regeneration activity from the local authority in this Renewal Area, plus the focus groups for this research, respondents reported that they had been able to develop new relationships with their neighbours, possibly to mutual advantage in the context of housing renewal.

Familiarity with the schemes and favoured options

There was surprisingly little resistance from the focus groups to grants being withdrawn as a policy option, and reasons for this were not clear. It may have been because respondents were selected from an existing Renewal Areas and therefore more familiar with legislation and policy than others might have been.

Equity release was not favoured, even following some explanation of what it entailed. However, this is possibly because it is a relatively new concept for many homeowners and there has been much bad publicity about some commercial equity release schemes. It would be useful to carry out further research here into some of the newer not-for-profit type equity release schemes that are now starting to operate elsewhere and assess homeowners' views on how they felt after participating in such options.

However, several issues were raised where local authorities may be able to take more innovative approaches to encouraging and enabling homeowners to be able to carry out works themselves, either by instructing a builder, or by DIY. In respect of DIY, most people would be willing to try works, yet this is clearly limited by age, disability and so on. This would help homeowners to understand more about the structure of their homes and what to do about repair and maintenance.

The results generally showed that respondents favoured assistance from the local authority in some areas but not others. It is here that local authorities can develop and implement strategies around what homeowners would find helpful. For example, many respondents reported that one reason they did not instigate works was because of lack of trust and faith in builders. Local authorities could do more to help homeowners find decent, reliable and cost effective builders through a regularly updated builders list operating on the recommendation of the community, including local businesses where possible.

Additionally, local authorities may be able to extend their own in-house local authority housing maintenance contractors and/or role of their local Home Improvement Agency to offer builders for large and small scale works, including a handy person service, to help build trust and encourage further works and tied into other strategies on offer. Although it is hard to know at this stage how effective this might be, it is another option.

Conclusions

Local authorities are freer than they ever have been to make local decisions about how to help address conditions in their private sector housing stock.

However, they still have to be able to make their decision in the context of what will help make inroads into poor housing conditions. Most importantly, they have to ensure that whatever their new strategies they deliver realistic solutions to ensure that low-income homeowners of poor housing.

The research showed homeowner's responses varied as regards interest and ability to carry out works themselves or to be able to knowledgeably instruct a builder to ensure a value for money and quality service.

It seems that there is a place to build on what is culturally acceptable already, such as more insurance-based subscription schemes, in which there is some level of confidence. It may take more time until there is confidence in non-commercial type equity release schemes, but these certainly provide an option for higher cost works. Otherwise, this research suggests that there is a need for more ad-hoc type schemes that suit individuals and communities.

Despite major policy changes, local authorities still retain the fundamental duty to ensure that legal housing standards in their area are met. This needs to align to strategies in the wider public health agenda, particularly addressing health inequalities where they are at their most acute. It is certainly a key policy area to continue to develop new and innovative ways of working, but local authorities need to ensure that their strategies actually deliver what they set out to do.

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Noise Induced Hearing Loss in Occupational Motorcyclists

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Abstract

There are in the region of 26,400 occupational motorcyclists in the United Kingdom, including couriers, dispatch riders, police motorcyclists, paramedics and journalists, and much larger numbers in other parts of Europe and the USA. Occupational motorcyclists can be exposed to very high levels of aeroacoustic noise generated around their helmets and are an important occupational population at risk of developing noise induced hearing loss (NIHL).

This paper provides data on inner helmet, at-ear noise levels for a variety of helmet styles, motorcycle configurations and speeds gathered in on-road investigations. The noise level data is combined with typical daily driving patterns generated from interviews with occupational motorcyclists to estimate the likelihood of hearing handicap using BS5330.

Noise levels in excess of 105 dB(A) were recorded for motorcycles travelling at 70 mph, the maximum public roads speed limit in the UK. Professional racers often travel at speeds in the region of 150 mph+ and police motorcyclists travel at over the maximum speed limit when attending emergencies.

The hearing handicap in the study population ranged from 40% in professional racers and 36% in paramedics to 6 per cent in driving instructors.

All occupational motorcyclists in this investigation had LEP,d's above the second action level of the Noise at Work Regulations. This will require their employers to reduce noise exposure as far as is reasonably practicable by means other than personal ear protectors. This is likely to be a difficult task based on our current level of knowledge of the methods of controlling wind noise generated around helmets.

The dominant noise source was the base of helmet between the chin bar and the neck of the rider. The use of a proprietary neck seal reduced inner helmet noise levels by around 4dB(A) at 120km/h. The neck seal was difficult to fit and on a number of occasions the wind pulled it from the helmet. These disadvantages may make this means of noise reduction unlikely to be used consistently in practice.

The value of conventional hearing protectors in the reduction of noise exposure of motorcyclists is likely to be limited due to the high level of low frequency noise generated by wind turbulence and the impediment they create to the effective use of radio communications. Further research and development is needed into methods for the control of noise in this occupational environment.

Key Words: Environmental health; hearing handicap; motorcyclists; Noise Induced Hearing Loss (NIHL); occupation; work.

Introduction

The numbers of employees exposed to hazardous levels of noise at work has increased substantially over the past 50 years. About 1.3 million workers in the UK are exposed to noise levels over 90 dB(A) and 120 million people worldwide have a disabling hearing impairment (WHO, 2001)

The noise levels now common in many work environments place an excessive burden on the employee's auditory system. European Union legislation requires that noise is monitored and prophylactic measures taken where levels exceed 85dB(A), although inconsistent compliance and spotty enforcement is considered to be a contributing factor to the large numbers of employees exposed to high noise levels (Noise and Hearing Loss, 1990). The Trades Union Congress (TUC) suggests that some new work environment types and expanding occupational categories may create further risks to hearing, for example, call centres, motorcycle couriers (TUC, 2002).

This paper concentrates on a diverse occupational group on which little has been written – occupational motorcyclists. An occupational motorcyclist rides a motorcycle as an essential function of their job although the work patterns, speed and distance travelled vary greatly – on the one hand a part-time pizza delivery person driving at relatively low speeds around a busy city, to a full-time police motorcyclist pursuit officer travelling long distances at high speeds on motorways. Our estimate of the categories and numbers of people in the occupational motorcyclists group in the UK is shown in Table 1.0.

Noise Induced Hearing Loss in Occupational Motorcyclists

Occupational Motorcyclist Category	Estimated UK Numbers
Dispatch/courier	15000
Professional Racer	8000
Police Motorcyclists	1500
Driving Instructor	1200
Driving Examiner	400
Journalists	100
Breakdown Recovery	100
Paramedic	70
Taxis	10
Track Day Instructor	10
Tour Guides	10
Total	26400

Table 1.0: Estimated numbers of Occupational Motorcyclists in the UK

The Government’s White Paper on the Future of Transport, A New Deal for Transport: Better For Everyone, recognises that mopeds and motorcycles can provide an alternative means of transport for many journeys (DTF, 1998). The White Paper also acknowledges the potential benefits that motorcycling offers for the environment with less fuel consumption and decreasing traffic congestion. However, it has long been recognised that motorcycles are a noisy form of transport. Legislation has been introduced to decrease environmental levels and to meet these requirements manufacturers have been developing quieter machines. In tandem with noise reduction technology, modern engineering principles have allowed increasingly faster motorcycles. Thus, as motorcycles become increasingly capable of travelling at higher speeds, and other noise sources continue to be quieted, aeroacoustic noise becomes more important to motorcycle and motorcycle crash helmet design.

Any large object moving at speed will create turbulent airflow around it, be it a bullet, car or motorcycle; this applies equally to the head (and helmet) of a motorcyclist. One of the first papers to examine the issue of motorcyclists and wind noise noted that the motorcyclist is exposed to very high levels of noise, induced by the speed-wind (Henderson, 1975). Later, Alman et al. (1983), concluded that with a speed of 100 km/h, there is a hearing damage risk for the motorcyclist, if daily exposed to a couple of hours for many years; when driving at speeds of up to 70 km/h, the risk is limited to people with highly sensitive hearing.

Binnington et al. (1993) undertook an investigation into the acoustic environment of the rider travelling between 0 to 100 mph. At 40 mph, wind noise became the dominant sound source and increased linearly with the log10 of the speed from 90dB(A) to reach 112 dB(A) at 100 mph. McCombe and Binnington (1994) evaluated the prevalence of NIHL in motorcycle grand prix racers. Twenty riders (45

per cent) had hearing losses greater than expected for age matched controls and this hearing deficit tended to increase with racing experience. Only 17 riders (39 per cent) were regular users of earplugs and only nine had used them for most of their racing careers.

McCombe et al. (1994) investigated methods of reducing the noise level the rider is exposed to using various aerodynamic and sound-proofing helmet modifications in an effort to reduce interior noise levels. The only modification which achieved a significant reduction was the incorporation of a pair of earmuffs under the helmet shell. This gave noise levels of 84 dB(A) at 50 mph and 93 dB(A) at 80 mph, compared to known average values of 95 dB(A) and 107 dB(A), respectively.

McCombe et al. (1995) studied the hearing loss from a variety of motorcyclists. Temporary threshold shift (TTS) was assessed by asking 18 riders to undertake a standard test run for one hour at a steady 80 mph and performing audiometry before and immediately afterwards. Permanent threshold shift was assessed by performing pure-tone audiograms on a highly screened group of 246 motorcyclists and comparing their hearing thresholds with those on an appropriate control group. Significant TTS was found at 0.25, 0.5, 1 and 2 kHz.

Lower et al. (1996) investigated the levels of wind noise under motorcycle helmets and concluded that the main noise source was the turbulent flow from the top of the windscreen acting on the base of the helmet.

This paper provides data on inner helmet noise levels for a variety of helmet/motorcycle configurations gathered in on-road investigations. This data is combined with occupational motorcyclist daily driving information generated from interviews with motorcyclists (see table 3.0) to estimate the likelihood of hearing handicap (see Table 4.0).

Methodology

The measurement of inner helmet noise levels, even for stationary objects, is arduous. Due to the limited space available between the ear and the helmet, normal methods of measurement cannot be used. As a motorcycle helmet is moving at speeds of up to 120 km/h this adds an extra dimension of difficulty. There are currently no standardised methods or protocols for the measurement of noise under motorcycle helmets. The Health and Safety Executive (HSE) published "Noise Guides" to advise on the measurement of noise for the Noise at Work Regulations. In noise guide 3, paragraph 23, it stipulates, 'occasionally a microphone within, or very close to, the external ear has to be used, for example when using a miniature microphone to measure the sound pressure level under a headset or a motorcycle helmet' (HSE, 1990). Thus a miniature microphone was used to measure the inner helmet noise levels.

Nine motorcycle helmets were chosen which varied in quality and styles to give a broad range of typical helmets worn by occupational motorcyclists, some of the more unusual styles sourced directly from occupational motorcyclists. A number of modifications were made to identical helmets. One helmet was left unmodified as a control, another had the visor/air vents sealed and the final had the addition of a fin, fixed to the rear of the helmet. All helmets were tested with the addition of a neck seal to the base of the helmet.

The wind noise measurement system could not be calibrated using normal calibration methods. This was due to the microphone being so small that normal calibrators did not provide a tight fit around it. Thus, the system was calibrated using a loudspeaker and tested against a known source. The difference between the known source and the resultant calibrated tone was -9.4 dB +/- 0.5 dB. This difference was accounted for in the results.

The miniature microphone was placed over the entrance to the ear canal of the rider, so as not to be in contact with any part of the ear. An earphone holder was used to prevent the microphone from moving. A DAT (Digital Audio Tape) recorder and battery were stored under the rider's clothing to prevent the wires from flapping in the wind and the helmet was put on in such a way as to avoid any displacement of the microphone or wires.

A straight, 5km (3 mile), flat, asphalt section of public road with a generally low traffic flow and few adjoining road junctions was selected as the test road. When a gap in the traffic became available the rider travelled along the road at set speeds for 20 seconds at a time. The rider shouted out the speed e.g. '50 km/h' at the start of the run and shouted "Stop" at the end of the run which would allow easier data recovery at a later stage. A number of runs were recorded using different helmet configurations,

windscreen heights/angles and speeds (50, 60, 70, 80, 90, 100, 110, 120 km/h).

Over 200 motorcycle police officers were interviewed, with at least 50 of each of the remaining occupational motorcyclists categories (allowing for those less than 50, all known occupational motorcyclists in those categories were interviewed) gave very 'typical' driving patterns. These daily exposure levels were then used to determine the long-term "noise imission level" (NIL) an index of the total energy incident on the ear over a specified period of time. Using table four of BS 5330 "Method of test for Estimating the risk of hearing handicap due to noise exposure" (1976), which considers the NIL and age of the subject, the expected incidence of hearing handicap resulting from such noise exposure was assessed (BS5330, 1976).

Discussion

Helmets

As expected, the helmets showed a steady noise level increase with increasing speed. The highest noise level recorded was 110.6 dB(A) and the lowest 76.1 dB(A). The average noise level increased by approximately 2.1 dB(A) per 10 km/h increase in speed. The dominant noise source was the base of helmet between the chin bar and the neck of the rider, although other noise sources are present, being the road, exhaust and engine and other wind noise sources around the helmet e.g. turbulence around the visor.

Many different styles of motorcycle helmet are available in today's market place. However, there are two main design features – full face and open face. Full face helmets have a chin bar which protrudes around the chin of the rider and the visor seals to this area. An open face helmet does not have a chin bar and the lower face of the rider is exposed to the elements; the majority of open face helmets also do not have visors. Full face helmets provided average noise levels of 88.3 dB(A) at 50 km/h up to 103.6 dB(A) at 120 km/h. While the open face helmets provided average noise levels of 87.2 dB(A) at 50 km/h up to 98.5 dB(A) at 120 km/h.

The majority of UK riders use full face helmets due to the added protection and comfort/warmth they provide. The visor will be mostly set in the down position, to increase comfort and eye protection. However, during slow town driving the visor may mist up due to condensation from the motorcyclist's breath and the lack of air movement within the helmet. For this reason, the visor is often opened to aid vision. With the visor position closed, average noise levels were 88.3 dB(A) at 50 km/h up to 103.6 dB(A) at 120 km/h. With the visor position open, average noise levels were 90.3 dB(A) at 50 km/h up to 103.5 dB(A) at 120 km/h. This leads to the hypothesis that the visor position is not the major source of wind noise within the helmet as a greater

difference between the resultant noise levels would be expected.

Neck Seals

The largest aperture on a helmet is the hole through which the head is pushed. Once the helmet is in place this aperture is no longer completely filled as the neck has a smaller diameter than the head. This leaves a relatively large air gap between the chin bar of the helmet and the neck of the motorcyclist. To investigate whether or not this has any bearing on the wind noise inside the helmet, a neck seal was chosen to seal this gap. The neck seal tested was the "Motrax - Stop Wind3 Helmet Skirt", a commercially available neck seal which advertised dramatic reductions in helmet wind noise. It fitted by being stretched over the base of the helmet, providing a smaller hole to which to place the head through. However, it left a small gap between the neck and the seal; also the seal was perforated near the chin bar (presumably to provide ventilation).

With the neck seal in place, average noise levels were 86.8 dB(A) at 50 km/h up to 99.8 dB(A) at 120 km/h. This is in contrast to, 88.3 dB(A) at 50 km/h up to 103.6 dB(A) at 120 km/h for identical helmets without the neck seal in place. The neck sealed helmets outperformed the non-neck sealed helmets throughout the speed range, although the wind noise drop is not as dramatic as promised on the box. It is likely that this is due to the neck seal not totally sealing the base of the helmet and allowing noise to enter via this hole and the perforations near the chin bar. If the neck seal was fully sealed against the neck with no perforations noise levels would be further reduced but this lack of ventilation would produce condensation on the visor. It should also be noted that the neck seal was difficult to fit and on a number of occasions the wind pulled the neck seal from the helmet. On these occasions the data was discarded and the run completed again. However, it is these disadvantages which would make occupational motorcyclists unlikely to use this product regularly.

In a bid to confirm the noise source, three identical helmets (Bieffe helmets) were tested under modified conditions. One was left unmodified as a control; the second had its visor and any ventilation holes sealed and smoothed; the third had a rear fin added to act as a spoiler. The visor was sealed to note if the gap around the visor and the helmet was the dominant noise source. It is hard to explain why the noise level actually increased; this may be due to the visor resonating, as it is now part of the structure of the helmet. The rear fin also increased the noise level of the helmet above 90 km/h; this is thought to be due to the extra turbulence that the fin provided. However, this area of the helmet is not the main noise source, as there are no air gaps for the noise to enter the helmet and it would be difficult for the noise to penetrate the shell.

Fairings and windscreens

The majority of motorcycles today have fairings. This is plastic bodywork that deflects the wind around

the rider to make riding the motorcycle more comfortable or to provide better aerodynamics so the bike can travel faster. Motorcycles with fairings come in two different styles, either touring or sports. A sports motorcycle will have a small fairing and the motorcyclist is tucked in behind the fairing with a bent back and their head looking up through the windscreen. On the other hand a touring motorcycle will have a large fairing and the motorcyclist will sit normally on the bike, with a straight back and look just over the windscreen.

With no fairing, average noise levels were 88.3 dB(A) at 50 km/h up to 103.6 dB(A) at 120 km/h. With the fairing and sitting normally, average noise levels were 87.9 dB(A) at 50 km/h up to 105.6 dB(A) at 120 km/h (Figure 2.0). With the fairing and sitting in tight, average noise levels were 91.2 dB(A) at 50 km/h up to 104.5 dB(A) at 120 km/h. The addition of a fairing actually increased the noise levels of the helmets. This is due to the air first hitting the fairing where it passes over the fairing until it reaches the edge of the windscreen, where the air will become turbulent. This turbulent air hits the helmet of the motorcyclist and becomes even more turbulent and the noise levels inside the helmet increase. The dramatic increase in noise levels between 80 km/h and 90 km/h for the majority of helmets can be explained with fluid dynamics. Under a critical speed (between 80 and 90 km/h) the air passing over the fairing does not become turbulent but remains laminar until the end of the windscreen. Over this critical speed, the edge of the windscreen will shear the airflow and a turbulent airflow will be generated which in turn will hit the motorcyclist's helmet and the noise level will increase dramatically.

Adjustment of the windscreen height did affect the noise level the motorcyclist was exposed to, but showed no correlation (Figure 3.0). This may be due to slight movements of the motorcyclist's helmet between measurements and was either in the turbulent air flow from the windscreen or not. The windscreen was also adjustable for angle (Figure 4.0). There was little correlation between windscreen angle and noise level. However, once the angle of the windscreen was reduced to 50° there was a dramatic drop in noise level. It is thought that there is a critical angle between 55° and 50° from which the airflow from the windscreen is redirected away from the helmet base. The air may be directed towards the chest and shoulders of the motorcyclist and there would be less air hitting the base of the helmet and less noise. Angles below 50° could not be investigated due to the structure of the motorcycle.

Estimation of hearing handicap

The daily exposure levels of the variety of occupational motorcyclists ranged from 90.0 dB(A) to 103.0 dB(A) (see Table 3.0). All the occupational motorcyclists were over the second action level of the Noise at Work Regulations.

Using BS 5330, an estimation of the hearing handicap for the occupational motorcyclists was calculated (Table 4.0). Professional Racers of 45 years old with 27 years exposure have the highest chance of hearing handicap (40 per cent). Hearing handicap is the percentage of that exposed population that will suffer a hearing loss of 30 dB or more. The next highest is paramedics with 36 per cent, and then track day instructors with 28 per cent. These percentages are very high and highlight the need for urgent action to be taken by the employers.

Noise reduction options

Currently, the only practical methods of noise reduction available to occupational motorcyclists are to drive more slowly (unlikely) or use earplugs. Conventional earplugs do not provide an adequate attenuation of low frequency noise which dominates the wind noise spectrum. They also complicate the use of radio communications equipment, an essential facility for most occupational motorcyclists.

Whilst not the subject of this paper we have examined the use of Active Noise Reducing Earphones which appear to have the potential to provide a satisfactory level of attenuation whilst still allowing the use of radio communications equipment.

Conclusions

- Occupational motorcyclists can be exposed to very high levels of aeroacoustic noise generated around their helmets and are thus an important occupational population at risk of developing noise induced hearing loss (NIHL).
- The daily exposure levels of the occupational motorcyclists in this study ranged from 90.0 dB(A) to 103.0 dB(A).
- The dominant noise source was the base of helmet between the chin bar and the neck of the rider.
- The use of a proprietary neck seal around the base of the helmet reduced inner helmet noise levels by around 4dB(A) at 120km/h. The neck seal was difficult to fit and on a number of occasions the wind pulled it from the helmet. These disadvantages may make this means of noise reduction unlikely to be used consistently in practice.
- Based on the measured inner helmet noise levels and the typical driving patterns generated from interviews with occupational motorcyclists and calculated using BS5330 the hearing handicap (percentage of the exposed population that will suffer a hearing loss of 30dB or more) in the study population ranged from 40 per cent in professional racers and 36 per cent in paramedics to 6 per cent in driving instructors.

- All occupational motorcyclists in this investigation had LEP,d's above the second action level of the Noise at Work Regulations. This will require their employers to reduce noise exposure as far as is reasonably practicable by means other than personal ear protectors. This is likely to be a difficult task based on our current level of knowledge of the methods of controlling wind noise generated around helmets.

- The type of motorcycle, hours of use, helmet type, average speed and distance travelled vary greatly amongst the occupational motorcyclist population and thus a risk assessment for each individual is necessary.

- There is a need for a standardised protocol for the measurement of noise exposure of motorcyclists for use by employers when conducting risk assessments.

- The value of conventional hearing protectors in the reduction of noise exposure of motorcyclists is likely to be limited due to the high level of low frequency noise generated by wind turbulence and the impediment they create to the effective use of radio communications. Further research and development is needed into methods for the control of noise in this occupational environment.

Acknowledgements

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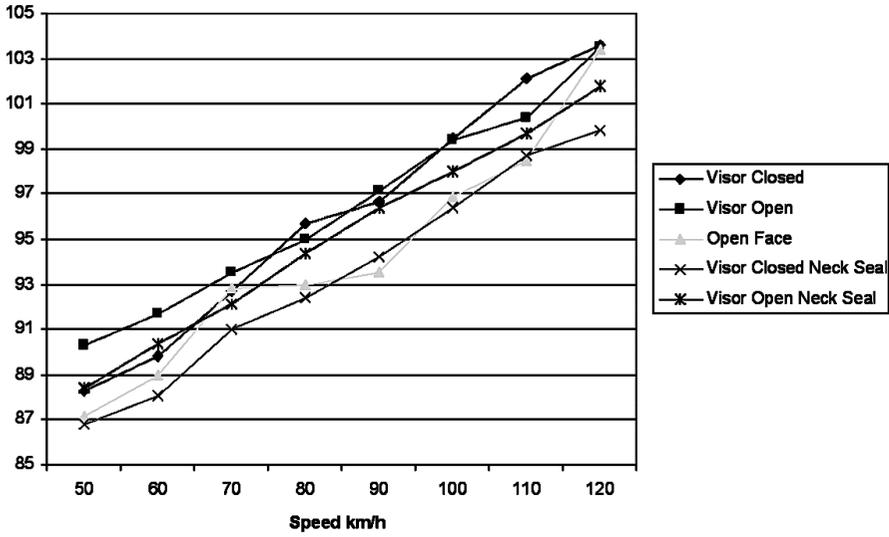


Figure 1.0: Average on-road noise levels for all nine helmets

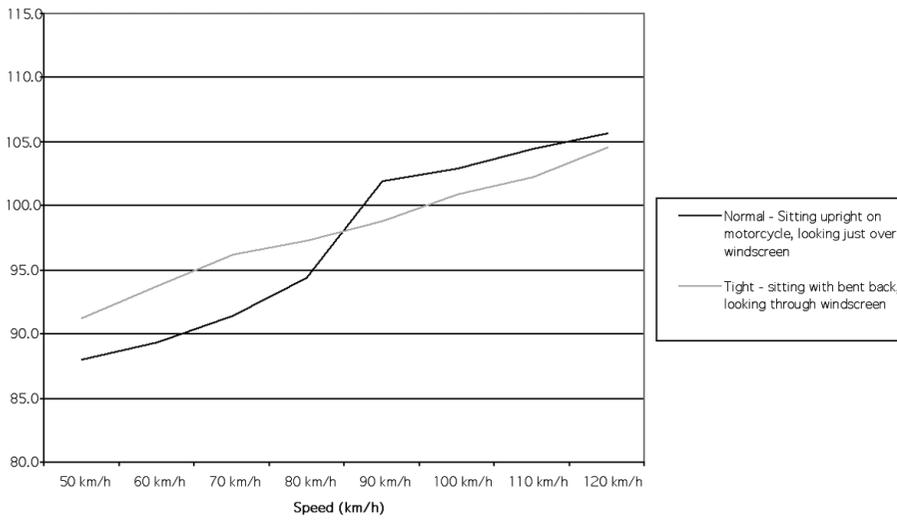


Figure 2.0: Average on-road noise levels for faired motorcycle

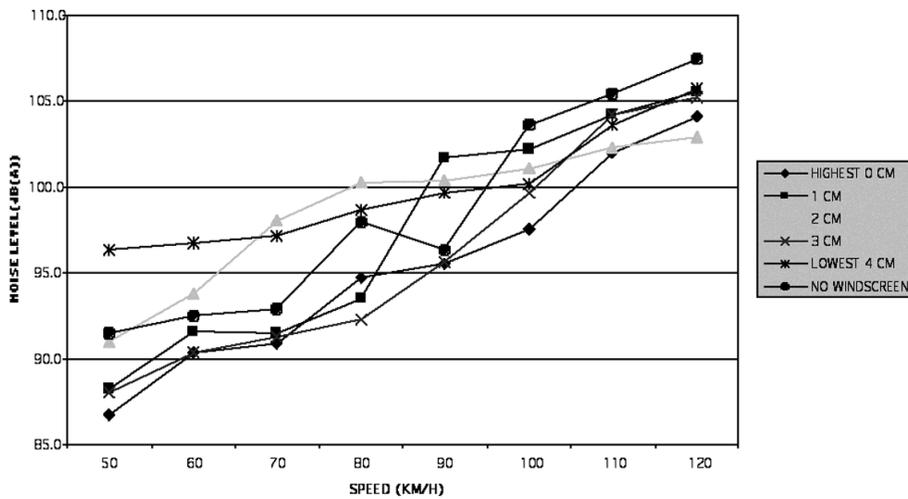


Figure 3.0: On-road noise levels for windscreen heights at maximum angle (65°)

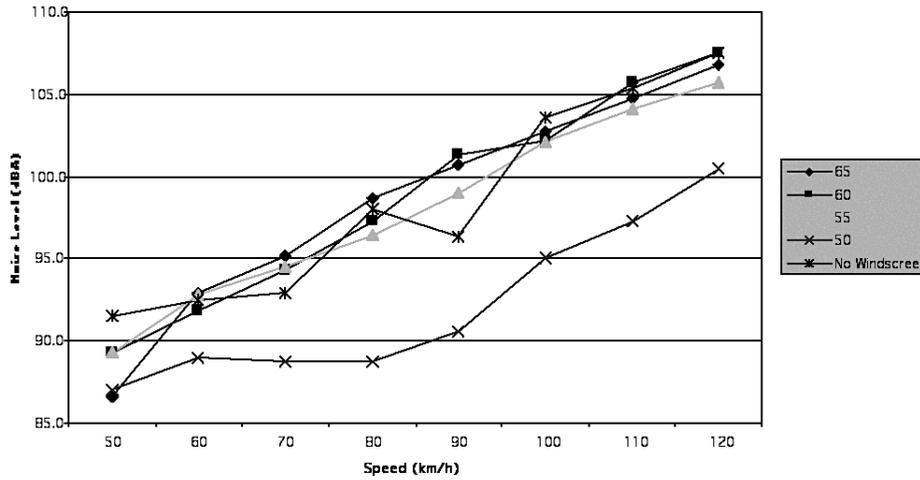


Figure 4.0: On-road noise levels for windscreen angles at maximum height (0cm)

Occupational Motorcyclist	Other duties	50 km/h	60 km/h	70 km/h	80 km/h	90 km/h	100 km/h	110 km/h	120+ km/h
Dispatch/Courier	2	4	-	-	-	2	-	-	-
Professional Racer	3	-	-	-	-	-	1	1	3
Police Motorcyclists	2	3	-	1	-	1	-	-	1
Driving Instructor	1	3	2	1	1	-	-	-	-
Driving Examiner	2	3	1	1	1	-	-	-	-
Journalists	4	-	-	-	-	1	1	1	1
Breakdown Recovery	3	1	-	1	-	1	-	1	1
Paramedic	4	-	-	-	-	-	1	1	2
Tour Guides	1	3	-	2	-	-	1	-	1
Taxis	1	-	2	-	2	-	1	-	2
Track Day Instructor	4	-	-	-	-	-	1	1	2

Table 2.0: Estimated typical driving pattern for Occupational Motorcyclists

Occupational Motorcyclists Category	Exposure Duration	Hearing handicap derivation
Police	27 years	24%
	12 years	9%
	7 years	6%
Professional Racer	27 years	40%
	12 years	22%
Dispatch/Courier	27 years	14%
	7 years	8%
Paramedic	27 years	3%
	12 years	1%
	7 years	36%
Driving Instructor	27 years	18%
	12 years	11%
	7 years	6%
Track Day Instructor	27 years	1%
	12 years	28%
	7 years	12%
Driving Examiner	27 years	9%
	12 years	7%
	7 years	1%
Tour Guides	27 years	1%
	12 years	18%
	7 years	7%
Taxis	27 years	4%
	12 years	24%
	7 years	10%
Breakdown Recovery	27 years	6%
	12 years	22%
	7 years	9%
Journalists	27 years	5%
	12 years	23%
	7 years	10%

Table 4.0: Hearing Handicap derivations for Occupational Motorcyclists

Occupational Motorcyclist Category	LEP'd
Professional Racer	103.0 dB(A)
Paramedic	101.8 dB(A)
Track Day Instructor	99.5 dB(A)
Police	98.4 dB(A)
Taxis	98.3 dB(A)
Journalists	98.2 dB(A)
Breakdown Recovery	97.7 dB(A)
Tour Guides	96.1 dB(A)
Dispatch/Courier	91.9 dB(A)
Driving Examiner	90.4 dB(A)
Driving Instructor	90.0 dB(A)

Table 3.0: LEP,d's for Occupational Motorcyclists

PROFESSIONAL EVALUATION

Students supporting students – lessons learnt from an environmental health peer support scheme

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Abstract

Over the past eight years qualifying courses in Environmental Health have experienced problems of recruitment. In order to help address these issues it is important to understand the student experience and act to enable students to progress. Many students entering higher education find the transition a difficult one. Those entering directly from school or college may find the change in life style and study methods problematic whilst, mature students may experience problems with finances, family commitments and social isolation. These issues may increase the risk of students withdrawing from their course, particularly during the first few weeks of the programme. The peer support scheme was therefore designed as a mechanism to help new students with these transitions. The aim of the project was to provide informal peer support for students embarking on the BSc (Hons) Environmental Health programme at The Nottingham Trent University (TNTU) in 2003.

Students entering their second year of study in 2003 were invited to act as 'buddies' for the new student intake. It was envisaged that the buddies would support new students by sharing experiences, assisting with orientation and accessing university facilities, advising on the availability of student support services and providing social contact. After undergoing training, buddies communicated with new students via email or through informal "drop-in" sessions.

After one term, the project was evaluated by means of a questionnaire survey. The project appears to have been very well received by new students, with 82 per cent of new mature students seeking support and advice from the buddies. The buddies were also positive about the scheme with all those participating indicating that they would have made use of the scheme had it been available during their first year.

Keywords Buddies, environmental health education, student peer support, widening participation.

Introduction

Higher education has changed dramatically over the past 40 years. In 1962, 6 per cent of the population entered higher education; now 43 per cent of 18-30 year olds are, or have, engaged in some form of higher education. The Government's target is to further increase the size of the sector with 50 per cent of 18-30 year olds engaging in learning by 2010 (Department of Education and Skills, 2003). Whilst the overall student population has increased, the numbers of students' selecting courses in environmental health was declining up until 2003. The recent small increase in applications is still woefully insufficient to address the estimated shortfall of 1,000 new Environmental Health Practitioners needed by 2005 (Khanna, 2001).

As well as moving from a model of limited- to mass-participation, the Government is keen to see the opportunity offered to all those who have the potential to benefit from a university education. Currently entry to university is still dominated by students from the top three social classes. However, strategies and objectives are now in place to draw in students from under-represented groups. These widening participation groups include students with disabilities, students from families with no history of learning in higher education, or from areas with low levels of participation, students from under-represented ethnic minorities and, of most relevance to this project, mature students (Department of Education and Skills, 2000).

The expansion of numbers in higher education and the increased heterogeneity of student population have created the potential for increased anxiety upon individual students. The diversification of the student population has the potential to leave individuals feeling isolated. It can be harder for students to feel that they belong and are supported if their course group is made up of students with backgrounds and experiences very different to their own. Student life has been associated with a number of stressors including financial pressures and examinations. For many students entry to higher education also marks the transition from home to independent living. For mature students there may be the added pressure of dealing with family and domestic responsibilities.

=The net effect of all of these changes may result in an impact on student health. Stewart-Brown et al (2000) found that the health status of students is lower than that of the general population, particularly in relation to emotional problems. There is evidence that the number of students presenting with symptoms of mental ill health has increased in recent years (Royal College of Psychiatrists, 2003).

Several studies have looked at the proportion of students showing symptoms of mental ill health. A study by Webb et al 1996 indicated that 17 per cent of male and 25 per cent of female students had moderate to severe levels of anxiety. More recently, the University of Leicester's Psychological Health Project (Leicester University, 2002) surveyed more than 1000 students and suggested that 13 per cent of students were moderately distressed by feelings of depression. Transition into higher education therefore needs to be managed in order to enable students to engage in the learning experience and have a positive experience of the education system.

Background to the project

The BSc (Hons) Environmental Health has operated at The Nottingham Trent University since 1990. The course is managed via a course leader with a year tutor responsible for each cohort and in addition each student is allocated a personal tutor.

The Environmental Health admissions tutor was approached by the Guidance and Progression Strategies for Widening Participation (GAP project) in 2001. The GAP project was particularly interested in developing access routes for mature students from further education into higher education. Links were established between the BSc (Hons) Environmental Health programme at The Nottingham Trent University (TNTU) and the access programmes of five local further education (FE) colleges. These links facilitated the development of targeted marketing material and direct access to students in the FE sector.

The work with this group contributed to maintaining recruitment levels. The numbers of students embarking on the BSc (Hons) Environmental Health programme following completion of an access programme increased significantly, as a result of this work, from 23 per cent in 1996 to 53 per cent in 2003. The age profile of the first year intake has also changed with mature students accounting for 48 per cent in 1996 to 63 per cent in 2003. The vocational nature of the programme and the accredited status make it attractive to mature students, particularly those seeking a career change.

Feedback from further education college tutors and students indicated that a support programme may be useful for new entrants. The peer support project aimed to provide informal support and advice to assist students embarking upon the BSc (Hons) Environmental Health programme in 2003 to settle into their new learning

environment and to help reduce the risk of students withdrawing as a result of issues such as social isolation.

Recruitment and training of participants

Students entering their second year of study in 2003 were invited to act as buddies for the new student intake. Training was essential to ensure that buddies understood the aim of the project and their role within it. A half-day training session was devised and covered the following topics:

- Recalling the first term at university and identifying the problems and anxieties associated with this.
- Mature students and younger students – how does their experience differ?
- Listening skills.
- Case studies. Students were asked to suggest how they would respond to a number of different situations *e.g.* a first year student explains that they are thinking of leaving their course.
- Guidelines and principles of the project, especially establishing the boundaries of the buddy role, when students should be referred to another source of assistance or when academic staff should be alerted, and the importance of maintaining contact with the tutor overseeing the project.
- Appropriate ways in which buddies and new students should contact each other.

Methods

The aim of the research was to evaluate the effectiveness of the peer support system. To achieve this it was considered that a self-completed questionnaire would enable the largest number of students to be reached at relatively low cost. Two questionnaires were designed as the information collected from the first and second year students would be different. Demographic information related to age and highest qualifications achieved was obtained from both groups. In addition, both groups were asked about the amount of contact that was made with their buddy. The first year questionnaire included examples of situations that they may have found themselves in and the likelihood of contact with the course tutor, buddy, student support services or other students. These questions were based on work carried out in the Nottingham Business School related to mentoring in undergraduate business management programmes (Stewart and Knowles, 2003). The final question for both sets of students was an open question to provide comments and suggestions about the scheme. Piloting was carried out with academic colleagues to ensure the face validity of the questionnaire. The questionnaires were distributed at the end of the first term to all new students and buddies. The data were inputted and analysed using the Statistical Package for the Social Sciences.

Results and discussion

Among new students 19 of the 23 (82 per cent) questionnaires distributed were returned. For second year buddies, 5 out of 6 (83 per cent) questionnaires were returned. Whilst the response rates are good it is important to consider the limitations of this size of sampling frame.

Demographic information

Of the 19 new student respondents 42 per cent (n=8) were from an A level background, 37 per cent (n=7) from access courses and 21 per cent (n=4) from had previous degrees or HND's. This demonstrates the change that has occurred in recruitment with 58 per cent (n=11) of the respondents being over the age of 21 and classified as mature students. This is a major difference from University wide figures for the period 2002-2003 where 16 per cent of full time undergraduate students at Nottingham Trent University were classified as mature students.

Although this project was primarily aimed at assisting mature students, it was felt that younger students (under 21) should not be excluded from seeking advice or assistance from the buddies should they wish to do so. Table 1.0 shows the numbers and age profile of first year students who made contact with a buddy. It is clear that a far greater proportion of mature students made contact with the buddies, than those in the under-21 age group. This may reflect the fact that the primary focus of the

Frequency of contact	Number of students (n=)	%
0	6	31.6
1-5	10	52.6
6-10	2	10.5
11+	1	5.3
Total	19	

Table 2.0 Frequency of contact with buddy.

between one and five occasions. Approximately half of those who responded thought that the frequency of contact had changed between September and December and this change was generally a decrease in frequency. However, it is worth noting that some students had reduced contact with their buddy due to a change in the first year timetable.

The buddying model is based on the assumption that an individual first year student will speak to an individual buddy about their problems. In one instance, the student feedback indicated that the first year students approached their buddy about issues that were affecting the whole year group and then, having had their question answered, fed the information back to other first years. Therefore, advice from an individual buddy was often disseminated amongst the whole student group, thus reducing the total number of contacts occurring.

Age Under 21	Total number of students	Number of students who made contact with a buddy	% Students who contacted a buddy
21+	8	3	37.5
	11	9	81.8
Total	19	12	63.1

Table 1.0 Number of 1st year students making contact with a buddy

project was to assist mature students and that all of the buddies were themselves mature students. Indeed, an open comment from a student under the age of 21 years indicated that s/he would have felt more comfortable approaching someone of her/his own age.

Of those students who did not make contact with a buddy, one student commented that they would have done so prior to enrolment if this had been possible. Another stated that although they had not contacted a buddy, they thought that the scheme was a good idea and felt reassured that there was someone to talk to 'just in case'.

Frequency of contact

Respondents were asked to estimate the number of times that they contacted a buddy (see Table 2.0).

The majority of respondents contacted a buddy on

If new students were able to contact a buddy prior to enrolment, would they do so?

New students were asked to state whether they would have contacted a buddy prior to enrolment if one had been available i.e. they were introduced to a current student at an open day (Table 3.0). The majority of students

Would make contact	Number of students (n=)	%
Yes	14	73.7
No	4	21.1
No data	1	5.3
Total	19	

Table 3.0 Number of students who would make contact with a buddy prior to enrolment

indicated that they would welcome the idea of having contact with a named current student prior to enrolment. This response has resulted in the project being reformulated for the next intake of students.

Reason for contacting buddies

New students were asked to indicate how likely it would be that they would contact a number of different sources of help if they encountered a range of difficulties commonly faced by first year students. Figure 1.0 summarises how likely or very likely it would be that they would contact a buddy.

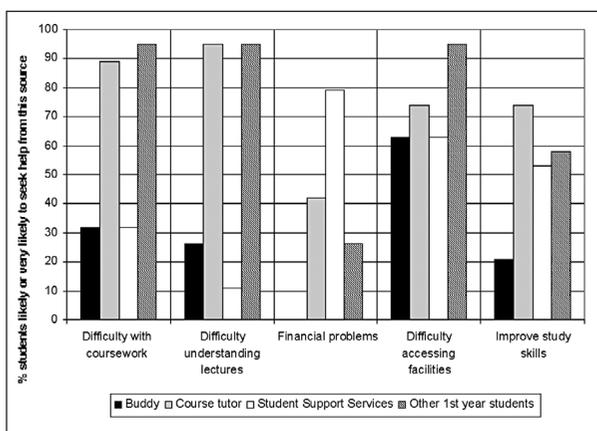


Figure 1.0 Range of contacts first year students would utilise in particular circumstances

Figure 1.0 demonstrates that whilst students would be likely or very likely to contact course tutors regarding academic matters they would also be equally as likely to support each other in these areas. Access to their buddy appears to be most likely when having difficulty in accessing services although, with the exception of financial problems, between 20-30 per cent of students would consider contacting their buddy across the range of identified problems. Finally the role and importance of student support services as regards financial support and accessing facilities is important to note.

Conclusions

The development of the buddy scheme has provided a new form of support for students on the BSc (Hons) Environmental Health. Overall both first and second year students have found this development to be beneficial. Whilst the buddy may not be the first point of contact for students, the fact that 68 per cent of first years made contact with them on at least one occasion, and 11 per cent had made contact on six or more occasions, demonstrates the value of this support scheme. In addition, there was a perception amongst lecturing staff that there had been a reduction in the number of queries from first year students about minor course matters, thus

freeing up time for other pastoral duties.

The project also raises issues for the environmental health profession. Changes in student profiles have an impact on recruitment to environmental health. As mature students make up a significant number of recruits, locally based placements are essential to enable them to complete course and home commitments. While Olohan (2003) identified the need for advocacy support from lecturers for students with mental health problems it may be that students peer support may also prove to be helpful in tackling this issue. The evaluation, however, was not designed to consider this aspect.

Future changes to Higher Education with the advent of increased fees and widening participation may have a significant effect on the student population. This type of peer support may be one mechanism to ensure that students are enabled to engage and progress in higher education.

Acknowledgements

Thanks to BSc (Hons) Environmental Health students year 1 and 2 students (2003 cohorts) for their engagement with the process and enthusiasm to make the project succeed.

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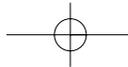
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Book Reviews



Evidence-Based Research – Dilemmas and Debates in Health Care

Brian Brown,
Paul Crawford and
Carolyn Hicks

Open University/McGraw Hill Education,
297 pages Price: £24.99

The world of research, particularly health-related research, has become an increasingly complex environment where a number of research paradigms strive for recognition, credibility and resources. Often research teaching reduces this striving to the somewhat simplistic "quantitative versus qualitative" debate; a fruitless and largely sterile exercise as the two paradigms (this in itself being a gross oversimplification) seek to achieve very different ends. With the rise of post-modernism and a greater acceptance of the eclectic epistemological base of research, this somewhat naïve dichotomy will no longer suffice.

In this book, the authors have attempted, and largely succeeded in producing a comprehensive yet accessible treatment of a complex subject – the underpinning philosophies of evidence-based research. Suitable for advanced undergraduate, postgraduate and professional study, the book covers, in its ten chapters, theories of science and society, positivism, concepts and theories, experimentation, interpretation and hermeneutics, description, post-modernism and research philosophy. This forbidding list is, however, addressed in a very readable style and well illustrated throughout with appropriate examples from the relevant research fields. Each chapter is extensively referenced with up-to-date literature.

While not for the faint hearted or the beginner in research, this book is nonetheless a very useful addition to the personal library for both the aspiring researcher who wishes to ground their research efforts in an appropriate epistemological context and the experienced researcher who wishes to re-visit their philosophical underpinnings. It certainly should find its place on the reading list of advanced research modules in a range of disciplines, not least environmental health.

Paul Fleming
19.07.04



Research Methods in Health: Investigating health and health services, 2nd edition

Ann Bowling

Open University Press, 0335206433 (paperback),
486 pages.

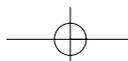
This is not just a standard text on research methods but examines the theoretical concepts used by the various disciplines engaged in health research. It contains a vast amount of material but there is something for everyone in this book. It should be on the shelves of all, from students to experienced researchers, involved with health and health services issues and also those needing to apply or evaluate such research.

The author, Ann Bowling, Professor of Health Service Research at University College London, has drawn on her long experience in health services research in developing the content of this book. She describes the many differing approaches to health research as well as pointing out the pitfalls which may be encountered. The style makes easy reading and even complicated costing issues are explained with clarity.

The seventeen chapters are divided between five sections and the summary of points at the end of each chapter is particularly useful. The content is wide ranging dealing with topics such as assessment of health needs, health economics, research philosophy, sampling and research and analytical methods. The work is comprehensively referenced and an excellent glossary of key terms is provided. Good use is also made of illustrations, examples and checklists to support the discussion.

My only criticism of this book, which is for the publishers rather than the author, is that the right justification of the text on left hand pages means that text runs annoyingly close to the binding!

Vance Kyle
28.07.04



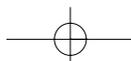
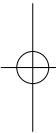
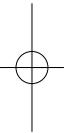


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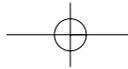
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Harvey, HD and Fleming, P (2003) Writing for JEHR and other peer reviewed journals. *Journal of Environmental Health Research*, 2 (1), pp 33-43.

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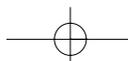
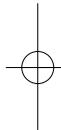
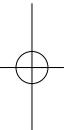
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