University Applicants' Perception of Environmental Health as a Career and Degree Subject

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Abstract

Applications to university courses accredited by the UK Environmental Health Officers Registration Board (EHORB) fell from a mean of c300 to a mean of c50 over the 5 years to 2001. This decline has led to the closure of two courses and has put others under threat. A shortage of qualified officers entering the environmental health profession may lead to the inability of environmental health agencies to properly fulfil their functions.

A number of reasons have been put forward for the fall in applications, including low awareness and a poor perception of environmental health. In particular it has been suggested that the television series 'A Life of Grime' (BBC, 1999, 2000) has contributed to a misconception of the role of the Environmental Health Officer (EHO).

98 students, all of whom were qualified to apply for entry to an environmental health course, but none of whom had applied, completed a comprehensive questionnaire. The questionnaire was designed, among other things, to examine the respondents' knowledge of the role of an EHO and to identify which of a range of job characteristics they found 'undesirable' or 'desirable'.

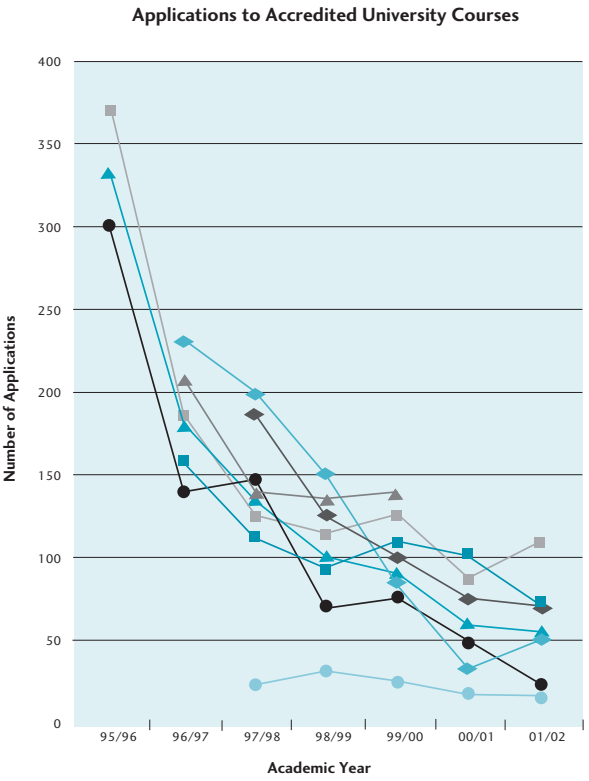
The survey suggests that a lack of awareness of the EHO is not a major factor in the reduction in the number of applicants to EHO courses, however, a misconception of the EHO's role may well be, and some of these misconceptions have their roots in the TV series 'A Life of Grime'. The results show that the EHO's training and work has many desirable features which are attractive to potential applicants, and policies should be adopted which better inform the public of the training, qualifications and the role of an EHO.

Key words: Accredited courses; Environmental Health Officers, Environmental Health Officers Registration Board.

Introduction

Approximately 4,200 Environmental Health Officers and 3,500 Environmental Health Technicians are employed by UK local authorities, and an increasing number, about 1,350, is employed in the private sector, and in other agencies of government (Bannister, 2001). EHOs fulfil regulatory and advisory public health roles in programmes such as Food Hygiene and Food Safety; Health and Safety in Workplaces; Housing Standards; Disease and Vector Control; Nuisances, and Pollution Control and Environmental Protection. The qualifications and training of EHOs in England, Wales and Northern Ireland are overseen by the Chartered Institute of Environmental Health (CIEH) and the Environmental Health Officers Registration Board (EHORB). Applications to university courses accredited by EHORB have fallen from a mean of c300 to a mean of c50 over the 5 years to 2001 (Harvey, 2000). This decline has led to the closure of courses at Greenwich and Edinburgh and has put pressure on the 12 remaining universities. The decline in applications to accredited university courses from 1995/1996 to 2001/2002 is shown in Figure 1. The information having been given on a 'confidential' basis, individual universities are not identified. The number of students on accredited courses has fallen by 20%, and this is despite the lowering of university entrance requirements (Robinson, 2001).

A number of reasons have been suggested for this decline. Various factors, including a shortage of specialist science teachers and the National Curriculum introduced after the Education Reform Act 1988, have reduced the number of secondary students taking science Advanced Level subjects ('A' levels). There are national socio-economic factors, such as: the abolition of the student grant system and the introduction of university fees; low salaries; the "blame culture" and a fall in the value that society accords to public service. There are also factors local to environmental health, such as: a poor image, which may stem from media coverage and a low public awareness; the introduction of the EHORB



Source: Harvey, H (2000), CIEH, (2001)

professional assessments; the loss of local authority training places, and a general failure of the employers to contribute adequately to the cost of training its future workforce (Bushell, 2000), (Parkinson, 2000 & 2001). Structural changes in local government, such as the erosion of professional identity and representation at chief officer and committee level, may also have had an impact. (Parkinson, 2000)

Factors adversely affecting recruitment to the public sector in general and the widening gap between private and public sector pay were the subject of a special two-day feature in a national newspaper (Guardian, 2001). The new labour government sees this as an area for policy intervention and has introduced key worker schemes (salary incentives, housing assistance, training bursaries, etc) for teachers, police officers, midwives, nurses, and trading standards officers, but not EHOs.

The closure of the Greenwich University course was attributed to the declining popularity of careers in local government, poor starting salaries and the financial hardship caused by four-year courses with one-year placements (Bushell, 2001). Parkinson (2000) added that a career in local government is no longer seen as secure, it is highly stressful and does not seem be respected, certainly in so far as its image in the national media is concerned. The image portrayed in the 'A Life of Grime' TV series, which did not clearly differentiate between EHOs and other environmental services staff such as mortuary assistants, pest control operatives, and cleansing assistants, has been highlighted as a possible contributory factor (Parkinson, 2000 & 2001). Murphy (2001) estimated that 340 students would graduate in 2001, and that this figure would reduce to 140 over the succeeding three years. The CIEH believes that more than 400 new EHOs are needed each year to replace those retiring and leaving the profession, and, if the current trend is not reversed by 2005, there could be a shortage of 1000 EHOs. The CIEH estimates that to recover from the current shortfall the annual number of graduates should be increased to at least 500 (Robinson, 2001)

The Chartered Institute of Environmental Health (CIEH), Government Departments and the Local Government Association have expressed concern (Humphries, 2001), but any intervention needs to be informed by an understanding of public perception of the role of an EHO and the factors that might attract or deter potential entrants.

Method

Factors influencing choice of degree course and university, and potential applicants' awareness and perception of environmental health, were researched by a questionnaire survey. There is no database of students who have considered and rejected environmental health, and access to the Universities and Colleges Admissions Service (UCAS) database of all university applicants was not available. The random selection of a representative sample of potential applicants was therefore impracticable and an alternative strategy had to be adopted. The respondents for this study formed complete cohorts of students at five institutions within an area of South East London. These comprised: an independent boys day school; an independent girls day school; a large co-educational comprehensive school, and two further education colleges. All of the 98 respondent students had recently submitted university applications through UCAS. All were taking at least two 'A' level subjects of which at least one was in a science subject. They all therefore potentially satisfied the nationally imposed CIEH/EHORB criteria for entrance to an accredited environmental health course.

The sample was not random, and care must therefore be taken in consideration of the survey results in a national context. However, the researchers were not aware of any local circumstances that might have influenced the responses to the survey.

Questionnaires were administered to complete cohorts of students during supervised tutorial sessions. Questionnaires were of a simple, structured format, incorporating a series of tick boxes, and scales. The questionnaire was in 5 parts: general information (name, school, ethnic group, etc); the usefulness of various resources in making a choice

between university courses; the importance of course and university characteristics; the desirability of a range of job characteristics, and, finally, awareness and perception of the role of an EHO.

Connor (1999) surveyed a representative sample of 36,245 UCAS applicants to explore factors that shape decisions to enter full-time higher education and students' choice of institutions. To enable comparisons with Connor's work, broadly similar categories were used in the questionnaire survey.

Respondents' perception of the role of an EHO was studied by asking them to indicate which of ten tasks are carried out by an EHO. Five tasks were included as key markers of the role of a mainstream EHO: Inspecting a Restaurant Kitchen; Solving Air Pollution Problems; Inspecting Poor Housing Conditions; Investigating an Accident at a Workplace, and Dealing with Noise Complaints. The remaining five were included because they are not EHO tasks. Two were chosen because they might be suggested by the job title: Protecting Endangered Species (environment) and Vaccinating School Children (health). The remaining three are not EHO tasks, although they may be functions of a environmental health service: Working in a Mortuary; Placing Poison for Rats and Mice, and Removing Dog's Mess from a Park. In the A Life of Grime TV series it was suggested that these last three are EHO tasks, and so their inclusion would enable the impact of the TV series to be tested.

Results were analysed using The Statistical Package for the Social Sciences (SPSS).

Results and Discussion

Course and University Characteristics

Respondents indicated that numerous and very wide ranging characteristics influenced their choice of course and university. No single factor predominated. However, the four characteristics most frequently ranked by respondents as most important were: Teaching and Research Reputation of the University, the Nature of the Course, the Overall Image of the University and the Nature of the Likely Career. These four factors must be accommodated in addressing the decline in applications to environmental health courses. Connor's (1999) research found a similar rating of importance. This suggests that the views of the students in the five South East London institutions reflect the views of Connor's large national sample, and this tends to support the sampling strategy.

Both this study and Connor's show that students are likely to be attracted to universities with good teaching and research reputations. Accredited environmental health courses can be found at twelve UK universities, including: a traditional 'Russell Group' university; red brick universities; new universities (former polytechnics), and colleges of Further and Higher Education. Being a relatively new undergraduate degree subject, and highly vocational, it is less likely to be found in Universities at the top of the league tables. This may well influence the quantity and quality of applicants. The nature of accredited courses, with a high burden of externally prescribed teaching, and the need to employ ex-practitioners rather than 'research stars', handicaps the development of 'reputation' in Research Assessment terms (it also makes environmental health teaching groups vulnerable in the current competitive university climate).

The opportunity to gain professional training was stated by 80% of students to be 'important' or 'very important' in their choice of degree course, but only 30% were aware that the EHO route includes professional training.

The 'Nature of the Course' and 'Likely Career' are linked characteristics; intrinsically linked in the case of an accredited environmental health programme. Students apply to an accredited environmental health course because they are attracted to the EHO career. Therefore, to increase the number of applicants, awareness of the attractive features of the career must be raised.

The Desirability of Job Characteristics

Respondents were asked to indicate which of a range of 20 job characteristics they found 'undesirable', 'desirable', and 'extremely undesirable' in the context of their choice of career. The results are ranked and presented in Table1.

There is a clear differentiation between desirable and undesirable characteristics but with very little variance within the clusters. The position of some characteristics in the general order was predictable and self evident, however, interest was focussed on the position of several characteristics of particular interest to this study of environmental health.

Seven of the eight highest ranked characteristics are indeed characteristics of EHO work. It would appear that potential applicants do not associate these features with environmental health.

A 'High Salary' was the highest ranked characteristic. Being predominantly a local government profession, it is unlikely that environmental health will ever be able to offer a high salary, but the salary offered should be comparable with similar professions and it should reflect market forces. Robinson (2001) draws

attention to the drift of EHOs to the private sector. 'Job Security' was highly rated. Traditionally, the relatively modest local government salary has been compensated by high job security. Over the last 25 years the local government employment market has changed, local authorities have shed staff, some new appointments are on fixed term contracts and many functions are performed by contractors who employ staff on less favourable salaries and with limited job security.

A 'Wide Variety of Tasks', which was highly rated, has been an attractive feature of EHO work, but local authority structures have drifted from a generalist 'district' division of labour to specialist or 'client grouping' structures. There has also been de-skilling. The employers should be made aware that an attractive feature of EHO work has been seriously eroded.

'Helping People/Giving Public Service' did not rank highly. This is a national issue, and it cannot be addressed by the environmental health community alone.

'Dealing with Difficult People' and 'Working in Dirty/Dangerous Situations' are among the most undesirable characteristics. They are, undeniably, occasional features of EHO work, but they predominate and are over-emphasised in the 'A Life of Grime' series, which, it is suggested below, has had a major impact on public perception of the EHOs role.

'Anti-social or Long Working Hours' was the most undesirable characteristic and it is an emerging characteristic of EH work (for example, 24hr noise patrols, and out of hours rotas).

Perception of the role of an Environmental Health Officer

81% of the respondents had heard of the environmental health officer, which suggests that awareness of the EHO is not poor among potential applicants, but, from the spread of correct and incorrect answers shown in Table 2, it is apparent that there is an incorrect perception of the EHO's role. 95% of respondents believe that 'working in a mortuary' is an EHO task. This is not a task that a layperson might be expected to believe is an EHO's, nor could it be construed from the name. This and 'removing dog's faeces from a park' (92%), 'placing poison for rats and mice' (80%) were featured in the TV series. These figures should be compared with the results for mainstream EHO tasks: 'dealing with noise complaints' (62%); 'investigating accidents in the workplace' (72%), and 'solving air pollution problems' (54%). That 84% of the students believe EHOs 'vaccinate school children' suggests that respondents were probably influenced by the word 'health' in the job title and have a poor knowledge of the role of the EHO.

All of the respondent students wish to go to university to study for a degree, but 42% did not know that the EHO qualification route includes a degree. The opportunity to gain professional training was stated by 80% of students to be 'important' or 'very important' in their choice of degree course, but only 30% were aware that the EHO route includes professional training. 60% underestimated the starting salary of a newly qualified EHO. Furthermore, all but one ('a high salary') of the factors most frequently cited as 'desirable' or 'highly desirable' job characteristics are indeed characteristic of EHO work.

Table 1: The Desirability of Various Job Characteristics

Job Characteristics and Numbers and Percentage of Respondents

Job characteristic	Undesirable No. (%)	Desirable No. (%)	Extremely desirable No. (%)	Desirability rating.*
High salary	1 (1)	35 (36)	62 (63)	1
Job security	2 (2)	56 (57)	40 (41)	2
Wide variety of tasks and new tasks frequently set	3 (3)	61 (62)	34 (35)	3
Meeting/working with people from all educational and cultural backgrounds	3 (3)	75 (76)	20 (20)	4
Easy to find a job anywhere in country	4 (4)	58 (59)	35 (36)	5
A job which requires professional qualifications/chartered professional	6 (6)	57 (58)	34 (35)	6
Opportunity to gain a pension	6 (6)	60 (61)	32 (33)	7
The ability to get 'out and about'	7 (7)	49 (50)	41 (42)	8
Opportunity for rapid promotion	8 (8)	60 (61)	30 (30)	9
The opportunity for foreign travel	10 (10)	49 (50)	39 (40)	10
Long holidays	10 (10)	(50) 51	38 (39)	11
Prestigious/well-respected/ glamorous job	12 (12)	52 (53)	34 (35)	12
Helping people/giving public service	15 (15)	54 (55)	29 (30)	13
Learning about and use of scientific equipment	15 (15)	54 (55)	29 (30)	14
High responsibility and pressure/ meeting deadlines	33 (33)	53 (54)	12 (12)	15
Little strenuous or physical activity	35 (36)	52 (53)	11 (11)	16
A career where you can be self employed	38 (39)	51 (52)	9 (9)	17
Dealing with difficult people	61 (62)	32 (32)	5 (5)	18
Working in dirty/ dangerous situations	71 (72)	21 (21)	6 (6)	19
Antisocial or long working hours	83 (85)	14 (14)	1 (1)	20

***1 is the most highly desirable. Desirability rating combines 'desirable' and 'extremely desirable'. If two factors score equally, the factor with the highest rating for extremely desirable is rated as the most desirable.**

Table 2: Perception of the Role of an EHO

Task *(Tasks in italics are not tasks of an EHO)*	Percentage of Respondents That Believe an EHO Carries Out This Task
Working in a mortuary	95
Inspecting restaurant kitchens	92
Removing dog's mess from the park	91
Protecting endangered species	89
Inspecting poor housing conditions	86
Vaccinating school children	84
Placing poison for rats and mice	80
Investigating an accident at a workplace	72
Dealing with noise complaints	62
Solving air pollution problems	54

Conclusion

This study indicates that a lack of awareness of the EHO is not a major factor in the reduction in the number of applicants to EHO courses. However, potential applicants have a misconception of the EHO's role; they are not aware that it has many desirable characteristics, and they incorrectly attribute to it some undesirable characteristics. The TV series 'A Life of Grime' has, at least, contributed to this misconception through its concentration on some entertaining and 'sensational' aspects of the work of an EH service, at the expense of mainstream activities, and through its lack of differentiation between the work of an EHO and that of other staff. Furthermore, the tasks highlighted in the TV series are 'dirty and dangerous', and involve 'dealing with difficult people'; job characteristics considered to be undesirable by potential applicants.

It would appear that potential applicants are unaware that seven of the eight job characteristics most frequently cited as 'desirable' are indeed features of EHO work. The most frequently cited 'desirable' characteristic, 'a high salary', is unlikely ever to be a characteristic of local authority EHO posts, nevertheless, market forces and the widening gulf between private and public sector salaries must be addressed. 'Key worker' status policies should be extended to EHOs.

The low value that society accords to public services and public sector workers must be addressed nationally, and the government, local government associations, professional bodies and trade unions all have a role to play.

A wide range of negative influences on the number of potential applicants to environmental health courses has been identified, and there is probably a complex of interactions rather than one or more predominant identifiable factors. Further research in this area is required.

Central government departments, local government employers and the professional bodies need to adopt a strategy to ensure that the public is better informed of the training, qualifications and role of the EHO. Greater involvement of government departments and employers in workforce issues is needed (a role performed in the USA by the Bureau of Health Professions). If present trends and policies continue, central and local environmental health policies will flounder for want of sufficient staff, and the public will be put at risk.

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Bench-marking Pool Water Treatment for coping with Cryptosporidium

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Abstract

The frequency of confirmed incidences of cryptosporidiosis associated with pool waters has increased. *C.parvum* oocysts are removed by filtration and inactivated by the chemical treatments used but only to various levels of success. Pool operators need an easy method for assessing the ability of their treatments to deal with oocysts.

The efficacy of a pool water treatment plant depends on its original design and on its existing condition and operation. Oocyst removal by filtration depends much on the size, depth and condition of the filter media, the filtration rate and effective use of coagulation. Either ozone or chlorine dioxide treatment can produce useful inactivation especially at normal pool water temperatures. Chlorination used without other disinfectants has negligible effect in oocyst inactivation even with the long contact times. However, allied to treatment with ozone or chlorine dioxide, chlorination can make a small contribution due to synergism.

Published results by various investigators of oocyst removal or inactivation are collated and adapted to provide a method for bench-marking the robustness of pool water treatment strategies for coping with oocyst-rich incidences. Key removal and inactivation data is set out as a set of easy look-up tables that is used in conjunction with basic information operators should know about their pool water treatment systems. The information also provides pool operators with a means of identifying how they might optimise the performance of or upgrade their existing treatment strategies.

Introduction

C.parvum oocysts in Pool Water

The frequency of confirmed incidences of cryptosporidiosis associated with pool waters has increased during recent years (Foundation for Water Research, 2000; PHLS, 2000). Pool swimmers contract cryptosporidiosis through ingestion of pool water containing *C.parvum* oocysts originating in faecal matter released by other swimmers suffering, or have very recently suffered, from cryptosporidiosis.

It has been estimated that 1 ml of faeces can contain as many as 5 x 107 oocysts. If a child has a loose-bowel movement of 150 ml into a typical 25m x 12m municipal pool of about 450 m^3, this would result in an average concentration of about 20,000 oocysts/litre (20/ml). When a pool has a large number of swimmers, these swimmers will contribute to the mixing process. Therefore, a localised faecal release will become dispersed quite quickly In practice there would be pockets of water with greater and less concentration than this, partly due to high oocyst concentration in clumped solids. It follows that if a faecal release is seen or reported then the pool must be cleared immediately and quickly.

A swimmer swallowing just 10 ml of water would ingest an average of 200 oocysts, which is a dose capable of causing infection (Kebabijan, 1995). The possibility exists that a loose-bowel movement by a child could be greater than 150 ml and also either the same person could have another movement or another swimmer could also have a movement shortly afterwards. Then the average oocyst concentration could exceed 50,000/litre. The UK standard for *C.parvum* oocysts in potable water is a maximum of 1 per 10 litres in a sample of 1000 litres collected over 23 hours, without differentiating between viable and non-viable oocysts. This bears no relevance to what might be an infective dose. This is because infectivity depends on the resistance by the individual ingesting viable oocysts and upon the source and strain of the oocysts. Some individuals might succumb to just one oocyst. In potable water treatment in the UK this standard is achieved mainly through a combination of optimal coagulation, clarification and filtration. Inactivation is not yet accepted in the UK as an alternative to removal partly because of doubts concerning effectiveness of inactivation methods in full-scale application.

Removal & Inactivation

If the potable water standard (1 oocyst per 10 litres) were to be applied to pool water, then a contamination level of 50,000 /litre would require more than 5x105 removal, i.e. 6-log removal. Therefore, there is need for pool filtration systems to be capable of removing this level of contamination in an acceptable period of time. The overall strategy in potable water treatment for microbiological quality control is one of using multiple barriers and in principle this applies to swimming pool water treatment with the combination of filtration and disinfection. In applying the potable water standard for *C.parvum* oocysts, it follows that filtration for removal of oocysts takes priority over treatments to inactivate oocysts. However this does not mean that treatments to inactivate oocysts is much less important, because of its contribution to reducing infectivity of oocysts in pool water or captured within filters and not yet discharged from the system by backwashing of the filters.

It follows that treatments that inactivate oocysts should do so in a much shorter time than it takes for filtration to remove them. Since there is the risk that oocysts within clumps might be protected from inactivation, a robust treatment strategy must be one with a combination of both an acceptable rate of removal and rapid inactivation. A maximum acceptable time might be the period for which a well-used pool is closed overnight (with treatment continuing) say, from 10 pm to 6 am, i.e. 8 hours.

C.parvum oocysts are removed by filtration, but effectiveness of removal depends on the efficiency of filtration, which in turn depends on size of filter media and depth, filter bed condition, filtration rate and the use of coagulation and its optimisation. *C.parvum* oocysts are extremely resistant to normal pool water disinfection practices with chlorine: a reason why pool operators must endeavour to maximise the effectiveness of their filters. Inactivation of oocysts is greater when ozone, chlorine dioxide or UV irradiation are also used. However, the effectiveness of these depends on time and exposure of the oocysts to them. Many pools have ozone installations. A stabilised liquid form of chlorine dioxide (understood to be a tetra-chloro deca-oxide complex (TCDO) - known as Hydroxan(r) and is approved in the UK for pool water treatment) is available and used in the UK. UV irradiation is used at a small number of pools. Synergism in inactivation of oocysts occurs when two methods of disinfection are used sequentially. Thus chlorination becomes more effective when used in combination with ozone or chlorine dioxide. Oocysts could also become "stressed", such as by passing through filters and therefore be more readily chemically inactivated.

In order that pool operators might operate their pool water treatment to best effect to inactivate and remove *C.parvum* oocysts they need to understand what the options are available to them, and to understand the chemistry and process engineering of these. A starting point is "Swimming Pool Water Treatment & Quality Standards" published by the Pool Water Treatment Advisory Group (PWTAG, 1999). Attention is also drawn to the advice by Kebabjian (1995) and to the PWTAG guidelines concerning pool operations when contamination of pool water by *C.parvum* is suspected (PWTAG, 2001). Pool designers and operators will also find the "Guidance Manual Supporting Water Treatment Recommendations from the Badenoch Group of Experts on Cryptosporidium" (UKWIR, 1998) and the 1999 UKWIR report (1999) useful.

So far there is negligible information available on the inactivation and removal of *C.parvum* oocysts by pool water treatments since so few investigations involving pool water conditions have been carried out and results published. However, the potable water industry, especially in the USA and the UK, has been investigating *C.parvum* inactivation and removal for more than a decade. As a result, much has been published in recent years. Although there is much in the literature to learn from there are a number of issues to accepting the viability of the research to real application. Firstly, most of the research has involved small-scale laboratory bench studies. Secondly, the studies have used cultured *C.parvum* oocysts and the robustness of the oocysts can vary substantially between sources and batches. It is believed that there is also considerable variation in robustness of oocysts arising in the wild and therefore also arising from release by humans. Thirdly, different methods are also used by researchers for assessing whether oocysts are viable and for determining the concentration of viable cells. However, standardisation in procedures is taking place. These issues are reviewed in the Badenoch (HMSO, 1990, 1995) and the Bouchier reports (HMSO, 1998). There is also a fourth issue being the difference between potable and pool water treatments, potable water treatment involves single pass and pool water treatment involves almost total recycling of water.

Although the information available can not provide confidence as to how effectively existing or proposed pool water treatments can inactivate and remove *C.parvum* oocysts, the information does provide a basis for estimating how well treatments might work and therefore can also be a basis for benchmarking treatments at pools.

Removal

Filtration

In potable water treatment, filtration is regarded important in disinfection as a physical barrier. This philosophy also applies to pool water treatment. It is clearly established in potable water filtration that the efficiency of filtration for removal of particulates (colloids and microorganisms) is dependent on the optimisation of coagulation. In potable water treatment coagulation is widely used with optimisation of coagulant dose. When an aluminium coagulant is used, optimisation of pH is also necessary (Gregory & Miller, 1994; Gregory et al, 1996; Hall, 1997; AWWA, 1999) and for pool waters should be less than pH 7.5 in order to minimise aluminium solubility. Polyaluminium chloride (PACl) can work better than aluminium sulphate (alum) and at a slightly higher pH. However, there are many pools where coagulation is never or rarely used, used intermittently or only briefly after filter backwash. The lesson from potable water treatment is that coagulation, optimised for coagulant dose and pH, should be used continuously. It is important to note that, in addition to having continuous and optimal coagulation, good filter performance is also dependent on having filter beds in good condition maintained by effective backwashing with the wash water rate appropriate for the water temperature.

Huck et al (2001) have carried out an extensive study of *C.parvum* oocyst removal by filtration. Their studies included comparison of filtration without coagulation, with sub-optimal coagulation and with optimal coagulation. Their results from pilot plants at two sites using formalin-inactivated oocysts showed the substantial importance of optimal coagulation. At both sites there was a 2-log (i.e. 102) difference in oocyst removal between optimal and suboptimal coagulation. However, whilst at one site with optimal coagulation average oocyst removal was about 3-log, at the other site it was about 5.5-log. This level of removal with optimal coagulation has also been found by others, such as by Hall et al (1994). Huck et al also found with optimal coagulation at both sites, that as the need to backwash approached removals were similar, having declined to about 2-log. Also at both sites oocyst removal without coagulation was only about 0.2-log.

It is unclear how oocyst removal might be affected by filtration rate and this is important since pool filters are used not only at rates similar to those used in potable water treatment, about 10 m/h, but also at rates greater than 25 m/h. Filtration at 25 m/h can not be expected to be as effective at removing oocysts as filtration at 10 m/h. McNaughton (1979) examined the effect of filtration rate (11.5, 23 and 37 m/h) in pool water treatment and reported that the effect of filtration rate on filtered water turbidity (a measurement of particulate contamination) was not substantial up to a rate of about 23 m/h. However, examination of his results indicates that filtered water turbidity approximately doubled for a 2-fold increase in filtration rate. This is reflected in some particle count results reported by Yates et al (1997) who examined filtration rates of 7.4, 14.7 and 22 m/h. Particle removal is affected by both filtration rate and influent solids concentration i.e. the solids loading rate. Increase in solids loading rate, due to increase in either or both filtration rate and solids concentration, reduces filter run length to breakthrough. Increase in solids loading rate also results in poorer base line and run-average filtered water quality. It follows that oocyst removal also should depend on filtration rate. Pilot plant results produced by Walker et al (1992) showed that with aluminium coagulation, breakthrough of aluminium increased approximately in direct proportion to increase in solids loading rate. When optimal coagulation is carried out, it is reasonable to assume that the coagulant metal ion concentration is an acceptable surrogate for the concentrations of all other particulate matter including oocysts. Consequently, it can be assumed (probably conservatively) that a 2-fold increase in filtration rate halves oocyst removal.

It follows that pool filters operated with efficient coagulation, with pH less than 7.5, filter beds with 16:30 BS mesh sand with depth of about 0.7m and at low filtration rates (about 10 m/h) could be rated with reasonable confidence for about 3-log removal of oocysts. As filtration rates increase the log-removal rating must be expected to decline. It is suggested that, as above and in the absence of more suitable supporting evidence, the log-removal rating for filtration follows the halving rule as in Table 1.

Table 1: Suggested *C.parvum* log-removal ratings for pool filters

Filtration rate m/h	10-14	15-19	20-24	25-29	30-34	35-39	40 -
Removal – $\log_{10}(N/N_0)$							
good coagulation	3	2.2	1.8	1.5	1.25	1.1	0.95
poor coagulation	1	0.75	0.6	0.5	0.4	0.35	0.3
no coagulation	0.25	0.19	0.15	0.12	0.10	0.09	0.08

GAC Filtration

When ozonation is also used then this must be followed by filtration through granular activated carbon (GAC). The filtration rate through GAC filters is usually high, typically 25 to 30 m/h. The grain size of the GAC is usually a size larger than the sand used in the filtration prior to ozonation. Therefore, the GAC filters can not be expected to be as efficient as the sand filters. However, ozonation can enhance the filtration of particles of similar size to *C.parvum* oocysts (Hall et al, 2001). Consequently, GAC filters may well provide some useful oocyst removal rating. However, information is not known to be available on which to base an estimate of removal rating. In the absence of such information, for a probably conservative estimate the removal rating is condidered to be one third that suggested in Table 1 for sand filters.

Shearing Stress

Ballantyne et al, (1999) evaluated the use of microbial indicators for Giardia and Cryptosporidium inactivation when disinfecting with chlorine dioxide They found the impact of filtration "stress" appeared to weaken Bacillus subtilis spores and render them 1.7 times more susceptible to chlorine dioxide inactivation when compared to "non-stressed" spores during bench-scale experiments at 20°C. It is assumed that shear stress resulting from contact with granular filter media damaged the spore coat and consequently facilitates easier access of chlorine dioxide into the cell thereby enhancing inactivation. Thus, to achieve a desired microbial inactivation level, less chlorine dioxide may be required to inactivate "stressed" spores when compared to "non-stressed" spores. Since published Ct values have been developed using non-stressed Giardia cysts and Cryptosporidium oocysts, treatment facilities with filtration may actually achieve higher microbial inactivation levels than those predicted. However, Chauret et al (1996) tested *C.parvum* oocysts stressed by a number of environmental factors and found their susceptibility to chlorine or chloramine was not changed. Consequently, if physical stressing (as distinct from synergism in chemical inactivation) does occur it can only be regarded as a bonus.

Inactivation

Chlorine

Chlorine, as gas or as sodium or calcium hypochlorite, is the disinfectant most widely used for public and other large pools. The effectiveness of chlorine as a disinfectant is a function of its residual concentration, C, and time of contact, t minutes, in terms of the Ct value. For a pool, the Ct value is most simply determined as the chlorine concentration in the water as measured prior to filtration and the theoretical pool turnover period (total pool, balance tank, pipework and filter volume divided by the pumping rate). More correctly, the Ct value should be calculated to take account of decay in chlorine concentration as the water passes through the system and the hydraulics of the system (i.e. to what extent the retention characteristics of the system reflect plug and totally mixed flow conditions). In practice there is a practical limit to the sophistication of the calculation. Results of bacterial, and other organisms, inactivation by chlorine and other disinfectants are usually shown graphically as log-reduction in organism concentration for increase in Ct value. This is the approach taken also for results of most investigations of the inactivation of *C.parvum* oocysts.

Various investigators have shown that *C.parvum* oocysts are extremely resistant to chlorine. Very large Ct values are needed for chlorine to achieve distinct inactivation. Driedger, Rennecker & Marinas (1999) found that for inactivation of *C.parvum* with free chlorine the inactivation rate decreased as pH increased, consistent with hypochlorous acid, not the hypochlorite ion, being primarily responsible for *C.parvum* inactivation in the pH range of 6.0-8.5. Korrich et al (1990) reported mouse infectivity became zero for doses of 600, 6000 and 6x104 oocysts, at 25°C and pH 7, for Ct values of 4800, 7200 and 9600 respectively. Carpenter et al (1999) reported that mouse infectivity to a dose of 150,000 oocysts becomes zero for *C.parvum* oocysts treated with hypochlorite at 30°C, pH between 7.2 and 7.8, with a Ct value of 2880 mg.min/l. Thus, confident 5-log inactivation by chlorine in pool water would appear to require Ct values of at least about 3000 and possibly more than 10,000. This means that for pool water with a chlorine residual of 0.8 mgCl/l a minimum contact time of 3,600 minutes (60 hours) is required to produce between 3 and 5-log inactivation. The results by Korrich et al cannot be used to predict inactivation at low Ct values because they appear to include 0.6-log reduction unaccounted for by Ct. However, both sets of results reflect that Ct values of about 1000 equate to about 1-log inactivation.

For a pool where residual chlorine concentration is, say, 0.8 mgCl/l and the turnover time is two and a half hours (i.e. 150 minutes) then the nominal Ct value is 120 mgCl.min/l. This will provide negligible effective log-inactivation of oocysts (possibly in the order of 0.1-log). However, if the pool is closed for 8 hours overnight and the water continues to be recirculated but with a chlorine residual of 1.5 mgCl/l, then the Ct value for this will be 720 mgCl.min/l. This value, for a water temperature of about 30°C, would be expected to produce measurable, albeit still small, oocyst inactivation providing pH is low enough. It is partly for this

reason why, when a faecal release incident in a pool occurs, pool operators are advised to close the pool and maintain circulation and chlorination.

It is because chlorination appears to be so inadequate for *C.parvum* inactivation that so much attention is being given to using other disinfection strategies, not withstanding the role of filtration in oocyst removal.

Ozone

Investigators have shown (Driedger et al, 1999; 2000) that ozone is a far more effective for inactivation of *C.parvum* oocysts than chlorine. They have also shown (Driedger et al, 2000; Rennecker et al, 2000) that there is even greater inactivation (i.e. synergism) when ozone is used in the presence of chlorine. Table 2 gives the log-inactivation by ozone alone proposed by Rennecker et al (2000).

Table 2: Proposed minimum Ct values for inactivation of *C.parvum* oocysts with ozone at 30°C (27)

Inactivation – $\log_{10}(N/N_0)$	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
Ct mg.min/l	0.62	1.01	1.40	1.79	2.18	2.57	2.96	3.35	3.74	4.13	4.52	4.91

It has been usual for ozonation in pool water treatment to apply doses that result in small residuals after 3 to 5 minutes. This is because the ozone is applied to little more than satisfy, what might be termed (Roustan et al, 1998; Park et al, 2001), the instantaneous ozone demand and to maximise the life of the carbon in the subsequent carbon filter needed to prevent ozone in water passing into the pool because of its toxicity and potential detrimental impact on building structures. Most ozone installations in the UK probably follow the BEWA "Code of Practice for Ozone Plant in Swimming Pool Water Treatment" (BEWA, 1990). This says that a minimum concentration of 0.4 mgO3/l after a contact time of not less than 2 minutes should be the design criterion. This equates to a Ct value of 0.8 mg/l-min, and at 30°C might be equated with a potential *C.parvum* oocyst 0.8-log inactivation, not allowing for inefficiencies. To achieve 6-log inactivation the pool water would need to be subjected to 7.5 turnovers, which may be viewed as unacceptably long. To achieve 6-log inactivation within 8 hours for a pool with, for example, a 3 hr turnover, the Ct value would need to be at least 1.84. This could be achieved by either or both increasing the ozone dose and contact time. The space in existing pool plant rooms would make it very difficult to provide additional contact time. Increasing ozone dose so that there might be a larger residual would reduce carbon life. From a safety perspective, it would also be important to ensure carbon filter contact time is long enough to remove all residual ozone.

Synergy was observed in the sequential inactivation of *C.parvum* with ozone and free chlorine (Driedger et al, 2000; Rennecker et al, 2000). Secondary inactivation curves were characterised by relatively rapid initial decline in viability followed by slower inactivation kinetics. Greater synergy was observed at pH 6 than at pH 7.5 and no synergy was observed at pH 8.5 (Rennecker et al, 2000). Additionally the rate of secondary inactivation with free chlorine decreased with increasing pH, again consistent with hypochlorous acid being the free chlorine species primarily responsible for *C.parvum* inactivation in the pH range 6.0-8.5.

Chlorine Dioxide

Chlorine dioxide is not as effective as ozone in inactivating *C.parvum* oocysts. For similar Ct value, the effectiveness of chlorine dioxide at 30°C is about as effective as ozone at 5°C. Chlorine dioxide has to be generated on-site unless stabilised forms are used. The draw-back with using chlorine dioxide for all but one known method of sourcing it is that the by-products chlorite and chlorate will exceed approved maximum concentrations in pools. The known exception is the proprietary product Hydroxan(r), which has to be used in combination with chlorine to be effective. The Queensland (Australia) Code of Practice (1998) advises that stabilised chlorine dioxide (liquid) and not on-site generated gas be used. It suggests that a Ct value of 78 results in inactivation greater than 90 percent at normal pool temperatures and pH. It also suggests a dose of 0.25 mg/l for 6 hours to achieve this.

Table 3 gives the proposed minimum Ct values for inactivation at 30°C as determined by Ruffell, Rennecker & Marinas (32). The Ct values in the table

mean that for a chlorine dioxide concentration of 0.3 mg/l a 6-log inactivation is predicted for a contact time of 340 minutes, i.e. almost 6 hours. Alternatively, 6-log inactivation would be achieved in 8 hours for a chlorine dioxide residual of 0.21 mg/l. It is assumed that whilst these results were produced using gaseously produced chlorine dioxide, they also apply to chlorine dioxide sourced from stabilised forms.

Table 3: Minimum Ct values for inactivation of *C.parvum* oocysts with chlorine dioxide at 30°C proposed by Ruffell, Rennecker & Marinas (32)

Inactivation – $\log_{10}(N/N_0)$	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
Ct mg.min/l	14.1	22.1	30.2	38.2	46.2	54.2	62.2	70.3	78.3	86.3	94.3	102

Corona-Vasquez, Rennecker & Marinas (1999) found that Ct values of 1,600 and 5,200 mg.min/l for chlorine are required to decrease viability by 1-log at 20 and 4°C respectively, after 1-log inactivation with chlorine dioxide at pH 6. It follows that synergism will be less for a pool water pH of 7.2-7.5 but greater for a temperature of 30°C. Therefore, one might expect for normal pool water temperature and pH that synergism might account for 1-log inactivation for a Ct value of about 1600. Consequently, a chlorine residual of 1.0 mgCl/l for 8 hours, having a Ct value of 480, might have a synergistic value of about 0.25-log inactivation.

UV Irradiation

Investigations have shown (Bukhari et al, 1999; Craik et al, 2000; Clancy et al, 2001) that UV irradiation appears to be particularly effective in *C.parvum* oocyst inactivation. However, the drawback is that UV irradiation results in enhancement of trihalomethane (THM) concentrations (Judd et al, 1998; Bronda). To avoid this it needs to be used in conjunction with ozonation and GAC filtration that is adequate to minimise THM enhancement. The effectiveness claimed for UV, based on model waters in simple bench tests, would appear to be remarkable. However, confidence with application to pool treatment might be best deferred until there is more evidence of the effectiveness of UV to inactivate oocysts when applied to real pool waters in continuous flow conditions.

Application

Benchmarking

Benchmarking of a treatment system (i.e. the pool water treatment plant) is assessment of the systems performance, and its individual unit processes (e.g. filtration, chlorination, pool retention time) with comparison to a reference or set of references. The references may be the performance of other plants or the performance of the system predicted from modelling the system. However, actual evaluation of pool water treatment plants for their inactivation and removal of *C.parvum* oocysts would be very expensive, and difficult, to carry out. Therefore, benchmarking based on prediction of performance is the more attractive option.

Only recently has enough information been published, albeit with respect to potable water treatment as referenced, that allows prediction of the possible efficiency of pool water treatment strategies for *C.parvum* oocyst removal and inactivation. Although the viability of this information is limited by the issues mentioned, it does provide a basis for evaluating existing and proposed pool water treatment strategies. The information is already being used in this way for potable water treatment.

Example 1

Consider a pool where treatment consists of filtration at a rate of 30 m/h applying coagulation only for a couple of hours after backwash, a pool turnover period of 2.5 hours, average chlorine residual of 1.5 mg/l at pH 7.5 and no other treatments. In eight hours the pool would have 3.2 turnovers. The removal rating for the filtration would be assessed as having no coagulation and therefore in 8 hours would only achieve, with reference to Table 1, a total rating of (0.10 x 3.2 =) 0.32-log. The chlorination for 8 hours has a Ct value of (1.5 x 8 x 60 =) 720 and this relates to an inactivation rating of about 0.7-log. For this example, probably representative of many pools in the UK and elsewhere, both the removal and inactivation ratings are very low and effectively worthless for controlling *C.parvum* oocyst contamination. Substantial increase in the level of removal could be achieved by introducing continuous and optimal coagulation.

Example 2

Consider a pool with a filtration rate of 25 m/h with continuous but not optimal coagulation, pool turnover of 2.5 hours, ozone dosed for a residual of 0.4 mg/l for a contact time of 2 minutes, GAC filtration rate also 25 m/h and a chlorine residual of 1.5 mg/l. The removal rating for a period of 8 hours for the sand filters would be (0.5 x 3.2 =) 1.6-log and for the GAC filters would be 0.5-log, being a total of 2.1-log. The ozonation has a Ct value over 8 hours of (0.4 x 2 x 3.2 =) 2.56, which equates to an inactivation rating, with reference to Table 2, of 3-log. The chlorination, as for Example 1, has a rating for itself of 0.7-log. The chlorine following ozonation will also have an inactivation rating due to synergism of about 0.7-log. Therefore the combined 8-hour rating for inactivation is about 4.2-log. For this example the removal and inactivation ratings are substantially greater than for Example 1 but still short of the target of 6-log. The removal rating could be improved by applying optimal coagulation.

Example 3

Consider a pool with a filtration rate of 20 m/h with continuous and optimal coagulation, a pool turnover of 2.5 hours, chlorine dioxide (i.e. TCDO-complex) dosed for a residual of 0.25 mg/l in conjunction with a chlorine residual of 1.0 mg/l. The removal rating for a period of 8 hours by the filtration would be (1.8 x 3.2 =) 5.76-log. The chlorine dioxide has a Ct value of (0.25 x 8 x 60 =) 120, which equates to an inactivation rating, with reference to Table 3, greater than 6-log. To this can be added the small inactivation rating of about 0.5-log due to chlorine alone and its synergistic contribution. For this example, the removal rating almost meets the target and the inactivation rating exceeds the target.

Discussion

The above draws upon information that is now available in the literature and enables an assessment to be made of the potential ability of pools and their treatment systems to cope with a release of *C.parvum* oocysts by removal and inactivation. Information is not known to be available on inactivation by any other disinfectants used in pool water treatment other than those mentioned. The information, albeit mostly produced in the context of potable water, would suggest that a large proportion of pools, as reflected by the examples, have treatment regimes that are inadequately effective for removing and inactivating *C.parvum* oocysts in a practical timescale. Pools with a low removal rating need to apply a combination of better coagulation, slower filtration rate and faster pool turnover. Pools with only chlorination need to improve their inactivation rating by applying an additional method of disinfection.

It is important to note that Ct values and log-ratings in the above tables apply to a water temperature of 30°C. For lower temperatures, Ct values will need to be greater for the same log-reductions or log-reduction will be less for the same Ct values. It is also important that assessment of treatment strategies should take account of disinfection by-product control and other quality control criteria.

There is a substantial need for investigations to be carried out to demonstrate the extent to which the information available does apply to pool water treatment and can be used to predict removal and inactivation by pool water treatments with confidence. In the meantime, the information available provides something that can be used. However, it is important to note that the information provides only an assessment of potential ability or a basis for comparative ability. It is also important to note, until proven otherwise, the information is not a basis for providing a confident prediction or guarantee of the performance of treatments to control *C.parvum* oocyst contamination. Further, even with a high removal and inactivation rating, action by pool operators following a known faecal release should follow the published guidelines of clearing the pool of bathers and disinfecting and filtering - with effective coagulation - for a minimum period. However, the minimum period might take account of the removal and inactivation rating.

Conclusions

1. Information is now available in the literature that enables an assessment to be made of the potential ability of pools and their treatment systems to remove and inactivate *C.parvum* oocysts.

2. The information, albeit mostly produced in the context of potable water, would suggest that a large proportion of pools have treatment regimes that are not effective for removing and inactivating *C.parvum* oocysts in a practical timescale.

3. There is a substantial need for investigations to be carried out to demonstrate the extent to which the information available applies to pool water treatment and can be used to predict removal and inactivation by pool water treatments with confidence.

4. Regardless of whether a pool can apply adequate treatment (removal and inactivation), the action following a known faecal release by a bather should follow the published guidelines of clearing the pool of bathers and applying disinfection and filtration (with effective coagulation) for a minimum period (reflecting the efficacy of the treatments applied).

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Developing Student Environmental Health Officers' Skills in Health Promotion

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Abstract

The focus of this paper is an approach to help student environmental health officers develop skills in the arena of health promotion. The students are required to concentrate on student health needs and plan, run and evaluate a health promotion campaign. This paper will explain the development of student skills within this area and provide an evaluation of student feedback related to the campaigns that ran over 2 separate years (n=60). Results indicate that students find this to be a valuable learning tool and they value the skills developed in addition to enjoying the process. The use of practical methods to engage students may be useful for their future career.

Keywords

Environmental Health Officers, Health promotion, Transferable skills, University.

Introduction

The Health Act 1999 aims to assist the joint working of Local and Health Authorities in order to facilitate co-ordinated action on health. Within this framework the role of local authorities is being recognised as one of the partners in assisting the promotion of health at a local level. It is therefore essential that professionals in this setting have a clear understanding of the techniques involved in health promotion and an ability to evaluate their effectiveness when undertaking this work.

Environmental Health comprises of those aspects of human health, including quality of life, that are determined by chemical, physical, biological, social and psychosocial factors in the environment. It also refers to the theory and practice of assessing, correcting and preventing those factors in the environment that can potentially affect adversely the health of present and future generations (MacArthur & Bonnefoy, 1997). Whilst much of the work undertaken is a statutory function in the areas of food safety, health and safety, environmental protection and housing it is often the case that they are the front line service for issues threatening people's health. Education and promotion are part of their day to day activities and yet there is a limited amount of training in these fields. The development of health promotion skills is essential if local authorities are to become involved in true partnerships with health authorities. Environmental Health Officers (EHO) are very used to thinking laterally, working across disciplines and to seeing the wider picture in relation to health issues. In order to do their work within the community they need to build alliances and partnerships with other health professionals and agencies. Health Promotion therefore underpins the work of the EHO although unfortunately since it is a non-statutory function this may well affect the position of this activity. Saving Lives, Our Healthier Nation (Department of Health, 1999) has recognised the value of the role of local authorities working in partnership with other key health providers and the community and the establishment of Health Action Zones to target health inequalities focuses on these links.

Developing Transferable Professional Skills Within The Undergraduate Qualifying Environmental Health Degree

The approach used to develop effective professional officers within the Undergraduate programme at Nottingham Trent University places problem-solving and transferable skill development as a central element within a reflective practitioner model of learning and professional development (Moon, 1999). Specific modules at each and every academic level are used as the main but not sole focus for this development. The approach adopted underpins the whole course and develops a key theme of Dearing (HMSO, 1997) - 'graduateness', through moving the student beyond competence to capability (Price, 1996) in contrast to a purely competency / content

driven programme. This approach recognises the idea of becoming competent in performing specific tasks as being a precursor to the production of 'graduateness' and capability, but that more is required to fulfil this task. Thus it identifies the crucial difference between training and education and accords with the model of professional development from novice to expert as researched by Dreyfus and Dreyfus (1986), cited in Eraut M (1994). However, the key is the nature of assessments used. They must be carefully selected to allow the individuals', and groups in which they are placed, to demonstrate capability. Care has to be taken to avoid assessments that require a demonstration of competence in relation to the environmental health subjects and pure knowledge.

Health Promotion features as a subject when introducing health and public health at the start of the course. The subject is introduced through the consideration and development of a model for health that embraces the range of factors that influence health and wellbeing, grouped according to the areas in which they operate in relation to the health of the individual (Dahlgren and Whitehead (1991)). Health Promotion is then developed into a module at final year level utilising an overarching approach to achieving environmental health objectives and to question routine professional behaviour in terms of the focus for environmental health work generally. Within the level 3 module, over a period of three months, the students are required, in-groups, to identify a student health need and then plan, run and evaluate a health promotion campaign within the university campus, too meet the need identified. In the past students have identified various health needs within the student population including sexual health, mental health, drug awareness and body art. The need identified may be gained from experiences as a student but they are also encouraged to use epidemiological evidence to support their assessment. The students then plan the area under consideration gathering data and information from various sources. The health promotion campaign is run at the city site students union over a day and the students carry out a short-term evaluation of the event. Methods used by students to promote health have been many and varied included information leaflets, display material (posters and "mock-ups"), participative competitions, demonstrations and video's. The results of the campaign are presented to an invited audience and a written evaluation report prepared. Both the report and presentation elements form part of the assessment for the module.

Methods

In order to evaluate the module an investigation was carried out to assess the students' attitude towards the health promotion module and the use of the health promotion campaign assignment in developing their transferable skills. Two consecutive final year cohorts of the BSc (Hons) Environmental Health from the years 1999 and 2000 were involved. The research focused on the students' evaluation of the health promotion module as a whole but particular emphasis was placed on the campaign that the students had been involved with. It was decided that a mixture of quantitative and qualitative data was the best approach in order to gain a range of information for the study. The most appropriate study design was a self-completed questionnaire as it enabled assessment of a wide range of information at relatively low cost and retained anonymity in order to encourage honest feedback.

The questionnaire was based on a standard departmental questionnaire that has been used successfully across a range of courses over the past few years. A total of 21 statements were made using a Likert scale with a scale of 1-5 where 1 was strongly agree and 5 strongly disagree with 3 being neutral. The initial 15 questions were standard questions that made various statements concerning the module as a whole. This required the students to provide feedback on the taught elements as well as the student led seminar exercises. The last 6 questions were specifically related to the campaign. The questions sought to identify the level of enjoyment, the relationship to skill development and levels of confidence. The second part of the questionnaire was based on open questions and requested that the students made comments concerning the elements they felt most and least valuable in relation to the campaign. Finally the students were encouraged to make free comment concerning the module.

Piloting had been carried out with the 1998 cohort of students and no difficulties were identified in responses. Due to the study design adopted it was decided to survey all those present following the completion of the campaign. Analysis was carried out by hand.

Results

In the 1999 cohort there were a total of 40 students. Of these 85 percent had worked during their third year in a local authority environmental health department and 15 percent had not. Of the population 48 percent were male and 52 percent were female. This compared to a smaller cohort of 29 students during the year 2000, all of whom had undertaken a placement period during their third year. The gender difference in 2000 was 55 per cent male and 45 per cent female. The anonymity of respondents prevents further analysis of results by gender. A response rate of 95 percent (n=38) was obtained from the 1999 cohort and 76 percent (n=22) from the 2000 cohort.

Firstly the students were asked whether they had enjoyed participating in the health promotion campaign. In both years it was pleasing to note that the majority of students agreed or strongly agreed with the statement with over 85 percent (n=53) of students in both years supporting this view. Secondly the students were asked whether the exercise had improved their confidence in planning, running and evaluating such a campaign. Again the results were high with over 90 percent (n=55) who agreed or strongly agreed with this statement. Thirdly the students were asked if the campaign had improved their planning and organisational skills. Figure 1 indicates the consistency across both years in relation to this area. A total of 44 students agreed or strongly agreed with the statement. Enquiries were then made to find whether the campaign had provided the students with the skills to evaluate a health promotion initiative as indicated in Figure 2. Results from this question were a little disappointing in 1999 as just over half of the group agreed or strongly agreed with the statement that it had provided them with evaluation skills. As a result of this analysis the theoretical input into evaluating health promotion was altered during the taught element of the course for the year 2000 cohort. The actual health needs that the students had identified were utilised to provide examples of evaluation and the 2000 cohort statistics demonstrate an improvement in this area with 77 percent (n=17) of the students agreeing or strongly agreeing with the statement. As part of the campaign students have to identify and work with a range of partners. Those contacted included health professionals from outside of the University, health professionals providing services to the students and staff within the University and Student Support Services. In addition, students approached private companies who sponsored the campaigns. Figure 3 indicates that when questioned about their confidence in the identification of a range of resources and partners, 85 percent (n=51) of both cohorts felt more confident in this work. Finally fewer students saw the skills developed as linking across all areas of environmental health, however it may take more experience for the students to establish these wider integrating links.

In addition to the questions above, the students were asked to comment on factors they believed were most and least valuable in relation to the health promotion campaign. A total of 24 students (40%) chose to comment. Feedback from this section demonstrated that students were very positive about the benefits of teamwork, communication and the improved understanding of the process. In order to demonstrate the positive aspects one student elaborated that "Organisational factors were the most valuable. The experience of planning and implementing a campaign will be very useful in the future" (Student 2000). On a negative note the lack of time for the actual campaign and the limited time period for evaluation were commented on including "It would have been better if more time was allocated post campaign in order to conduct a more thorough evaluation" (Student 1999).

Discussion

The development of effective professional officers places problem-solving and transferable skills as a central element and therefore the approach to health promotion assists in this process. In addition to this the health promotion module develops graduateness.

The health promotion campaign provides a form of assessment that places the students at the centre of the activity. Results from the campaigns and evaluation are very positive not only in the level of enjoyment but also in relation to the arena of skill development.
The exercise requires students to put their knowledge into practice and to utilise their transferable skills in a real situation; including the identification and development of partnerships in order to achieve a successful campaign. The students themselves are an important resource which can be utilised by the health promoting university whilst at the same time nurturing and developing the key transferable skills within the health promotion professionals of the future. The role of students is essential in this process as "it is well established that people pay much more attention to health promotion messages received from lay or professional educators who share their own social and cultural identity" (Anderson & Wilkie 1995 p.47).

An additional benefit of the process is the fact that in a Health Education Authority (1996) study it was found that health promotion was most likely to be located in the Environmental Health Department and 45% of respondents felt that this role would expand. This theoretical input and the practical experience of carrying out such an assessment provides the students with a skill to take forward into their future career which will also benefit their employers.

Feedback from across the university, the professionals and agencies who have been involved and successive cohorts of participants have all commented on the value of such work both practically and professionally. The results indicate that most students found that various skills had been developed during the process of completing the campaign. Utilising the feedback form also assisted in the reflection of the lecturing team as the results from the1999 cohort indicated that the students were not too confident in evaluation skills therefore the theoretical input was altered for the year 2000 cohort.

The limitations identified related to the short-term nature of the campaign, evaluation focuses only on the immediate impact of a particular campaign on the day. There may be merit in utilising campaign ideas year on year, and requiring students to further develop previously used campaigns.

Conclusion

Whilst the development of 'real' skills in actually undertaking health promotion work is crucial, students need to understand that health promotion is about more than this. The real challenge is to encourage a greater health promotion focus in the environmental health profession.

Finally valuable bridges have also been built between students and those who provide a range of services for them within the University. It is hoped that these links will be further developed through involving health care providers and support services formally at an earlier stage in the planning of the campaigns.

Acknowledgements

We would like to extend our thanks to the students who have participated in these campaigns with such great enthusiasm. Also the Students Union Welfare Officers over the years have provided space and support for the student group.

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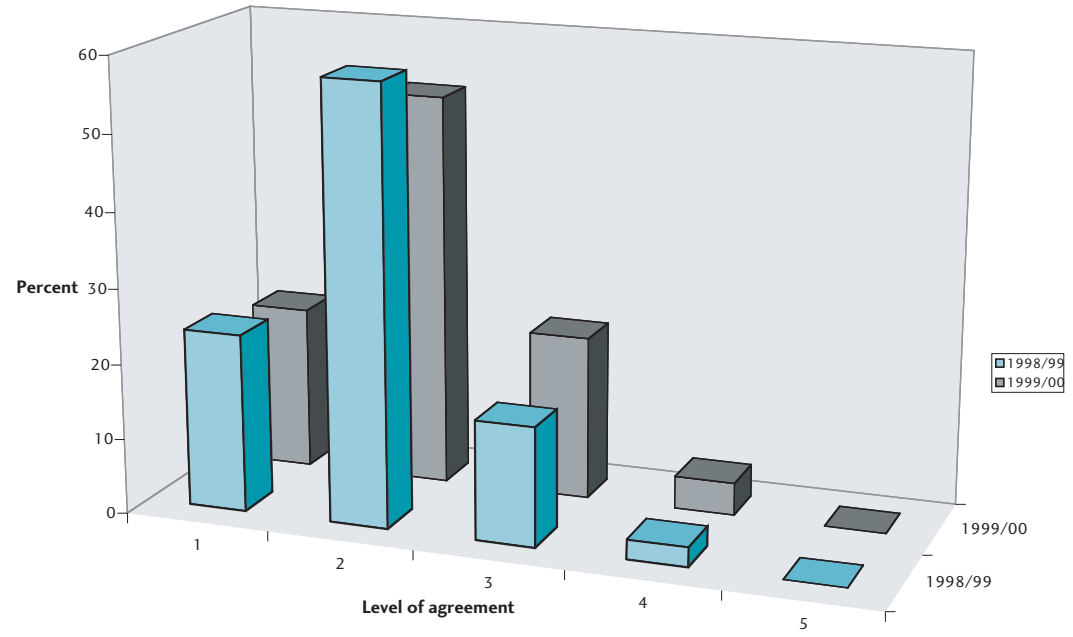
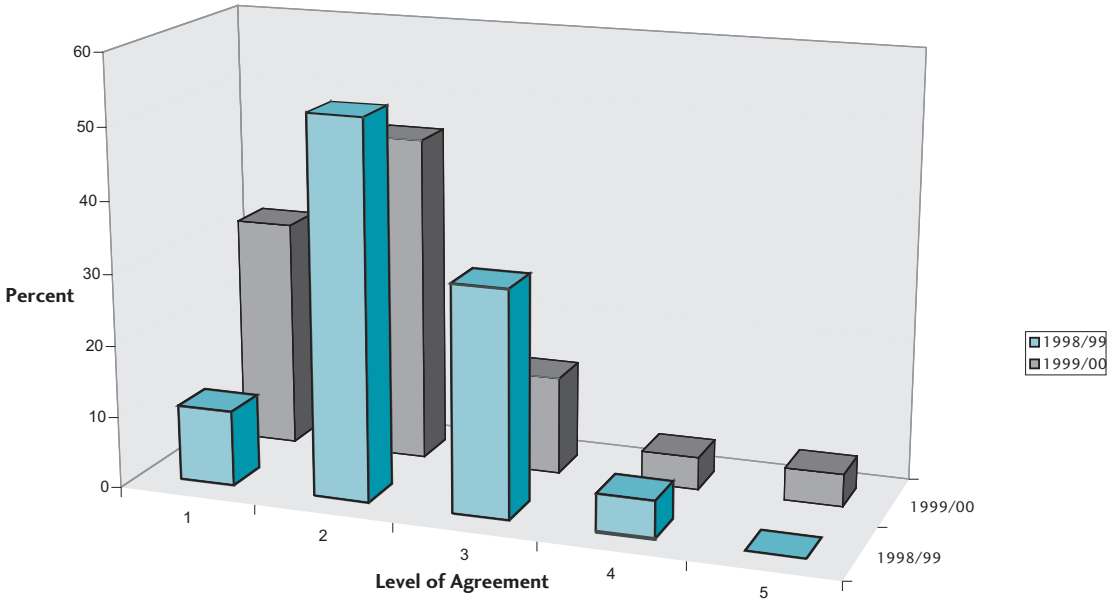
Figure 1 - Improvement in Planning & Organisational Skills (student responses)



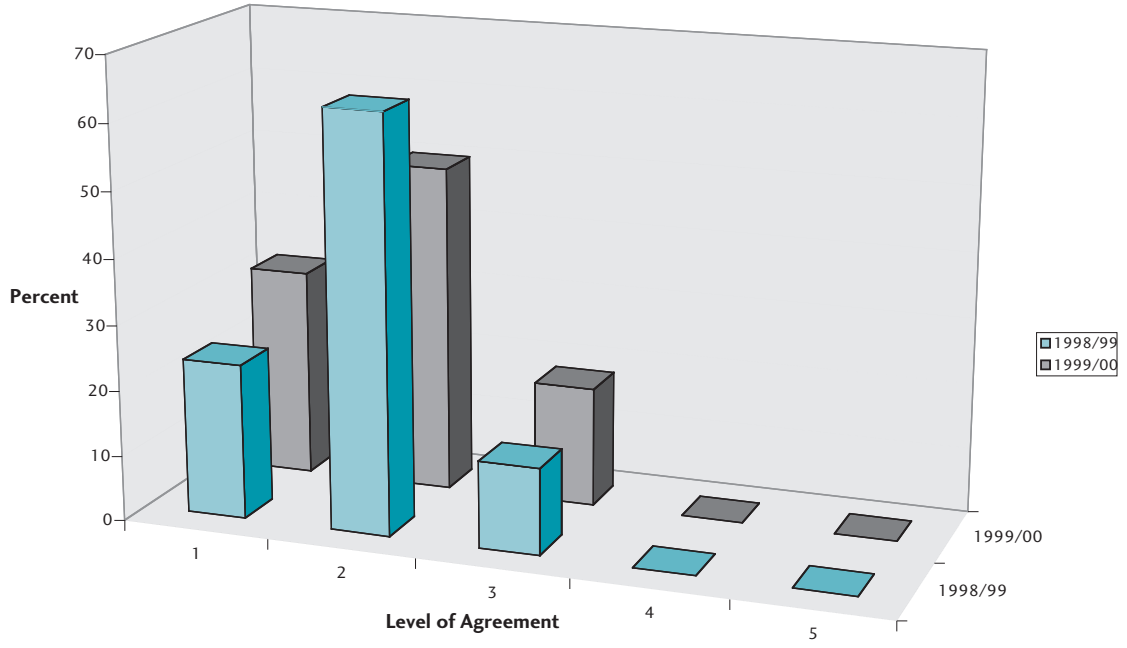
	1	2	3	4	5
1998/99	23.68	57.89	15.8	2.63	0
1999/00	21.74	52.17	21.74	4.35	0

Figure 2 - Provision of Evaluation Skills (student responses)



	1	2	3	4	5
1998/99	10.53	52.63	31.58	5.26	0
1999/00	31.82	45.45	13.63	4.55	4.55

Figure 3 - Confidence in Identifying Partners (student responses)



	1	2	3	4	5
1998/99	23.68	63.16	13.16	0	0
1999/00	31.82	50	18.18	0	0

Condensation In Dwellings

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Abstract

Houses that experience condensation dampness create unpleasant living conditions and encourage the growth of mould. Previous studies have linked dampness to ill health, particularly chest related conditions and have concluded that the presence of mould growth in homes constitutes a risk to health. This study attempts to identify the common factors contributing to condensation dampness and to determine whether the presence of condensation mould growth in homes influences the quantities of airborne fungal concentrations. The types of moulds associated with condensation dampness have also been identified.

Three methods of sampling were employed in the fieldwork of this study. An inspection form was devised and used in each property in the sample population and control group. A Surface Air Systems (SAS) sampler was selected and used for the collection of airborne moulds. Wall scrapings of visible mould growth were obtained for the examination and identification of types of moulds associated with condensation dampness.

The main finding of this research indicates that there is a significant association between condensation dampness and airborne mould concentrations, confirming that houses experiencing condensation mould growth, have a greater concentration of airborne moulds than dry houses. The greater the quantities of visible mould growth, the greater the concentration of airborne mould. The removal of visible mould growth from the surfaces resulted in a reduction in the concentration of airborne mould, although the overall levels of airborne mould remained higher than those for dry houses. The moulds identified included Penicillium, Ulocladium, Acremonium, Aspergillis, Mucor and Trichothecium. All of the houses sampled that experienced condensation dampness had inadequate heating, insulation or ventilation.

Key Words

Condensation; dampness; mould growth.

Introduction

Condensation dampness together with its associated mould growth, is regularly encountered by Environmental Health Officers working in Belfast City Council. It is a form of dampness, that is most prevalent during the coldest months of the year and is characterised by water droplets collecting on cold impervious surfaces, damp patches and the formation of black or green mould growth.

Damp conditions can occur in the home for a variety of reasons and according to the Building Research Establishment, 80-85% of dampness problems arise due to condensation or manmade moisture (Allen 1995). Condensation is a major problem throughout the United Kingdom. The 1991 House Condition Survey found that 10.4 million homes were affected by mould growth (Wheeler & Critchley 1998) and the Northern Ireland House Condition Survey 1996 found that 16% of homes experienced some form of dampness or mould growth (approximately 95,000 houses). The occurrence of condensation dampness depends on the relationship between heating, ventilation, insulation and the patterns of the occupiers' activities, thus the predominant cause can be difficult to identify. The presence of mould growth and its associated odour not only creates unpleasant living conditions and damage to property, but is associated with ill-health. Cold and damp living conditions can be a factor, which affects both physical and mental health. A number of studies have examined the effect of housing conditions on health and several large epidemiological studies have been able to show that damp housing and the presence of mould growth is associated with respiratory symptoms and other illnesses (Brunekreef et al 1989, Hunt et al 1989, Garrett et al 1998, Koskinen et al 1999, Williamson et al 1997).

The purpose of this study was therefore to examine the causes of condensation and to explore the relationship between condensation dampness and the manifestation of mould growth in the home.

Methods

The fieldwork for this study involved three separate investigative methods. An inspection form was devised and used in each property to determine the main factors contributing to the condensation dampness problems in the sample homes.

The Surface Air System Sampler (SAS sampler) was selected as a suitable air sampling device for the purposes of measuring the airborne concentrations of mould spores in houses experiencing condensation dampness and dry houses in the control group. The sampler draws air through the holes of a sampling head, over a plate containing a culture media. The plate is incubated and the resultant colonies, which are visible to the naked eye, can be counted.

Samples of moulds were removed from surfaces in the damp homes for the purposes of identifying the types of moulds associated with condensation mould growth.

Six households who had previously been in contact with an Environmental Health Officer in Belfast City Council regarding condensation dampness in their homes were recruited to participate as the sample population. The houses varied in size, age, occupation, type of heating and structure. The severity of the condensation dampness and mould growth varied in the six sample houses ranging from extensive mould growth throughout the house to small-localised patches of mould growth in others. Each house was given a classification of low, moderate or high/severe levels of dampness in each case.

A control group comprising of five dry homes was also selected for comparative purposes. The houses in the control group varied in size, age, structure and type of heating system. A pilot study was undertaken in the dry houses in May 2000 to determine the average quantities of airborne moulds in dry houses and also to determine whether the seasonal variation would influence the quantities of airborne spores found in houses. The samples were taken in the early evening of a warm day and most households had left their windows opened prior to sampling.

The fieldwork was undertaken during the months of January to March 2001 when condensation dampness is most prevalent. Each house in the sample population and the control group was visited once a week. Two 20 second air samples were taken in a room with visible mould growth and the exercise was repeated in a room without visible mould growth in each house. Two 20 second samples were taken in the control houses. The air sampling plates were transported to the Microbiology Laboratory at the University of Ulster, Jordanstown where they were incubated at 25°C for four days and the resultant colonies counted. Wall scrapings of visible mould growth were cultured using Rose Bengal Chloramphenicol Agar and incubated at 25°C for five days. The resultant growth was examined under a microscope for the purposes of identifying the types of mould present.

Results

Factors contributing to condensation in the sample homes

Using the data obtained from the inspection forms, a number of observations were made regarding the causes of condensation dampness in the sample houses:

- Houses situated next to vacant houses were more prone to condensation.
- Mould growth was most prevalent on the external walls in each case.
- None of the homes experiencing condensation dampness had wall or roof insulation.
- Some heating systems were either inadequate or not used properly due to financial constraints.
- Double-glazed windows did not eradicate condensation dampness in the absence of other measures.
- Some of the houses were inadequately ventilated due to a lack of extractor fans in the kitchen or bathroom, an absence of trickle ventilators in the window frames and in some cases, a reluctance to open the windows.
- Tumble dryers were used without suitable ventilation.
- Portable gas fires were used in some cases.

These findings concur with the wealth of information and textbook theory that is available on the causes of condensation dampness.

Airborne Concentrations of Mould in Damp and Dry Houses

The weekly results of the air sampling for each house were calculated using statistical tables and a formula provided with the manual for the SAS sampler. The results are expressed as the number of colony forming units per cubic metre of air (cfu/m3) and are collated in tabular form. Table 1 shows the number of visible mould spore counts per cubic metre of air in rooms with visible mould growth in damp houses over a six-week sampling period. Table 2 shows the concentration of mould spores per cubic metre of air in the rooms of damp houses without visible mould growth. Table 3 shows the airborne concentrations of mould spores per cubic metre of air in the dry houses.

Table 1: Visible mould spore counts per cubic metre of air (cfu/m3) in the rooms of damp houses with visible mould growth.

HOUSE	A	B	C	D	E	F
WEEK1	16	750	–	766	21783	1300
WEEK2	–	1383	983	700	1866	4633
WEEK3	83	1233	1283	1650	2700	4516
WEEK4	333	633	1333	1183	21783	1066
WEEK5	233	1050	350	1533	2566	4100
WEEK6	250	516	166	116	21783	5150

Table 2: shows the visible mould spore counts per cubic metre of air (cfu/m3) in the rooms of damp houses without visible mould growth.

HOUSE	A	B	C	D	E	F
WEEK 1	33	500	–	350	1600	21783
WEEK2	–	1700	533	483	300	4816
WEEK3	83	9916	1166	1350	2400	21783
WEEK4	250	383	550	283	2216	21783
WEEK5	233	1216	433	1183	1650	12833
WEEK6	233	316	233	100	21783	4100

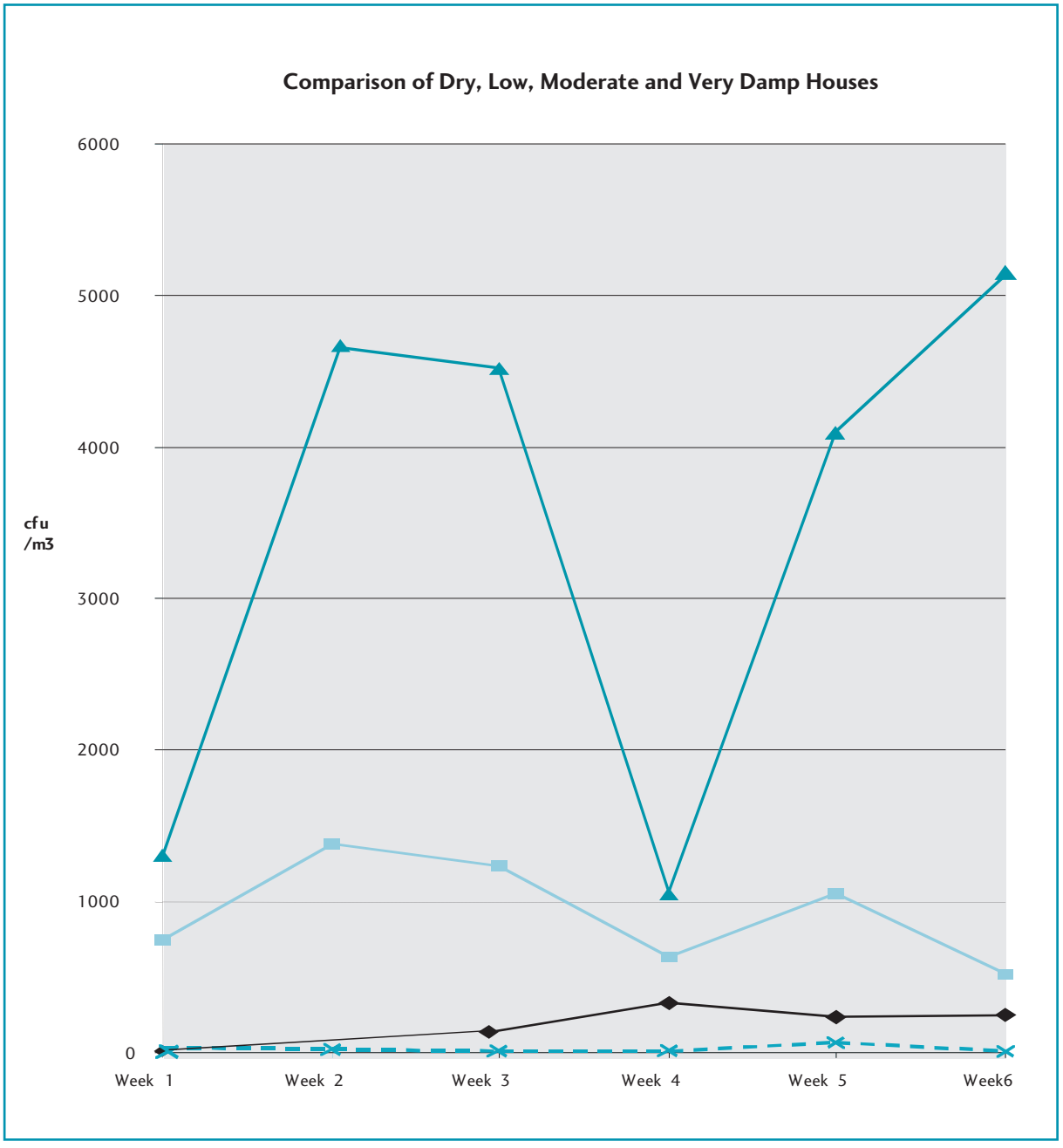
Table 3: shows the visible mould spore counts per cubic metre of air in the dry homes.

HOUSE	1	2	3	4	5
WEEK 1	0	50	0	33	16
WEEK2	33	33	22	22	55
WEEK3	0	16	16	16	16
WEEK4	233	50	0	16	16
WEEK5	33	100	16	66	16
WEEK6	0	83	0	16	33

Statistical analysis of the data using the two-sample z-test shows that the mean recorded levels of airborne mould spores per cubic metre of air in houses experiencing condensation mould growth are higher than the level of airborne spores found in dry houses. However in the case of houses that experience condensation mould growth, there was insufficient evidence to suggest that rooms with visible mould growth have a higher concentration of airborne spores than rooms in the same house without visible mould growth.

Figure 1 shows the results of the air samples in colony forming units per cubic metre of air (cfu/m3) for a dry house (House 4), a house with a low level of dampness (House A), a house with a moderate level of dampness (House B) and a house with an extensive amount of dampness (House F).

Figure 1



The results obtained for the pilot study of the dry houses ranged from 50cfu/m3 to 466cfu/m3 indicating that airborne levels are affected by seasonal changes.

Moulds identified from Surfaces in the Sample Houses

Penicillium, Ulocladium, Aspergillis, Mucor, Acremonium and Trichothecium were identified from the mould samples obtained in the damp houses. Support is given to these findings in the results of studies undertaken by Hunt & Lewis (1989) which indicated that Penicillium, Ulocladium and Cladosporium were the most common moulds found in damp homes.

Discussion

The results of this study show that houses with condensation mould growth have greater levels of airborne moulds than dry houses. These findings are comparable to other similar studies undertaken by Hunt et al.(1989), Verhoeff et al. (1990), Dotterud et al. (1995) and Dales et al. (1997).

There are no official standards for acceptable quantities of airborne spores in houses, however, the levels of airborne moulds in dry houses were low, ranging from 0 to 233 cfu/m3. These findings concur with observations made by Singh 1994, IEHO 1985 and Hunt et al 1989.

The extent of the dampness in each of the sample houses was categorised as low, medium or high depending on the severity of the mould growth in each case. The data was evaluated by classifying the spore level counts for each house into one of five categories. Hunt et al. (1989) in a study of damp housing and symptomatic health had devised this classification.

Using this classification, the results of this study show that there appears to be a dose-response relationship in that, the greater the quantity of visible mould growth, the higher the concentration of airborne mould in the sample houses (Table 4).

Table 4

HOUSE	Extent of Dampness	Concentration Range Cfu/m3	Spore Level Classification
A	Low Level	16 - 333	Medium
B	Moderate Level	316 - 9916	Very High
C	Moderate Level	166 - 1333	Very High
D	Moderate Level	100 - 1650	Very High
E	High/Severe	300 - 21783	Extremely High
F	High/Severe	1066 -21783	Extremely High

A significant observation of this study was that when the occupiers of the damp houses removed the mould growth from surfaces in a room, there was a reduction in the quantity of airborne spores in that room. Conversely, the airborne concentrations in other rooms in the same house remained higher. These findings indicate that in the absence of visible mould growth in houses experiencing condensation, the levels of airborne mould remain higher than would be the case for dry houses. In addition, the absence of visible mould growth in the damp houses still did not achieve the airborne levels that were achieved in the dry houses, implying that the airborne levels of fungi remain elevated in houses experiencing condensation dampness.

The quantities of airborne moulds in dry houses were affected by seasonal changes, as a greater quantity of airborne spores was found in dry houses during the summer than in the winter months. Thus supporting the findings of other studies by Garrett et al.1998, IEHO 1985, Singh 1994.

There exists a body of research that has established a causal link between ill health and the presence of mould in the home. The results of this study confirm that there is a significant relationship between condensation dampness and airborne mould. Hence the risk of ill health for those who live in damp homes is increased.

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Poor Housing and Mental Health in the United Kingdom: Changing the Focus for Intervention

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Abstract

There has been a great deal of research carried out in the past on the physiological outcomes of health and housing, looking at such issues as accidents, asthma and other such indicators to assess whether certain types of housing present more risk to its' occupants health.

Until relatively recently, there has been very little comprehensive research on the psychological effects of poor housing, or indeed housing type on mental well-being. This paper examines the research that exists in this field and provides evidence of links between poor housing and its' detrimental impact on health; with particular emphasis on mental health of residents. It also provides evidence to support the view that provision of poor housing exacerbates mental health illnesses of those housed in such accommodation.

The review will commence with an overview of the links between health and housing, before moving on to examine the context of poor housing together with an examination of the extent of the problem in the UK. The review will then move on to explore the links between psychological ill health and housing. This will look at particular housing stressors such as overcrowding, dampness and multiple occupancy and the impact on personal well-being and the impact of poor housing on those already suffering from mental illness. The paper will also briefly explore the area of causation and drift hypotheses as an explanation of the high incidence of mental ill-health in multi-deprived areas. It finally calls for policy makers and housing practitioners to reconsider the focus of improvement schemes from one of predominantly physiological health gain, to one that would also enhance mental health.

Keywords: Mental health, housing, homelessness, human health

Introduction

There has been a considerable amount of research connected with the physiological outcomes of poor housing on health (Burridge and Ormandy 1993, Stirling 1997, Ashmore 1998, Heinrich 1998, Andriessen 1998, Matte & Jacobs 2000, Blackman et al 2001) and indeed it is a central strand of both the Black Report (DHSS 1980) and the Acheson Report (1998). These reports indicate that the increased incidence of dampness, house dust mites, moulds, and accidents all bare a significant relationship to poor health.

What has been missing from many of these reports and research papers has been the analysis of the effect of poor housing on psychological well-being and health status, with Blackman (op cit) being a notable exception.

Allied to this is the considerable volume of work that has been done in the field of homelessness and health (Etherington 1983, Joseph Rowntree Foundation 1994a, Pleace and Quilgars; 1996, North et al 1997, Sullivan et al 2000, Styron et al 2000, Bottemley 2001, Trevena 2001) and homeless families and mental health (Drennan and Stern 1986; Conway 1988, Morton 1990, Davies 1992, Efron et al 1996, Vostanis et al 1997, Vostanis et al 1998, Cumella et all 1998, Bogard et al 1999, Waldron et al 2001) and indeed the type of housing that should be provided to homeless people, particularly those with mental health illness (Joseph Rowntree Foundation 1994b, 1996a, 1996b and 1998, Lipton et al 2000, Wong &Piliavan 2001). This work provides an indication of the need for quality accommodation to reduce deleterious impact on mental health.

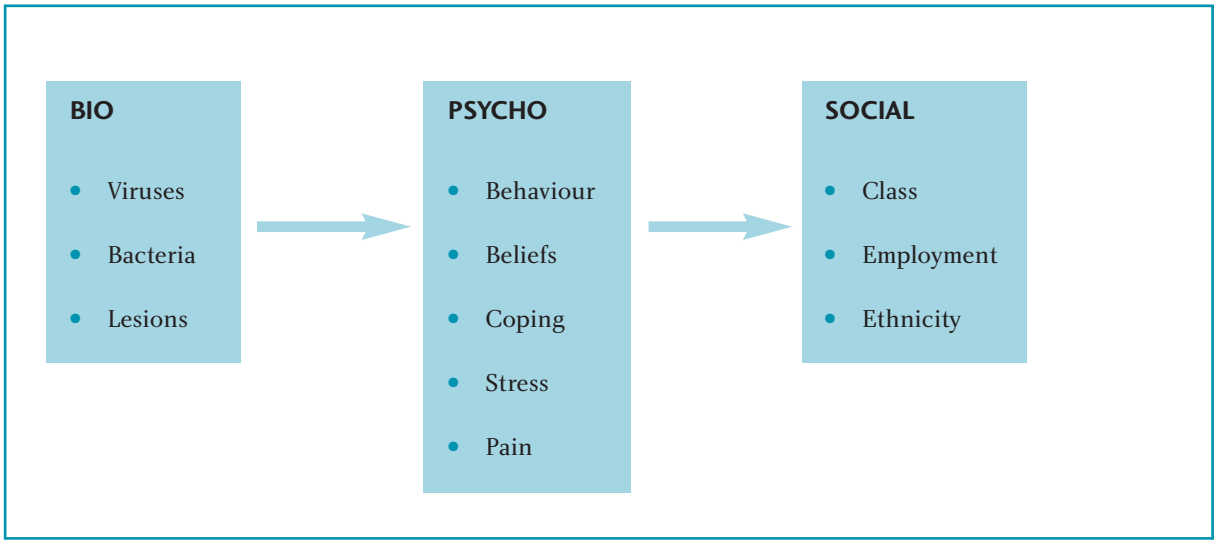
Defining Health

The United Kingdom has until recently followed a traditional Cartesian biomedical model, in which the health practitioner responds with either physical or chemical intervention to correct a malfunctioning biological system, or even part of a system. This has resulted in a significant specialisation of health

interventions and of practitioners responding to particular pathology.

The biopsychosocial model in figure 1 (Engels 1980 in Naidoo and Wills 2001 page 72) emphasises the role of both psychological and social factors in the causation and exacerbation of disease and illness, and indeed in the promotion of health.

Figure 1



Source: Engels 1980 in Naidoo and Wills 2001 page 72

There is an increasing conviction in some circles that the major determinants of health and well-being are not based on medical intervention but are cultural, social and economic (Dunn 2000 and Naidoo and Wills 2001). Dunn (op cit) (page 343) goes on to suggest that:

"one's immediate social and economic environment and the way that this environment interacts with one's psychological resources and coping skills, shapes health much more strongly than the medical model would suggest"

It is suggested that enhanced environmental and economic conditions provide a perceived "buffer" to negative, physical and mental health impact. One's self esteem and degree of control over your own position, and standing in society appears to have a direct relationship on health status (Frank and Mustard 1994), with the degree of control or sense of control being a theme that will recur throughout this paper.

The inter-relationship between the type, condition or location of housing, with unemployment or low fixed income and health can be demonstrated through lack of choice, with many in society reduced to renting low quality accommodation in deprived areas, suffering attendant increased lack of security associated with such accommodation. Such accommodation does not offer the perceived "buffer" described above.

An element missing from the model above is the degree to which social support acts as both a strong moderator against illness (Durkhiem 1952 in Nettleton 1995, Bloom 1990) and also provides a significant form of protection for those already ill. This argument is marginally countered by the work of Wong and Piliavan (2001), who show only modest impacts on psychological distress, through improved social resources. Some forms of housing do mitigate against the creation of strong social networks. Within multiply occupied housing there is a lack of privacy, forced sharing of amenities and enforced social contact, which are significant stressors (Drennan and Stern 1986, Standing Conference on Public Health 1994). Similarly high rise accommodation (Mitchell 1971, Freeman 1993) and accommodation in poor physical condition (Kearns and Smith 1993) both act against the creation of strong social networks. Such accommodation provides a considerable barrier to good health. The poor quality of housing at an actual level and at a perceived level, reduces the "buffer" effect in terms of environmental conditions, and prevents the creation of strong support networks.

What do we mean by poor housing?

The National Housing Federation (NHF) (1999) looked at housing and mental health. They defined poor housing as dwellings that were cold and damp, overcrowded, or badly designed and built.

Whilst this provides a simple and useable definition it does not provide the whole picture. The American Public Health Association as far back as 1939 (Ormandy and Burridge 1988) suggested housing should provide all of the above and be viewed as a place of sanctuary. This was reiterated in 1989 when a series of fundamental principles governing the relationship between the housing environment and the health of the residents were set out by the World Health Organisation. These were divided between those directly related to the housing conditions, and those that went on to highlight the connection to the environmental context of the housing. They provided recommendations that housing should be situated in a setting which has adequate industrial, commercial, social, religious, educational, recreational, welfare and health facilities (WHO 1989). The latter issues mirror the view that an individuals immediate environment, access to health and employment opportunities and support networks interact with psychological resources and coping skills, and impact directly on health status much more fundamentally than a purely biomedical model would advocate.

Poor housing can therefore be described in terms of an individual premises, in relation to the physical conditions, and at a community level in terms of lack of community facilities, crime levels, employment and social support networks.

Residents at both an individual and community level who are unable to fully utilise or access fully the economic and social resources available will experience stress and anxiety since they will not have the abilities or facilities to alter their circumstances. Likewise a person who lives in poor housing, especially if they are forced to share facilities, such as kitchens and bathrooms, with non family members, will have little privacy and little opportunity to seek true refuge and sanctuary. Poor housing, as an immediate environmental stressor, therefore, plays a central role in the psychological well-being of residents both at an individual and community level.

How bad is the housing in the UK?

Clearly massive improvements have been made throughout the Twentieth Century in the improvement of housing. Slum clearances of the 1930s to 1960s removed much of the poorest housing in the UK, but we are now left with a divergent stock which has a large proportion of dwellings in urban areas over 100 years old. Surveys of the stock such as the English House Condition Survey (EHCS) (DETR 1997) reveal a strong correlation between the age of the stock and the degree of disrepair. Nearly 50% of all unfit dwellings in England and 40% of dwellings in disrepair were built prior to 1919 (EHCS 1996). This compares to 11% and 15.5% for post 1964 dwellings respectively (Op cit).

Overall the national picture, in England, can be described through the results of the EHCS (Op cit), which reveals a considerable percentage of the English housing stock in need of some level of intervention. (Table 1) Wales and Northern Ireland reveal similar levels of unfitness and disrepair (Revell and Leather 2000). Scotland utilises an assessment based upon a tolerable standard and differs from the rest of the UK. It provides the lowest level of poor housing of all the UK countries (Revell and Leather 2000).

Figure 2

	Dwellings Unfit	Dwellings requiring urgent works over £1000	Dwellings requiring general repairs over £3000	Dwellings requiring comprehensive repairs over £5000
Dwellings	1.67 million	6.4 million	4 million	4.8 million
% of Stock	8%	31.5%	20%	23.7%

Source: English House Condition Survey 1996

The slum clearance programme, however, did result in human health costs. Ineichen (1993) provides a summary of the research into the effects of slum clearance on mental health of those "aided" by the clearance programme. Studies have indicated that there imposed slum clearance had a significant mental health impact on some groups, particularly older persons. This is balanced by international studies which indicate a different picture, but comparison is difficult since in many instances the communities in the UK were re-housed in peripheral housing estates and in new forms of housing which may reduced the feeling of well-being. Subsequent studies collated by Ineichen (1993) reveal a significant pathology associated with high and low rise housing and estate dwellings in the UK: with neurosis, depression and other mental illnesses reported as multiples of the national average. Issues such as alienation, loss of control and social isolation have all been shown in studies on residency in such accommodation.

Later forms of housing improvement focused upon improvement, in situ, of dwellings and areas. Since health improvement was not a key indicator of success (Allen 2000) it has been difficult to establish whether the process of improvement had any material impact on health status (Thompson et al 2001). What is apparent is that there is a mixed response to the process and outcome of renewal schemes. Some residents have prospered both during the process and as a result of the works done to their property (Blackman et al 2001, Thompson et al 2001). An equal number, however, appear to be negatively affected by the actual process of improvement, which often tempers any positive feelings they may gain through the enhancement of their dwellings. Many participants report significant stress created through the loss of control during the process (Allen 2000). This was particularly the case where the relationships involved a landlord and tenant environment, in which improvements were imposed, much like the experiences of slum clearance.

Why good housing?

Decent housing should be seen as a place for growth and a foundation for the fulfilment of life objectives, and one that provides for good physical and mental health and personal well-being (Ambrose 1997). A dwelling is more than a physical structure, bringing with it elements of security, community and well-being (Smith 1991).

This inclusive view of housing has not been recognised in the housing standards that have been used in the UK. To date they have failed to recognise the full impact of poor housing on health and have been generally linked to the state of the building rather than the impact on the person occupying. Attempts were made in the 1990s to make the Fitness Standard (Section 604 Housing Act 1985 as amended by the Local Government and Housing Act 1989) to be more related to health impact of the dwelling. There were, however considerable limitations of this standard notably that you could not look at the impact on individual occupants, thus a house could be considered fit for human habitation, but be unsuitable for the existing occupant. In addition the psycho-social elements such as the impact of noise, social isolation, privacy and mental health were not covered within the current legislation or standards.

A new standard to judge fitness of accommodation for occupation is being advocated which attempts to relate risk to health to judgement of fitness to occupy, (DETR 1998, 2000a 2000b, 2001). This proposed standard covers a greater range of topics in the assessment process, but it remains the case that the health impacts being considered are primarily physiological with little consideration of psychological ill-health.

The lack of emphasis on psychological ill-health is surprising since one can see that if your premises suffers from severe dampness, mould growth, is cold and in poor repair that your feeling of well-being will be compromised. A home should act as a place of sanctuary from the external stressors of life and should not add to the attendant stresses one faces. It is clear that if you are forced to reside in poor quality accommodation or in poor socio-environmental communities that this will present a major barrier to well-being.

What is the Connection between Housing Conditions and Mental Health?

In order to show the connections between housing conditions and mental health it is necessary to examine both physiological and psycho-social factors that can lead to chronic ill-health or repeated incidence of acute illness. Such ill-health and illness has a significant impact on the quality of life of the sufferers and has an influence over perceived ill-health.

Damp and mould

Damp and mouldy conditions have a number of direct and indirect impacts on health and mental well-being. Dampness directly reduces the ambient air temperature within the dwelling. This is a caused by a direct reduction of thermal insulation properties of the building fabric and heating systems attempting to remove atmospheric water through evaporation. Thus with marginal heating supplies the premises will feel colder in damp conditions causing dissatisfaction. Evidence has suggested that a temperature of 21°C (Boardman 1991, Burridge and Ormandy 1993) is necessary to

provide an adequate level of comfort. This is frequently unachievable in premises with significant dampness. Haverinen et al (2001) also reports an association between moisture damage and respiratory infections, whilst Engvall et al (2001a) reports a "pronounced increase in symptoms compatible with sick building syndrome and structural dampness in residential accommodation.

It also has to be acknowledged that economic factors do play a part in this equation. People on low fixed incomes, long term sick or the mentally ill often find themselves in the least desirable of homes with significant dampness. By their very socio-economic position they are least able to afford to heat their homes to a recognised level of comfort (Standing Conference on Public Health 1994).

In addition dampness is associated with the proliferation of both mite and mould populations. Mites have been shown to be natural allergens since 1922 (Ormandy and Burridge 1988) and have been the basis of a significant number of studies connecting mites with asthma and allergy (Hyndman et al 1994, Cloosterman et al, 1997, de Montis 1998, Chinn et al 1998, Warner, A., et al 1998a, Strachen 1998, Gotzsche et al 1998, Smith et al 1999). Outcomes of such sensitisation can be coughing and sneezing, rhinitis and allergic respiratory diseases (Ormandy and Burridge 1988).

Moulds on the other hand are strong immunosuppressors and significant allergens. They have been linked as risk factors for asthma (Garrett et al 1998, Jedrychowski & Flak 1998, Norback et al 1999, Engvall et al 2001b, Kilpelainen 2001), and atopic dermatitis (Garrett et al 1998). Due to their action the body attempts to respond to their presence through natural defence mechanisms including coughing and sneezing, excess mucus production or rhinitis. Studies have shown links to persistent cold like symptoms in adults and children (Huang and Kimbrough 1997, Koskinen et al 1999). The American Academy of Paediatrics on Environmental Health (1998) have issued a statement on the toxic properties of mould and indicate impacts as diverse as upper respiratory irritations, rash and pulmonary haemorrhage.

The important issues to highlight from the physiological impact of these stressors is that they are chronic or cyclical illnesses which will impact significantly on the quality of life of the sufferers. If there is constant suffering from cold like symptoms or your body is strongly immunosuppressed such that other infections are common then overall wellbeing will be reduced.

Dampness can also exacerbate social isolation with residents unwilling to invite friends and family into properties with mould and dampness. As stated earlier premises in poor conditions mitigate against the creation of strong social networks which are seen as buffer against ill-health. Studies have also shown that far beyond mitigating against mental well-being that in fact such conditions may be linked directly to higher incidence of depression and anxiety related disorders (Hyndman 1990, Lowry 1991, Ineichen 1993).

Overcrowding

The predominant focus of overcrowding and ill-health research, in the UK, has been infection rates and transfer of communicable diseases, particularly diphtheria, mumps and tuberculosis (TB). Whilst the first two diseases have been largely eradicated TB has returned particularly amongst homeless adults and nursery and school aged children. There has been more limited work on the connection between overcrowding and mental health (Mitchell 1971, Wilson and Jenkins 1985, Gabe and Williams 1987, Standing Conference on Public Health 1994), which suggest a high correlation between depression, psychological symptoms, and accidental and violent deaths (including suicide).

Adverse impacts on mental health appear to commence when persons are required to reside in accommodation at a rate of 1.5 persons per room (Gabe And Williams 1986). In a study of temporary accommodation in London (London Research Centre, 1989) it was found nearly two thirds (61%) of bed and breakfast accommodation used for long term accommodation was occupied at a rate of 2 persons per room. During the 1990s there was a significant reduction in use of such accommodation but it is increasingly being re-utilised in the face of the rise in homeless application and as a response to the increase in asylum seekers. The latter is a particular problem in light the high incidence of mental ill-health amongst asylum seekers (DoH 1999).

Children appear to be significantly affected in such accommodation with increased irritability, tension, increased aggression and lower levels of interaction with other children and poorer educational attainment and mental adjustment (Standing Conference on Public Health 1994).

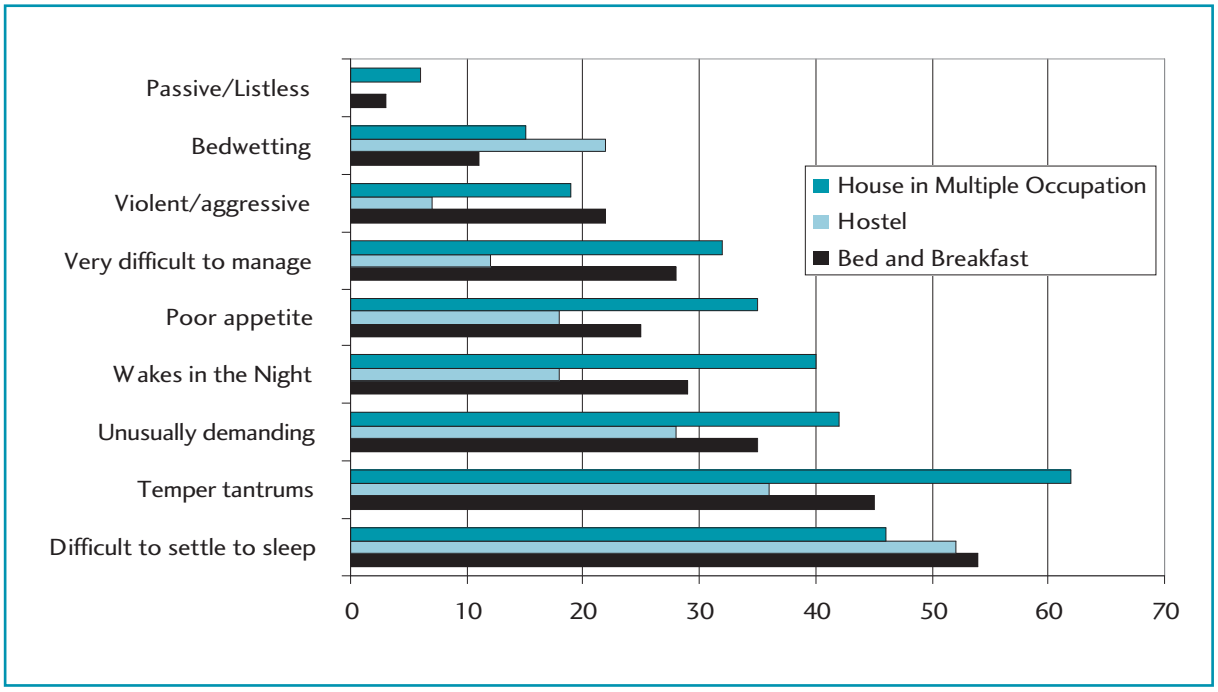
Intriguingly there also appears to be a very stark impact of overcrowding in early life with studies suggesting that adult ill-health is significantly affected (Britten et all 1987 re respiratory disease, Barker et al 1990 re stomach cancer, and Montgomery et al 1996 re short stature and attendant diseases such as heart disease, as reported in Marsh et al 2000).

Multiple Occupation and Temporary Accommodation

There have been a large range of studies which have looked at the impact on physiological and psychological ill-health of living in temporary accommodation (Wilson and Jenkins 1985, Conway 1988, Davies 1992, Efron et al 1996, Vostanis et al, 1997, 1998, Bogard et al 1999). Issues such as delayed childhood development, poor educational attainment, irritability, temper tantrums and disturbed sleep patterns have all been revealed. Likewise at an adult level increased incidence of depression, domestic violence, alcoholism, family stress and relationship breakdown have all be shown through the studies above. Such accommodation does offer some of the worst housing in the UK but it is not alone. There are large numbers of multiply occupied accommodation such as bed-sits, group homes and hostels which are in similar conditions but utilised as permanent accommodation for a variety of individuals and families often who have little choice as to the accommodation they can obtain. There is increasing evidence that people with mental illnesses are drifting to such accommodation, particularly along the South Coast of England. Such accommodation is inappropriate to their needs and it is often difficult to identify such individuals as benefits to cover housing costs are often paid directly to the landlord..

The impact of such accommodation, on children in particular, can be seen from the chart below, which reveals significant issues around temper tantrums, and settling the children to sleep in all three forms of accommodation.

Figure 3



(Source: Davies 1992.)

What is significant is that houses in multiple occupation, which offer longer term accommodation than hostels and Bed and Breakfast show a higher level of detrimental impact in virtually all areas. It must also be recognised that there is a consequent impact on the family as a whole of living in such accommodation. In the same study, 55% of adults with children reported that their dependants got on top of them. The reported reasons were cramped conditions, difficulties in coping with bad behaviour and lack of privacy (Davies 1992) (Figure 2).

Whilst children are a vulnerable group they are not alone. In a report by the NHF 1999 it was revealed that people living in temporary bed and breakfast accommodation had two and half times more mental distress than people housed in permanent accommodation in the same area.

Tenure and control over Housing Environment

As has been shown above there is a significant risk to mental health through overcrowding, forced social interaction, and sharing of amenities. The lack of control over the internal environment, particularly around safety, can play an important role in anxiety states amongst primary carers. If one is forced to live in multiply occupied accommodation, stair gates to both the stairs and kitchen areas are inappropriate. Play space is at a premium and difficult to supervise, with children often left to play in hallways and on stairs and landings, with increased risks of falls. If you are forced to share kitchens then children are deliberately taken to these areas rather than left in the bed-sit rooms thus bringing them closer to dangerous areas.

Lack of control and choice are also important within UK housing structures. There have been significant structural changes in the housing market which reduce the ability of some groups, such as those who are unwaged, on low fixed income, are single parents, those with long term illness and the mentally ill, to obtain quality housing. Tenure restructuring has resulted in a significant reduction in the amount of privately rented accommodation throughout the Twentieth Century (Balchin and Rhoden 1998). The remaining private rented sector has also seen a significant delineation with high quality accommodation being available at a premium for the business and executive market, leaving a residual of poorer accommodation for those with little choice. Even within this latter sector rents frequently outstrip housing benefit caps with tenants forced to find additional monies to cover the shortfall.

Within the public sector, policies such as Right to Buy and stock transfer has resulted in the sale of the more desirable properties, leaving the Local Authorities to manage a high level of flats, high rise and hard to let units, with increased management costs per unit (Malpass and Murie 1999). Malpass and Murie 1999 (Op cit) go on to suggest that rents within this sector are set to rise which may further decrease affordability.

Within the owner occupied sector affordability has become an increasingly visual issue with many public sector workers priced out of the market, forced by pay levels into housing choices they may not have wish to follow. For others that aspire to owner occupation all in not certain. Nettleton and Burrows (1998, 2000) highlight the links between mortgage debt and mental health status and the sense of loss of control as a primary cause in reduced mental well-being.

All of the above clearly impact on the economically disadvantaged, reducing their housing choices and their degree of control over their housing environment. As an additional factor, the lack of access to quality housing creates a demand for cheaper and poorer accommodation, with no resultant market necessity for it to be improved.

This lack of choice and control must impact on well-being. Recent work done by Macintyre et al 1998 found correlation between housing tenure and both physical and mental well-being. In particular those in rented accommodation appear to be suffering from significantly poorer health. It can be argued that this may be a direct result of the lack of direct control over their living environment.

Housing for those with Mental Illness

The context of appropriate care for those with mental illness has significantly changed over the past 20 years. The closure of the long stay hospitals and the reduction in dedicated hostel provision, day care and the rapid increase in privately rented accommodation providing housing has resulted in vulnerable individuals being housed in inappropriate environments (Arblaster et al 1996). Warner, L. et al (1998b) indicated that nearly a fifth of all residents in their study with mental health problems were receiving housing inappropriate for their needs

The Joseph Rowntree Foundation (JRF) 1996a suggests that loneliness and social isolation constitute major problems in re-housing persons with mental health problems. They identify the importance of the right neighbourhood and provision of social support which may not be available through lack of client affordability, and their social and economic isolation, and standing in society. In a further paper the JRF advocate the use of quiet locations with easy access to towns and facilities for those with mental health problems and the need to protect their residential space against noise.

The private rented sector, and in particular multiply occupied accommodation with no attendant social support network is a common but inadequate form of housing for those with mental health problems. This is exacerbated by the fact that it is often difficult to identify all such individuals once they are housed in such accommodation. Such accommodation imposes social interaction in communal spaces, forces sharing of amenities and in mixed usage accommodation there are additional conflicts arising from the noise of children playing, and loud music. Davies (1992) reported that is was not uncommon for homeless families to be placed in temporary accommodation

alongside single mentally ill men causing isolation and distress to all the occupants. It is clear that such accommodation far from providing a safe environment, free from stress, provides a considerable stressor for the person suffering mental health problems to overcome and may exacerbate anxiety and depression. It is often presumed that all those identified with mental illness are in contact with a community trust, Community Psychiatric Nurse or Social Services, but this is not always the case (Gorrara 1993). Thus without support and in a "stressful" residential environment there is a substantial potential for deterioration in mental health.

Causation or drift?

It is well recognised that mental well-being is influenced by a plethora of factors and that individuals respond differently to these. They include population density both at a single dwelling scale and at community level, changing social and support networks, access to employment, socio-economic factors, and living conditions. Likewise those suffering from mental illness can be compromised through such factors as those above. The very inter-relationship of these factors limits the ability to show causation of any one single factor as a major determinant of health status (Dunn 2000 and Allen 2000).

There are indeed two schools of thought in relation to the whole debate on ill-health and social determinants. Clare 1980 usefully summarises these:

The "Stress" hypotheses: that in the context of this paper, housing conditions cause stress and other mental disorders that were not present before,

Or

The "Drift" hypotheses: that those suffering from mental illness or who are least able to cope with external pressures drift into conditions of deprivation.

It is likely that both hypotheses have a role to play in the overall relationship between health and housing and that it would be difficult to discount the influence of the drift hypotheses since the impact of housing conditions on health can take a considerable period of time to surface. It would appear however that whichever comes first the poor housing causing ill health or those suffering from ill-health drifting to poor housing that such conditions will negatively impact on their mental well-being. Recent studies in the Netherlands (Reijneveld and Schene 1998 and Reijneveld et al 2000) support the notion that the concentration of mental disorders in areas of socio-economic deprivation may be a result of both drift and causation.

Conclusion

This paper has examined a range of issues that can impact negatively on both physiological health and subsequently on psychological health through cyclical or chronic ill-health and more directly on psychological health. What can be seen from the research is that there appears to be a significant relationship between poor housing and mental health both at an individual premises level and at a community level. The evidence supports the contention that there is a causal link between some physical conditions, such as dampness and overcrowding both on a physiological and psychological basis; and that certain forms of housing at the very least mitigate against mental well-being and in some instances certainly appear to prejudice it. In addition, the paper has examined the impact of poor housing on those already suffering from mental illness and concludes that poor housing would be significantly detrimental to their health status. The paper has also examined tenure restructuring which has limited access to decent affordable housing and has shown a link between lack of control over the housing environment and mental health

As a result of the above, the paper firstly calls for a more research into the field to establish a deeper understanding of the relationship between mental health problems and housing provision. The author also suggests a more considered approach to preventative measures to combat mental illness as part of Our Healthier Nation targets including the promotion of housing improvement both at an individual and community level to reduce mental illness in the United Kingdom. The NHS, medical and health practitioners must also recognise the impact of poor housing on mental well-being and respond at both a strategic level and at an individual level in the provision of services and in formulating interventions.

It is also important for all housing practitioners and those involved in regeneration and social inclusion initiatives to recognise the importance of control over the improvement process. Of equal importance is the need for practitioners to recognise that the effect of poor housing conditions is not limited to physiological ill-health and that they will have a strong effect on mental health. Likewise housing strategies need to recognise the inter-relationship between environmental and housing conditions, and the importance of affordability in providing a "buffer" to mental illness. This paper provides an evidence base to indicate the forms of housing that mitigate against positive mental health and should be used to prioritise interventions.

Allocation policies need to recognise the mental health impact of poor housing as they currently do for physiological outcomes. They also need to reflect on the housing of vulnerable clients in accommodation which may be detrimental to their mental well-being. Teams working with the homeless and asylum seekers, similarly, need to recognise the links between poor housing and mental health and wherever possible identify properties and support networks that will promote mental well-being.

Finally, it is suggested that any guidance issued in support of the proposed new Housing Health and Safety Rating System considers the impact of poor accommodation and defects within such accommodation on mental health.

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Violence at work: an initial needs assessment for the environmental health department as a health promoting workplace

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Abstract

Work-related violence provides a range of emerging challenges within the context of the development of the health promoting workplace advocated by the European Union in the Luxembourg Declaration on Workplace Health Promotion. Violence is thus becoming a priority issue for many governments, trade unions and employers. Public awareness and perception of work-related violence has shifted and some employers have moved it higher up the health and safety agenda as perceptions of the issue have become more all-encompassing.

This paper reports on an initial health and safety needs assessment which employed a qualitative survey design which sought to ascertain the knowledge of, attitudes to and experience of work-related violence amongst the several categories of staff employed in local authority environmental health departments.

Lower age and nature of the job done were positively associated with the likelihood of violence. Perpetrators are most likely to be subjects of investigation, complainants and those other than key players who choose to intervene. 'Out of hours' working was the most important work situation for violence, or the perception/fear of violence.

The prevention of violent incidents therefore requires a multi-layered strategy based on a systematic needs assessment which takes account of issues such as job type, work situation, perceived risk and fear of violence, sources of violence and employee views on risk reduction.

Such measures will give confidence to staff that their best interests are being addressed to empower them at the individual, organisational and community levels. Organisations and communities which fail to take this responsibility may find that workers will seek to empower themselves to challenge the status quo in relation to their personal safety.

Key words: environmental health, health and safety, health promotion, needs assessment, violence, workplace

Introduction

Work-related violence is emerging as one of the greatest concerns in the workplace today and is becoming a priority issue for many governments, trade unions and employers. Aggression, verbal abuse, bullying, assault, sexual harassment, physical abuse and homicide are causing widespread concern across occupational sectors worldwide (Fletcher et al, 2000, Boyd, 1995, CDC, 1992, Wynne and Clarkin, 1995). Following high profile cases such as that of the disappearance of English estate agent Suzy Lamplugh in the course of her work, the violent incidents at Dunblane Primary School in the United Kingdom and the Columbine High School incident in the USA, press and media coverage has focussed increasingly on it. This has resulted in heightened public awareness of the issue with employers having moved violence at work higher on the health and safety agenda as a result. Legislators have also acted in response. For example, in the UK violence has been placed on the list of work-related incidents which have to be reported (HM Government 1995).

Estimating the true prevalence of violence is difficult because of the failure to agree on operational definitions (Love and Hunter, 1996). The term

'violence' has been applied with little consistency to behaviours ranging from mild verbal abuse, through a series of intervening stages, to grievous bodily harm (Nolan et al, 1999). Leather et al (1997) explain the difficulty this causes in measuring levels of violence with an acceptable degree of reliability and validity.

Whilst formal reporting is inconsistent and variable, there is sufficient evidence to suggest that a high incidence of violence exists within many work situations, placing employees and others at risk from personal experience of incidents of violence and/or the stress which results from a constant fear of violence. A study for the UK Health and Safety Executive and the British Home Office (Budd 2001) focussed on physical assaults and verbal threats made against people in the course of their work. It was found that in 1999 in England and Wales there were 634,000 physical assaults and 654,000 threats by members of the public against workers. It was also reported that 604,000 workers experienced at least one violent incident during the year, 304,000 were assaulted on at least one occasion and 338, 000 were threatened. This means 2.5% of all working adults were the victim of at least one violent incident and 1.4% were threatened. Two percent of all workers said that worry about violence at work affected their health a great deal or quite a lot. Between 1997 and 1999 the total number of incidents of violence at work in England and Wales is estimated to have increased by 5%. These figures do not take into account any incidents of worker to worker violence.

Violence was once seen as a problem mainly in security related occupations but it is now evident in a much wider range of work environments. At particular risk are employees who provide a service to the public. Triggers for violence include delaying or denying the service, being perceived by the client as the source of the delay or denial, dealing with people in pain, those in trouble or under the influence of alcohol or other drugs and those who handle money.

Historically, workplace violence was narrowly defined to include only physical assault or homicide that occurred at the workplace. The general tendency now is for definitions to widen the scope over time in parallel with the greater public and professional awareness of the problem. Thus in some circumstances the understanding of what constitutes work-related violence has been expanded to encompass forms of aggression such as verbal threats, abuse, harassment, any assault or threat that cultivates psychological harm, personal or motor vehicle theft and self-directed harm (Cole et al, 1997). It has also been widened to 'work-related' from just 'workplace' to include incidents connected with work but which do not take place in the workplace itself, for example environmental health officers on a routine inspection visit or a dog warden on patrol. The situation, however, is by no means consistent. The legal requirement to report work-related violence in the UK applies to physical violence only; thus whether an incident has to be reported is entirely dependant on the physical outcome of the incident and not its nature.

Whilst definitions may be developed which offer an objective basis for policy, law or related action, their interpretation and meaning is vested in the fact that it is the perception of violence that forms reality for the individual and that it is this which largely determines its sequel (Cox and Griffiths, 1995). There is emerging evidence which suggests that fear of future violence after exposure to workplace violence is a predictor of diminished psychological well-being (Rogers and Kelloway, 1997). The critical feature of an incident is the individual's subjective interpretation of it. The most significant issues being the perception of harm, intent and the expectation of violence. Thus any definition of violence should take account of both the objective and subjective elements of the violent act. What seems non-violent to one person may be perceived as violent to another. Harkness (1997) suggests that it is the privilege of the employees, with their varying tolerance levels, to define for themselves, and for their employers, what is and what is not acceptable behaviour at work. With the substantial increase in the number of employees in so-called 'call centres' serving customers on telephone, e-mail and text messaging help lines, violence from remote clients could become a significant aspect of work-related violence which needs to be included within any contemporary definition.

In the UK, whilst there is no specific law on work-related violence the general law on health and safety - the Health and Safety at Work etc Act 1974 in England, Wales and Scotland and the Health and Safety at Work (Northern Ireland) Order 1978 and associated Regulations - applies to risks from violence, as it does to other work-related risks. Thus employers must protect their employees and others from violent acts by assessing the risks, consulting with employees and taking appropriate measures to eliminate or reduce those risks. Appropriate measures will include policy development, implementation and monitoring, and the provision of information, training and supervision. Incidents of violence against employees which result in physical injury necessitating a period of three or more days off work must be reported to the health and safety enforcement authority under the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR). An employee who reasonably believes that he or she is in serious or imminent danger, which they could not reasonably be expected to avoid, has the right under the

Employment Rights Act 1999 to leave the place of work until the danger has passed. The employee should not suffer any detriment to their employment for exercising this right and if they are dismissed they will be deemed to have been unfairly dismissed.

There may also be a need for employers to take action to identify potentially violent employees as part of the on-going monitoring or assessment of risks to employees. There have been several well publicised incidents where employees have been killed or physically injured by fellow workers. In today's employment climate, where 'downsizing' and 're-organisations' are common, the changed circumstances can give rise to stress which in some employees can lead to acts of violence against fellow employees. To comply with the law on the assessment of risks it may be necessary for employers to have in place a means of monitoring the workforce for signs of potentially violent employees and to take action to determine whether those signs are real (McClure and Werther 1997). Many incidents between fellow employees take the forms of bullying, harassment or verbal abuse. Litigation may follow such incidents and in past cases the employer has commonly been cited as a defendant.

The issue of work-related violence therefore provides a range of challenges within the context of the development of the health promoting workplace as advocated by the European Union in the Luxembourg Declaration on Workplace Health Promotion (EU, 1997). The declaration defines workplace health promotion (WHP) as "...the combined efforts of employers, employees and society to improve the health and well-being of people at work". It states that WHP can be achieved through a combination of improving the work organisation and the working environment, promoting active participation and encouraging personal development. This clearly reflects the principles of health promotion which has as its underlying aim the principle of empowerment which is implicit in the World Health Organisation's (WHO) basic definition of health promotion. This states that "health promotion is the process of enabling people to increase control over, and improve their health (WHO, 1986)." This theme of empowerment through increased control can be conceptualised at the individual, organisational and community levels (Schultz et al, 1995). However, it should be recognised that empowerment of the individual can lead to the challenging of existing power bases (Rissel, 1994). This has obvious implications for the managerial culture of the workplace.

This paper reports on a study which aimed to ascertain the knowledge of, attitudes to and experience of work-related violence amongst the staff of local authority environmental health departments in a selected area of Northern Ireland. Environmental health departments of local authorities are enforcement authorities for the health and safety at work legislation. Thus in addition to holding the responsibility for their own staff in relation to health and safety issues, local authorities have a major role in the enforcement of the law. In addition, they also seek to advance the promotion of the concept of the health promoting workplace in a wide range of workplace situations.

The study was designed to:

a. identify those behaviours displayed by perpetrators which staff consider to constitute acts of violence;

b. ascertain the levels of violence experienced by staff employed in environmental health departments in a defined geographical area;

c. make a preliminary assessment of the effects of violence on staff; and

d. ascertain the views of staff on the most effective measures for dealing with instances of violence

Methods

A self administered postal questionnaire was deemed to be the most feasible method of canvassing the views of the staff in the ten environmental health departments under study. The questionnaire, which employed a series of closed response questions, was specifically targeted at the issues of perceptions of violence, actual experience of violence at work, sources of violence, perceived at-risk violence scenarios, education and training relating to violence and incident and post-incident support provided by employers.

When developing questions relating to perceptions of violence, a number of working definitions of types of violence were developed to guide respondents. The term 'Physical Assault' was used to include blows of any type to the person (whether or not injury is caused) including pushing, hair pulling, physical restraint, indecent assault, spitting and throwing of any object or substance. 'Threatening Behaviour' was a generic term which was defined as any form of behaviour which falls short of physical assault but which induces in the victim a sense of threat to personal safety.

This term was then further explored by examining a number of overlapping sub-categories which included verbal abuse - shouting and/or the use of foul language; implied threat - here direct threats of violence are not made, but questions or statement

imply negative consequences e.g. "I know where you live/work...that's your car, isn't it?...I don't think you should feel safe after this..."; sexual harassment - here violence focuses on the victim's gender through stereotyping and/or sexual innuendo; derogatory/antagonistic comments - here negative references are made to the victim's appearance, professional competence, personal qualities e.g. manner of speech, lack of seniority in the organization; discriminatory comments - this focuses on negative comments relating the perpetrators' perceptions of the victim's race, ethnicity, religion, sexual orientation, disability status.

The environmental health service in Northern Ireland is administered in five regional groups, Northern, Southern, Eastern, Western and Belfast. The Northern Group was selected for the purposes of this study as it contains a mix of urban and rural locations with a wide range of environmental health activity. It was also the area to which the researchers had facilitated access. The Group covers 10 district councils which range in population size from over 80,000 to less than 15,000 and provides a mix urban residential, commercial and industrial areas and rural districts with farming and tourism as their main activities. Each District Council has its own environmental health department which is managed autonomously but within an advisory enforcement and practice group policy.

In drawing up a sampling frame it was considered appropriate and feasible, given the relatively small size of the population, to approach a census sample of the total population which comprised all grades of professional and administrative staff. While only a 100% response to a census will give a complete picture of the population in question (Atkinson, 1991), a substantial response can still be reckoned representative of the sample if the tool is accessible to the entire population and each has an equal opportunity to respond. Eligibility for inclusion in the sample was established by ensuring that respondents were permanent staff on the payroll of the district councils who were employed within the Group during the time frame of the questionnaire administration.

Gender distribution was equal in the District Environmental Health Officer grade, women predominated in the Administrative Staff and men predominated in all other grades. Field enforcement staff include District Environmental Health Officers, Senior Environmental Health Officers, Dog Wardens, Enforcement Officers, Technical Assistants, Rivers Inspector and Pest Control Operative. Those in the Chief Environmental Health Officer grade were office based but contribute to some field operations. Administrative staff were office based.

A pilot study was undertaken whereby the survey instrument was submitted to a small number of respondents who worked in environmental health departments outside the Northern area and were thus not included in the main sample. The pilot resulted in minor adjustments being made to the wording of several questions and the definitions of violence being made more explicit.

Content validity was achieved through an extensive literature search and the submission of the survey instrument to two independent experts (DePoy and Gitlin, 1994). Reliability was ensured using the test-retest strategy (Parahoo, 1997) where responses were found to be consistent from a small sample who were not involved in the main survey.

The questionnaire was posted to all respondents with a covering letter and an unmarked envelope for return through internal mail. To ensure good ethical practice, respondents were informed that participation was voluntary and anonymous; no results would be attributed to any specific department or council. One month after the initial posting, a reminder was sent to all participants asking for their response if this had not already been sent. Analysis was subsequently carried out using SPSS v9.

Results

Of the 138 staff canvassed, 100 valid questionnaires were returned. This provided a response rate of 72.5%. Demographic analysis of the respondents, 51% of whom were male and 49% female, is outlined in Table I. Of the 100 respondents included in the analysis, 11 had been in post for less than 2 years, 11 for 2 - 4 years, 30 for 5 - 8 years, 20 for between 9 - 16 years and 28 had more than 16 years service in the environmental health department.

Table 1: Respondents by staff grade (percentage of respondents)

Staff Grade	%
District Environmental Health Officer	38.0
Administrative staff	21.0
Senior Environmental Health Officer	12.0
Chief Environmental Health Officer	9.0
Dog Warden	6.0
Enforcement Officer	5.0
Technical Assistant	5.0
Rivers Inspector	3.0
Pest Control Operative	1.0

Table 2: Age of respondent (percentage of respondents)

Age range (years)	20-29	30-39	40-49	50-59	>60
% of respondents	32	29	26	9	4

Table 3: Opinions on what constitutes Violence/Aggression (percentage of respondents)

Category of violence	%
Physical assault	100.0
Threatening behaviour	93.0
Implied threat	88.0
Verbal abuse	84.0
Sexual harassment	49.0
Derogatory/Antagonistic comments	43.0
Discriminatory comments	42.0

Table 4: Personal experience of violence whilst at work (percentage of respondents)

Category of violence	% of respondents who experienced this quite or very often
Verbal abuse	28.0
Derogatory/Antagonistic comments	25.0
Discriminatory comments	11.0
Implied threat	10.0
Physical violence	9.0
Sexual harassment	8.0

Other key findings on personal experience of violence whilst at work

- 60% of staff employed less than two years reported that they had experienced verbal abuse compared with 23% of those employed more than nine years
- Only female staff reported having suffered sexual harassment
- Twice as many male staff as female staff have experienced implied threat
- 33% of dog wardens have been subject to threatening behaviour compared with 14% of environmental health officers

Table 5: Most common sources of violence (ranked by respondents)

Source of violence	Rank
Complainants	1
Members of the public	2
Proprietors of premises inspected	3
Work colleagues	4
The employees of proprietors	5

Other key findings on most common sources of violence

- 100% of dog wardens identified 'the public' as a source of violence
- 22% of environmental health officers considered 'proprietors' as a source of violence whilst no other staff category considered this a problem

Table 6: Perceived risk and fear of violence in common work situations

Work situation	% of respondents who considered this a high or medium risk situation for violence
Out of hours work	59.0
Dealing with noise complaints	39.0
Dealing with dog related complaints	33.0
When informing accused of formal action	28.0
Investigations within premises	12.0
Other complaints	4.0

Other key findings on perceived risk and fear of violence in common work situations

- 43% of environmental health officers considered 'routine inspection of premises' as a medium or high risk situation for violence (a daily activity for most EHOs)
- 40% of environmental health officers considered there to be a medium or high risk of violence when interfacing with the accused in relation to initiating formal legal action
- There was a clear age difference amongst environmental health officers regarding the perception and fear of violence when serving formal legal notices with 11% of respondents in the 20-29 year age range considering this a high risk situation compared with 1% in the 50-59 age band and none in the over sixty age band
- 71% of environmental health officers considered that 'out of hours work' a medium or high risk work situation for violence against them
- 100% of enforcement officers felt that 'out of hours work' created a medium to high risk for violence

Table 7: Assistance provided by employers in reducing risk of violence (percentage of respondents)

Risk reduction measure	%
Accompanied working	65.0
Conflict training	60.0
Provision of a mobile phone	44.0
Action to identify known aggressors	42.0
Supply of a personal alarm	27.0
Access to a counselling or other support service	23.0
Other assistance	2.0

Discussion

This study provided a valuable insight into the baseline which is needed to provide a starting point for planners who wish to address the issue of violence in the workplace from the standpoint of an expanded conceptualisation of violence (Cole et al, 1997). It could reasonably be supposed that the population and the organizations from which the sample were drawn could have a better than average grasp of workplace health and safety issues. This is also a population which appears, within widely defined parameters of violence to experience higher incidences of violence than the average member of the national workforce (Budd, 2001). This would indicate that health promotion measures engaging with the nature and scale of work-related violence still need to be reviewed and/or initiated.

In terms of the sample's opinions on what constitutes violence there was, as observed elsewhere (Nolan, 1999), a lack of consistency of view. Slightly less than half of the respondents rated sexual harassment, derogatory/antagonistic and discriminatory comments as constituting violence (see Table III). This has implications for policy formulation relating to both the defining of violence and in devising staff education and training which makes the nature of violence and its consequences and remedies a real issue (Cox and Griffiths 1995). Members of staff who are unaware of the negative consequences of these phenomena may unwittingly and unnecessarily endure unacceptable levels of behaviour from clients and co-workers thus placing themselves at risk of a breakdown in their psychological wellbeing (Rogers and Kelloway 1997).

When focusing on the experience of violence at work, several interesting trends emerged (see Table IV). Violence primarily involved verbal exchanges - verbal abuse (28%) and derogatory comments (25%). When these figures were further analysed, however, several interesting trends emerged. It was found that staff who had been in post for less than two years were 2.5 times more likely to suffer verbal abuse than those who had been in post in excess of nine years. This figure also largely represents those in the 20 - 29 years age band, and so it appears that younger staff are more vulnerable. The same trends were observed when respondents stated their experiences of violence relating to the serving of formal legal notices. This has obvious implications for those who mentor or otherwise support younger members of staff at the early stages of their careers in terms of the provision of adequate induction and ongoing support.

Gender also had a part to play in several findings. The figure for sexual harassment is of particular significance for those situations where women are employed. While intra-staff sexual harassment is taken increasingly seriously by many employers, the issue of harassment coming from clients and the general public is one which may receive less attention. In this study, a relatively low figure 8% of staff - all women - claimed they had suffered such harassment quite or very often (see Table IV). While this may indicate a small problem overall, for the 8% it is a real issue. This therefore raises an issue in policy formulation in regard to issues which affect a minority of staff. The ability to identify such issues within mechanisms such as staff appraisal, which operate in most well organised workplaces, allows managers to ensure that no minority problem areas remain unaddressed.

Another key issue is the level of violence which may be experienced by specific professional groups within the workforce. In this study 33% of dog wardens as opposed to 14% of environmental health officers had been subject to some form of threatening behaviour. This may be accounted for by the traditional British affinity with the canine species, but points to a wider issue of identifying those occupations which are more likely to engender violent responses.

Linked to the nature of the occupation are the potential source and site of the violent encounters for staff. As might be expected, persons against whom complaints are being investigated and members of the public who either lodge complaints, observe and/or intervene in the work of staff are the most likely perpetrators (See Table V). Each occupational category has, of course, its own specific profile. Thus environmental health officers experience greater problems from 'proprietors' of inspected premises (22%) and 100% of dog wardens identify the public as a problem. Further, the site of violence is, in the vast majority of cases for employees of environmental health departments, perceived to be away from the base offices of the department and out of office hours (see Table VI). The accurate recording and analysis of any incidence of violence is thus of prime importance in identifying and addressing such issues for the various job categories.

The issue of addressing violence has direct relevance for the final element of the survey which sought to assess the perceived support from the employer in the reduction of violence (See Table VII). The eclectic mix of measures which were identified as helpful indicates the expectations of employees that the issue of violence should be addressed on a number of fronts. Thus, reducing the levels of isolated working away from base, facilitating easier contact through the provision of mobile 'phones/personal alarms, access to adequate training and identification of known perpetrators can all reduce the perceived threat of violence.

Conclusion

This study has shown that staff recognise violence as a reality which goes beyond the narrow confines of physical assault. In order to prevent violent incidents becoming the precursors of reduced psychological wellbeing of the workforce, there is a need to address further the measures currently in place to inform and implement policy on work-related violence. This will involve senior management ensuring that they have adequate knowledge of the issues as it affects all grades of staff in the organization through a detailed needs assessment.

In this needs assessment study, young environmental health officers were more likely to experience some forms of violence; this has obvious implications for induction training and mentoring programmes. Specific professional groups reported different levels and situations of violence and may therefore require special attention. The potential source and site of violence are linked to the nature of the job done. Those against whom complaints are made and members of the public who either lodge complaints, observe and/or intervene in the work of staff are the most likely perpetrators. 'Out of hours' working was the most important work situation for violence, or the perception of violence.

These issues identify employee needs which are likely to be quite different from those who are employed in, for example, an ordinary fixed workplace or a call centre. Thus a detailed needs assessment should be carried out by every employer taking into account all occupational groups, job done, work situation, gender, age, perceived risk and fear of violence, actual sources of violence and the employees' views on what is needed to reduce the risk or fear. Such a needs assessment should lead to an improved recording mechanism for violent incidents which should, in time, enable employers to more closely target specific jobs and situations where violence may be an issue.

In addition to holding the responsibility for their own staff in relation to health and safety issues, local authorities have a major role in the enforcement of the law, and as a key partner in the HSE Occupational Health Strategy (HSE, 2000), are likely to have an increasing role in advancing the concept of the health promoting workplace. Thus enforcement managers should be keenly aware of the importance of including work-related violence as part of their enforcement and educational programmes.

Such measures will give confidence to staff that their best interests are being addressed to empower them at the individual, organisational and community levels. Organisations and communities which fail to take this responsibility may find that workers will seek to empower themselves to challenge the status quo in relation to their personal safety.

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