The perceived importance of cockroach infestation to social housing residents

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Abstract

This paper reviews published work on injury levels, particularly aesthetic injury levels, in respect of cockroach infestations in housing. The term “injury level” is used here to mean the pest population level (measured in terms of insect numbers or activity) at which the victim (in this case the tenant), suffers injury. The injury itself may be physical, psychological or economic. That is, the insects may spread disease, cause distress or damage property e.g. food. This paper discusses the importance of victims’ perceptions of injury in cockroach control programmes. It is argued that these perceptions of injury are important, especially in terms of psychological injury actually suffered. They also influence the likelihood of the tenant taking action themselves to control the infestation and also determine the level of satisfaction with pest control services. The paper then reports the findings of an initial study which examined the relative perceptions of residents regarding cockroach infestations as compared to other common housing problems, e.g. dampness, poor security, poor repair. The results of this study showed that residents who had experience of infestation in their dwellings were more tolerant of cockroach infestation than those who had not. This finding is consistent with that of an earlier study which suggested that as pest numbers increase, victims’ tolerance increases. In the case reported here, however, the perceived importance of cockroach infestation was considered relative to other housing defects rather than cockroach abundance. The relevance of the above to cockroach control programmes and customer satisfaction is discussed.

Key Words: Blatta orientalis, Blattella germanica, cockroach, environmental health, infestation.

Introduction

Cockroach infestation in the UK, although less widespread and less common than in, for example, the USA, remains a serious problem in some areas. This is important in terms of public health not only through the long established capacity of cockroaches to carry pathogenic organisms but also because of the risk of cockroach infestations causing asthma and other allergic disease, evidence for which is now accumulating.

The ultimate success of cockroach control programmes is dependent upon the degree of satisfaction and therefore the perceptions of those who have to live in cockroach infested environments. This point is particularly important, as cockroach infestations are often impossible to eliminate, so the preference expressed by many people for zero infestation is sometimes not achievable.

This paper will report the findings of an initial exploratory study into the perceptions of social housing tenants in a south London borough regarding the importance of cockroach infestation. The published literature on the health effects of cockroach infestation will be reviewed and the importance of setting injury levels and tolerance thresholds in cockroach management programmes will be explained. The indicative findings of this study will then be used to secure an indication of tenants’ perceptions of the importance of cockroach infestation as compared to other common housing defects.

The risks to human health from cockroach infestations

It has been established for some time that cockroaches are able to carry pathogenic bacteria onto food (Morrell 1911, Antonelli 1950, Bitter & Williams 1949, Alcamo & Frishman 1980, Brenner, Koehler & Patterson 1987). This clearly demonstrates the potential for cockroach infestations to be responsible for food poisoning outbreaks. Causative links between infestations and outbreaks have been more difficult to demonstrate. Another risk to human health arises from the ability of cockroach tissue and fras to cause allergic reactions that can be very serious for some sufferers. Kang & Chang 1985 and Kang et al 1987 found evidence that exposure to german cockroach Blattella germanica (L.) populations appeared to be responsible for atopic and allergic reactions in people living in cockroach infested environments.
More recently Arlian, (2002) has pointed out that large numbers of people are affected by arthropod allergy in the U.S. and that cockroach allergy is a major factor in this. Asthma has been found to be associated with reported cockroach infestation (Lwebuga-Mukasa et al 2002), and exposure (Kane et al 1999). More specifically, Rosenrech et al (1997) found associations between environmental cockroach allergen concentration and sensitivity among 476 children with asthma. 36.8% were allergic to cockroach allergens.

Evans and Kantrowitz, (2002) concluded that exposure to cockroach allergen was a factor in the socio-economic status-health gradient in the U.S. This is supported by the findings of Rauh, Chew and Garfinkel, (2002) who found higher cockroach allergen levels in houses that were in poorer states of repair. Alp et al, (2001) concluded from their field research that cockroach allergen sensitivity starts early in life and may be the only sensitising allergen in many young inner-city children. Arruda et al, (2001) also pointed out that cockroach allergen exposure was associated with asthma and allergy especially in lower socio-economic groups and exposure in the first three months of life was associated with asthma. They also make the interesting observation that Cockroach asthma is an important public health problem that affects patients who are likely to be the least compliant with treatment with asthma medications or environmental control.

Cockroach infestation can, of course, also produce additional health risks as a product of the control measures employed. Wyatt et al, (2002) expressed concern over levels of pesticide use and consequent indoor pesticide residual concentrations in a study of pregnant women from minority groups in the U.S. Davis and Ahmed, (1998) similarly expressed concern over indoor exposure to chlorpyrifos used to control cockroaches.

Finally it is not unreasonable to suggest that the intense disgust felt by many people towards cockroaches, especially when they are in contact with human food, is likely to produce psychological effects and consequent risks to mental health.

The control and management of cockroach infestations

Cockroach infestations have often proved particularly difficult to control, (Bennett and Owen 1986, Beasley, Oldbury & Owens 1988, Rivault and Cloarec 1996). This difficulty arises from a range of factors, some of which are unique to cockroaches, others of which apply to insect pests generally.

Firstly cockroaches are nocturnal crevice living species that are difficult to reach with pesticides. They are not seen during the daytime so their exact location and activity may not be noticed. Their bodies are dorso-ventrally compressed and they can therefore find harbourage in very small crevices, as small as a few millimetres in width in the case of the nymphs. This makes them difficult to spot, for example behind loose wallpaper and architraves, and difficult to reach with insecticidal sprays.

Years of difficulty in controlling cockroach infestations have led to the application of large quantities of various pesticides over long periods. This has resulted in significant resistance to insecticides in many pest cockroach populations (Batt 1977, Cochran 1989, Rust & Reirson 1991). More specifically resistance to organophosphate, carbamate and especially pyrethroid insecticides were found in three strains of Blattella germanica collected in London by Chapman, Learmount and Pinniger, (1993).

To reduce pesticide application and target the pest species more accurately, thus reducing the potential for inducing resistance, a range of pesticides applied as bait have been developed (Milo, Koehler and Patterson 1986, Lucas, Invest and Dodd 1992). Many of these baits have been based upon hydramethylnon, which has a different mode of action to products commonly used in the past such as organochlorines organophosphates, carbamates and pyrethroids (Lucas & Invest 1995) thus reducing the risk of cross resistance. Resistance to a pesticide also tends to lead to the application of more pesticide in an attempt to increase the number of insects killed. This itself will provide pressure for further resistance and can endanger non-target species. Control using insect growth regulators which reduce the risk to non-target, at least non-target insect, species has also been used (Reid, Bennett & Yonker 1990, Evans 1993).

The abundance of cockroaches has also been linked to various environmental factors such as cleanliness and human density (Rivault and Cloarec 1996). Similarly Shah, Learmount and Pinniger, (1996) found cockroach infestation levels to be related to hygiene levels in individual flats and, in larger blocks, to district heating.

Integrated Pest Management

Because of the problems encountered in controlling pest populations, and in some cases the impossibility of eliminating the pest species completely, the concept of integrated pest management (IPM) has been developed. This concept was originally introduced in agricultural pest situations as integrated pest control (Stern et al 1959) where natural biological control mechanisms were optimised. This was later developed into integrated pest
management, defined then as “the reduction of pest problems by actions selected after the life systems of the pests are understood and the ecological as well as economic consequences of these actions have been predicted, as accurately as possible, to be in the best interests of mankind” (Rabb 1970). In many respects this definition remains valid today. Another definition was offered by Smith and Reynolds (1966): “a pest population management system that utilises all suitable techniques in a compatible manner to reduce pest populations and maintain them at levels below those causing economic injury”.

Integrated pest management applies a thorough understanding of the ecology of the pest species to optimise control strategies. More importantly it accepts that elimination, even temporarily, of the pests is sometimes impossible. This requires the establishment of some sort of injury level up to which pest populations will be tolerated. In agriculture this level is described as the “economic injury level” and can be calculated from economic damage to crops and the costs of avoiding that damage. In environmental health pest control where risks to human health are complex, establishing an “injury” level is much more difficult. This task was undertaken by Zungoli and Robinson (1984) who discussed the concept of an “aesthetic injury level”. One author of the work reported here has, however, experienced hostility to the term “aesthetic injury level” from public housing tenants who rightly pointed that their main objections to insect pests were based upon concern about health risks rather than aesthetic considerations.

Perceptions of the seriousness of cockroach infestations

The perceptions and attitudes of those who suffer cockroach infestation are important in designing effective cockroach control strategies. This is because it is these perceptions and attitudes that will be used to determine tolerance and injury levels for integrated pest management programmes. This process is complicated by the fact that it is very difficult to quantify, even approximately, the risks to human health of cockroach infestation. Furthermore, the victim’s perception of the importance of cockroach infestation contributes to the actual psychological harm suffered by that person.

Another reason that the perception of the importance of cockroach infestation is important is that this will influence the actions that victims take to prevent or reduce cockroach infestation. For example, those who view cockroach infestation as very harmful are likely to pay more attention to good hygiene and other preventive measures. They are also more likely to instigate or apply immediate control measures.

The fact that cockroach infestations sometimes cannot be permanently, or sometimes even temporarily, removed from buildings is also important. People in the UK are generally unaccustomed to cockroaches and therefore expect their homes to be cockroach free. It is difficult, therefore, to persuade them to accept any, even temporary, level of cockroach infestation. This leads to the suggestion of an aesthetic injury level of nil, which, it has previously been pointed out, is sometimes impossible to achieve.

The London Borough of Southwark and the survey site

The London Borough of Southwark is located on the south bank of the river Thames, facing the City of London. The borough has the largest public housing stock of the London authorities with 50,843 dwellings and 11,870 under the control of housing associations. Southwark has in the past suffered severe deprivation in parts of the borough but, more recently, has undergone a period of dramatic regeneration and improvement of its housing stock and the general environment. Around £250m has been budgeted for this goal (Southwark Housing Report 1999).

In 1988 the Council set up an in-house team to deal with complaints of pest infestations. The Council routinely monitors housing for pest infestations on a sample basis and monitors recently infested houses for a period after treatment has been completed. This policy has resulted in a reducing budget for pest control as overall numbers of pests reduce. There remain, however, a number of ‘hot spots’ where severe infestations of cockroaches, pharaoh ants and mice occur despite intensive pest control activities.

The Cossall Estate

The study reported here was conducted on the Cossall Estate. This consists of 421 apartments contained in eight three-storey blocks. The buildings were built within the last 20 years, have cavity walls and central (district) heating. The estate has a history of cockroach infestation, Blatta orientalis (L) and Blattella germanica (L). At the time of the study 15.7% of the apartments were infested with cockroaches.

Methods

A quantitative questionnaire was used for the study. This was delivered face-to-face in all cases. Because of the nature of the data collected it was considered essential that all efforts be made to obtain access to as many dwellings as possible of those chosen to survey. This would also reduce the extent to which the samples were self-selecting. The final response rate was 80%.
The quality of the data collected in terms of their validity depended, to a large extent, upon the degree to which respondents trusted the interviewer and supported the study. To this end approval was obtained from the senior management of Southwark housing department. Also, letters were sent to households chosen for the samples in advance of the questionnaire visit. In this letter the tenants were told of the Council’s support for the project as well as its overall objectives and were invited to contact the researchers to discuss any concerns they might have or to ask not to be visited. A number of people took up this offer. The interviewer was himself a resident of Southwark.

The questionnaire itself was also piloted to ensure that the questions asked and the method of delivery were appropriate.

The Cossall estate was chosen for the study because it had a relatively high level of recent cockroach infestation. Thirty dwellings with records of current cockroach infestation were chosen and thirty with no record of cockroach infestation. Of these sixty dwellings appropriate access was obtained to forty-eight (80%). This level of access was obtained by repeatedly calling back to flats where no one was found at home at the first visit, in the evenings and at weekends if necessary, until it was established that all had been done to obtain access. Some residents were never found at home despite repeated visits. Very few residents refused completely to take part. It is suggested that the high level of access obtained in this study improved the validity and reliability of the findings.

The questionnaire consisted of closed and open questions. It was refined by five pilot interviews. These included a number of sets of similar questions intended both to test the effectiveness of various forms of wording and to enable the validity of the questionnaire to be assessed by looking at the consistency of the responses. The responses were highly associated demonstrating a high degree of validity in the pilot. Even in the case of closed questions, considerable explanation was often given and emphasis was always placed upon a clear understanding of the question by the respondent rather than precise replication of the question itself to each respondent. The overall purpose of the questionnaire was to explore respondents’ experience of, and attitudes to, pest infestations. Although the study consisted initially of thirty ‘infested’ and thirty ‘non-infested’ dwellings, these were provisional classifications. The perceived infestation status of each dwelling was established during the interview itself by asking the respondents if they had recently seen cockroaches in their homes.

Tenants were asked how long they had lived at their current address. This was to remove from the study those who had moved in over the last few weeks and whose recent experience of pest infestation did not relate to their current home. Tenants were then asked if they had seen any pest species in their dwelling recently as described above. Responses to this question included descriptions of, among others, cockroaches, mice (Mus domestica), pharaoh ants (Monomorium pharaonis L.) and ghost ants (Tapinoma melanocephalum Fab.). Tenants were then asked to describe the pest species that they had seen and, by careful questioning and non-specific prompting, it was ascertained whether or not the tenants were describing cockroaches and, where possible, if these were Blatta orientalis or Blattella germanica.

In the manner described above, dwellings were classified as ‘infested’ or ‘non-infested’. In several cases those provisionally classified by Southwark Council as infested were found, upon questioning the tenants, to be non-infested and vice versa. It is accepted that there is likely to have been a number of dwellings that were infested but where the tenant was not aware of the infestation. This will not have adversely affected the study reported here as the questions related to tenants experience and perceptions of pest infestations rather than the actual infestation level of their houses.

The tenants were then asked a series of questions relating to their perceptions of cockroach infestation. These questions included their overall view of the seriousness of cockroach infestation, their views of the harmful effects of cockroach infestation, and the seriousness of cockroach infestation as compared to other common housing problems such as ‘dampness’, ‘poor security’, ‘poor repair’ and ‘poor heating’. Respondents were also asked to make a comparison of cockroach infestation and infestation with other pest species. In all comparisons the parameters were explained in terms of a ‘word picture’. The “word picture” consisted of an explanation of the parameters being compared. In the case of cockroach infestation, for example, the frequency and location of cockroach sightings, debris and contamination of food envisaged was described. Respondents were also invited to ask questions to clarify their interpretations of the descriptions given. Thus the “word picture” technique was used so that tenants were able, as far as possible, to compare similar situations in each case. The process was repeated for each parameter for example; the nature and degree of, e.g., ‘dampness’, was described with examples and confirmation was sought that the respondents understood the conditions that were being compared. Respondents were also given the opportunity in all cases to say that the two choices in the question were of equal importance to them. It is considered unlikely that people really did have precisely the same attitude to the various parameters of poor housing conditions that were compared. The opportunity to rate choices as equal, however, meant that those who did not have a definite or strong
opinion were excluded from the data. Finally tenants were asked questions on whom, if anyone, they considered responsible for cockroach infestations and what they thought of the Local Authority pest control service.

In the results, differences between responses were tested for significance using the Chi-squared test. Significance is expressed as probability, (p).

Results

The data presented here form part of a wider study that was undertaken by the first author of this paper. That study examined tenants perceptions of a range of factors and, indeed, included a number of pest species. The data, therefore, are drawn from what are often quite small samples. This has made conventional statistical analysis difficult. Having said this, the method employed is considered to be particularly valid as participants were always offered a ‘don’t know’ or ‘equal ranking’ choice box. Furthermore, participants from dwellings described as ‘non-infested’ were always from the same estates and, therefore, the same types of houses, as tenants from dwellings described as ‘infested’. This ensures that the differences detected do not arise from variations between the estates. This, although improving validity, contributed further to reducing sample sizes for analysis. All statistical analysis and statistical interpretation has been conducted, therefore, using the advice of a consultant statistician (see acknowledgement). Statistical probabilities are given where appropriate. The main results are summarised in Table I.

Tenants perceptions of the importance of cockroach infestations when compared with other adverse housing conditions

In all cases participants were asked to say which they considered worse and to choose between cockroach infestation with another adverse housing condition. ‘Cockroach infestation’ and each of the other adverse housing conditions were described to participants as explained in the methods section earlier.

Table 1. Comparisons of perceived importance of factors in tenants of infested and non-infested houses

<table>
<thead>
<tr>
<th>Comparison factor</th>
<th>Infested (percent)</th>
<th>Non-infested (percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cockroach infestation worse than poor security</td>
<td>48</td>
<td>80</td>
</tr>
<tr>
<td>Cockroach infestation worse than dampness</td>
<td>79</td>
<td>84</td>
</tr>
<tr>
<td>Cockroach infestation worse than poor heating</td>
<td>68</td>
<td>83</td>
</tr>
<tr>
<td>Cockroach infestation worse than poor repair</td>
<td>61</td>
<td>89</td>
</tr>
<tr>
<td>More concerned about physical health risks of</td>
<td>19</td>
<td>56</td>
</tr>
<tr>
<td>Cockroach infestation than nuisance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cockroach infestation worse than mice infestation</td>
<td>25</td>
<td>39</td>
</tr>
</tbody>
</table>

Poor security

48% of respondents in infested dwellings reported considering cockroach infestation to be worse than poor security. In non-infested dwellings 80% of respondents considered cockroach infestation to be worse than poor security. Therefore, a significantly higher proportion of respondents from non-infested dwellings (p=0.042) considered cockroach infestation to be worse than poor security compared to those from infested dwellings.

Dampness

79% of respondents living in infested dwellings reported considering cockroach infestation worse than dampness. 84% of respondents living in non-infested dwellings reported considering cockroach infestation worse than dampness. Therefore a higher proportion of tenants in dwellings, which were not infested with cockroaches reported considering cockroaches worse than dampness, compared to those respondents living in infested dwellings. In this case the responses were not significantly different.

Poor heating

68% percent of respondents living in cockroach infested dwellings reported considering cockroach infestation worse than poor heating. 83% of respondents living in non-infested dwellings reported considering cockroach infestation worse than poor heating. Therefore a higher proportion of respondents in non-infested dwellings reported considering cockroach infestation worse than poor heating compared to those in cockroach-infested dwellings. In this case the responses were not significantly different.

Repair

61% of respondents living in cockroach infested dwellings considered cockroach infestation worse than poor repair. 89% of respondents living in non-infested dwellings considered cockroach infestation to be worse than poor repair. Therefore a higher proportion of respondents living in non-infested dwellings reported cockroach infestation to be
worse than poor repair compared to those living in cockroach infested dwellings. In this case the difference in responses approached significance, p = 0.084.

The above results indicate that those tenants living in cockroach infested dwellings consistently report less aversion to cockroach infestation than other common housing defects compared to those living in dwellings that are not infested. The results also indicated that tenants in both infested and non-infested dwellings consistently rated cockroach infestation as more serious than other common housing defects.

The health effects of cockroach infestation
56% of respondents in non-infested dwellings reported their main concern over cockroach infestation as being related to physical health risks rather than nuisance. Of those in cockroach infested dwellings, however, only 19% were concerned more about physical health risks than about nuisance. The difference in responses was statistically significantly different (p = 0.019).

The above findings demonstrate that those tenants who suffered cockroach infestation reported less concern about physical health risks from cockroach infestation as compared with nuisance than those who lived in uninfested dwellings. It is interesting that when asked specifically about health issues that concerned them about cockroach infestation only 2% mentioned asthma or allergy. This question is returned to in the discussion section.

Cockroach infestation as compared with mice infestation
25% of respondents who lived in cockroach infested dwellings said that they believed cockroach infestation to be worse than mice infestation. 39% of respondents who lived in non-infested dwellings said that they considered cockroach infestation to be worse than mice infestation. In this case the responses were not significantly different.

These findings indicate that those tenants who live in cockroach infested dwellings consider cockroach infestation to be less serious when compared with mouse infestation than those who lived in non-infested dwellings.

The causes of and responsibility for cockroach infestation
Tenants opinions on the causes of and responsibility for cockroach infestation did not differ significantly between infested and non-infested dwellings. 40% of participants blamed unhygienic tenants for cockroach infestations, only 6% blamed the council and the remaining 54% thought that no one in particular could be blamed. Of those tenants who lived in cockroach infested dwellings, 83% rated the pest control service offered by the council as excellent or good.

Discussion
The data presented in this study indicated that when tenants were asked to choose between cockroach infestation and other housing defects; those who lived in cockroach infested dwellings consistently reported a lower perceived importance of cockroach infestation as compared to those tenants who lived in non-infested houses. These findings are consistent with those of Zungoli and Robinson (1984) who found that tenants’ tolerance of cockroach infestation increased with the level of infestation that they suffered. Whereas Zungoli and Robinson were concerned with the variation in cockroach tolerance reported by tenants over time with varying levels of infestation, the study reported here examined cockroach tolerance against other common housing defects in infested and non-infested dwellings. In common with Zungoli and Robinson’s findings, experience of cockroach infestation appeared to increase cockroach tolerance.

It was explained earlier in this paper that in integrated pest management (IPM) programmes for cockroach control, the degree to which people will tolerate cockroach infestations is of paramount importance. This is because it is often not possible in urban situations to completely eradicate the cockroaches. “Injury levels” at which cockroach control measures are implemented must therefore be determined based upon “customers” or “victims” tolerance levels.

Cockroach tolerance may well be influenced by people’s experience of other housing defects. For example, those suffering from severe dampness or very poor perceived security may feel less strongly about cockroach infestations than those living in otherwise good housing conditions. It seems, however, that experience of cockroach infestation itself influences cockroach tolerance by a process of habituation.

It is interesting to note that experience of infestation does not always result in habituation. Smithers and Ramsey (2001) found that people living close to a large poultry unit appeared to become sensitised to fly nuisance and became increasingly concerned about fly species that occur naturally in rural environments.

It was pointed out earlier that the data reported here are the findings of an initial exploratory study into the perceptions of tenants regarding cockroach infestations. Despite the limitations of the study in terms of, for example, sample size, it is believed that the findings are important as they demonstrate the fluid nature of pest tolerance and its dependence upon people’s previous exposure to infestation. These findings will be important in developing and sustaining pest management programmes in the future.
It is also interesting to note that tenants, whether in cockroach infested or in non-infested dwellings, almost always rated cockroach infestation as more serious than other common housing defects. This demonstrates the continued importance of cockroach control. It should also be noted that only 2% of tenants mentioned asthma or allergy when asked specifically about health issues that concerned them about cockroach infestation. Although cockroach asthma and allergy has not been demonstrated in the UK, cockroach allergens have been shown to be the most important contributors to indoor air quality induced asthma in children in the US, (Rosenstreich et al 1997).

Finally it is surprising that, given the difficulty of permanently removing cockroach infestations from housing developments, that so many tenants were satisfied with the pest control service offered by the Council. This is likely to be due to the highly proactive approach to pest control that Southwark Council has taken over recent years. The inclusive and open attitude of the pest control team themselves is also likely to have assisted in this, giving the tenants a sense of ownership in pest control strategies. This finding appears to indicate that customers’ perceptions of the efforts of those attempting control can affect customer satisfaction and, therefore, injury levels.

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