Is the Wellington medical school facility a sick building?

Jesse Gale
Julian Crane
Robert Seibert
Philippa Howden-Chapman
Wellington School of Medicine and Health Sciences
University of Otago

Robyn Phillips
Institute of Technology and Engineering
Massey University

ABSTRACT
The sick building syndrome (SBS) is an occupational health description that indicates a high prevalence of certain symptoms in a building’s occupants. This article describes a pilot study that was undertaken to determine whether Wellington School of Medicine and Health Sciences (WSMHS) facilities suffered SBS. An internationally validated questionnaire was delivered to staff electronically. The response rate was 60%. The prevalence of work-related symptoms was found to be similar to international studies (mean 1.76 symptoms per person, from list of five), with a similar detrimental effect on productivity. As in previous research, gender and job were found to be major contributing factors to SBS symptoms, but no locations within WSMHS were found to be better or worse than others. Environmental causes of SBS may vary widely depending on the occupants than in comparable buildings.

INTRODUCTION
Sick Building Syndrome, indoor air quality, gender, occupation

Keywords Sick Building Syndrome, indoor air quality, gender, occupation

METHODS
The target population were staff and postgraduate students working at least ten hours per week in the two main buildings of WSMHS: Workers who spent less time in WSMHS would introduce confounding effects from other workplaces. The Academic and Link buildings stand adjacent, contain a wide variety of work environments, and are supplied by three sealed mechanical ventilation systems: designated A, B (Academic) and C (Link). Only A and B systems contained humidifiers, and system A recycles 30% of the air returning from office spaces, but the systems had equivalent construction.

The study was approved by the Wellington Regional Ethics Committee, and was supported by the Dean, Professor Nacery.

A questionnaire was developed from that of the SBS advisory group to The Royal Society of Health (RSH) of the United Kingdom. The RSH questionnaire was designed by an international committee to standardize the screening of buildings for SBS and was validated both in terms of reliable prevalence estimates and the detection of clinically accurate symptoms1–3. The questionnaire was piloted on six staff outside of the buildings, and minor comments were incorporated.

The questionnaire contained questions on symptoms, and potentially associated variables (i.e., personal, psychosocial, occupational factors and location). The eight SBS symptoms investigated were: 1) eye, 2) itchy or watery eyes, 3) blocked nose, 4) runny nose, 5) dry throat, 6) headache, 7) lethargy and 8) dry, itchy or irritated skin. Symptoms were only included if they were confirmed as ‘better on days away from WSMHS’ by the respondent. The questionnaire had to have occurred on at least two separate occasions in the preceding 12 months.

RESULTS
From the 193 target e-mail addresses, a total of 141 completed questionnaires were returned (overall 60% response). Only 3% of the respondents were men, and they were significantly older than the women, with higher levels of formal education and more senior academic positions than female respondents. None of the other medical, occupational, psychosocial or environmental factors differed significantly between the genders. For the remainder of the result, there was no information available on non-respondents, so it was not possible to assess responder bias objectively.

Overall, respondents reported an average of 2.45 work-related SBS symptoms (from the list of eight, while the BSI was 176). Only 27% of respondents did not report any of the eight work-related SBS symptoms, and 57% experienced at least two symptoms (which is described as an important level for effects on productivity4).

The BSI for areas of WSMHS are shown in Table 1. The BSI (or BSI R) did not differ significantly between these five ventilation areas, despite the wide range of symptom rates (Kruskal-Wallis, H = 8.97, p = 0.062). Logistic regression could not adjust for gender and job position, because respondents from some locations were entirely female, or of one job type. Alternative models, using broader location zones, found no differences in prevalence after adjustment for gender and occupation. The floor or room type of the occupant were not associated with symptom prevalence either.

Women suffered more symptoms (PSI = 2.09) than men (PSI 1.63), followed by clerical/secretarial (PSI 2.89), research (PSI 3.12), managerial (PSI 3.33) and technical staff, who suffered most (PSI 4.28).

Several other factors were associated with PSI on univariate analysis. An attempt was made to correct for the large number of interacting factors, using sequential logistic regression. The result modeled the odds of suffering each symptom, adjusted for gender: job position, subjective ratings of indoor air quality, air movement, lighting and overall comfort, computer use, photocopying, and history of asthma, rhinitis or conjunctivitis. The adjusted odds ratios (aOR) indicated that for gender were not significantly different to 1.0, with the exception of dry eyes, which women were 7.69 times more likely to suffer after adjusting for other factors, (95% CI 1.80–32.8). Some other symptoms appeared associated with gender (aOR 4.15, 95% CI 0.93–18.6), dry throat (aOR 0.46, 95% CI 0.11–1.87), but the model did not have sufficient power to detect this.

DISCUSSION
Overall, workers in WSMHS facilities suffered an average of 2.45 work-related SBS symptoms each and 77% of respondents reported at least one. This means the WSMHS facilities were not particularly ‘sick buildings’ by international standards, and compared favourably to British building with similar ventilation systems5. The reported symptom rates were generally lower than were found in Palmerston North buildings, or the UK study (except for women suffering dry eyes5). It would seem then, that WSMHS has SBS symptoms at similar, if not healthier, rates to comparable buildings.

A total of 57% of respondents reported at least two work-related symptoms, a similar

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Table 1: The Building Symptom Indexes of Wellington School of Medicine and Health Sciences

<table>
<thead>
<tr>
<th>Building</th>
<th>Ventilation system – area (%</th>
<th>BSI</th>
<th>BSI R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total (141)</td>
<td>2.45</td>
<td>1.76</td>
<td></td>
</tr>
<tr>
<td>Academic (69)</td>
<td>2.29</td>
<td>2.05</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>2.03</td>
<td>1.49</td>
<td></td>
</tr>
<tr>
<td>- Lowery (10)</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Thermal faculty (2)</td>
<td>5.00</td>
<td>3.50</td>
<td></td>
</tr>
<tr>
<td>- All other areas (11)</td>
<td>2.22</td>
<td>1.21</td>
<td></td>
</tr>
<tr>
<td>Link (27)</td>
<td>2.74</td>
<td>1.71</td>
<td></td>
</tr>
</tbody>
</table>

Job position was also associated with PSI (H = 249, p < 0.001). Senior academic staff (of whom 46% were men), suffered four times more symptoms (PSI 1.09) than library staff (PSI 1.63), followed by clerical/secretarial (PSI 2.89), research (PSI 3.12), managerial (PSI 3.33), and technical staff, who suffered most (PSI 4.28).
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ABSTRACT

The sick building syndrome (SBS) is an occupational health description that indicates a high prevalence of certain symptoms in a building's occupants. This article describes a pilot study that was undertaken to determine whether Wellington School of Medicine and Health Sciences (WSMHS) facilities suffered SBS. An internationally validated questionnaire was delivered to staff electronically. The response rate was 60%. The prevalence of work-related symptoms was found to be similar to international studies (mean 1.76 symptoms per person, from list of five), with a similar detrimental effect on productivity. As in previous research, gender and job were found to be major contributing factors to SBS symptoms, but no locations within WSMHS were found to be better or worse than others. Environmental causes of SBS may vary widely between nearby works areas. Detailed, systematic study is required to elucidate environmental causes of SBS in New Zealand.

Keywords

Sick Building Syndrome, Indoor air quality, Gender, Occupation

INTRODUCTION

The term sick building syndrome (SBS) is applied to a building in which certain non-specific symptoms are more common amongst the occupants than in comparable buildings. The symptoms are present when the person is in the affected building and alleviated when the person is away from the building. It is a heterogeneous clinical picture, comprising headache, lethargy, with dryness or irritation of the eyes, nose, throat or skin. The symptoms are common amongst office personnel (over 80% experience one or more), but generally occur with low severity, and in different combinations1. The SBS is defined by prevalence: sick building occupants suffer from an average of more than 2.5 work-related symptoms each (occurring at least twice in 12 months, improving when the person is in the affected building, and alleviated when the person is away from the building). The eight SBS symptoms investigated were (1) dry eyes, (2) itchy or watery eyes, (3) blocked nose, (4) runny nose, (5) dry throat, (6) headache, (7) lethargy and (8) dry, itchy or irritated skin.

METHODS

The target population were staff and postgraduate students working at least ten hours per week in the two main buildings of WSMHS. Workers who spent less time in WSMHS would introduce confounding effects into the data, and the WSMHS buildings are typical of those that suffer SBS, and it has been estimated that over 90% of the target population were included in this e-mail list. The questionnaire was delivered to 252 valid e-mail addresses, and non-responders received a reminder at seven days and hard copies at three weeks. Fifty-nine recipients did not spend more than ten hours per week in the two buildings (and were excluded), creating an accessible population of 193 addresses. The PSI is designed by an international committee to quantify the sick building risk (SBR) in a building. It was estimated that over 90% of the target population were included in this e-mail list. The questionnaire was delivered as a Microsoft Word attachment to all WSMHS e-mail addresses (anonymised with previous successes)2. An e-mail is a fast and cost-effective survey method, but can introduce new difficulties (e.g. subject identification and redundant addresses)3,4. It was estimated that over 90% of the target population were included in this e-mail list.

RESULTS

From the 193 target e-mail addresses, a total of 146 completed questionnaires were returned (overall 60% response). Only 3% of the respondents were men, and they were significantly older than the women, with higher levels of formal education and more senior academic positions than female respondents. Of the eight SBS symptoms, occupational, psychological or environmental factors differed significantly between the genders. Symptoms were only included if they were confirmed as ‘better on days away from work’ by respondents. A total of 29 respondents reported at least two work-related symptoms, a similar proportion to comparable buildings.

DISCUSSION

Overall, respondents reported an average of 2.45 work-related SBS symptoms (from the list of eight, while the PSI was 1.76). Only 27% of respondents did not report any work-related SBS symptoms, and 57% reported at least two symptoms (which is described as an important level for effects on productivity). The PSI for areas of WSMHS are shown in Table 1. The PSI (or BSI) did not differ significantly between these five ventilation areas, despite the wide range of symptom rates (Kruskal-Wallis, H$_{4}$ = 8.97, p = 0.062). Logistic regression could not adjust for gender and job position, because respondents from some locations were entirely female, or of one job type. Alternative models, using broader location zones, found no differences in prevalence after adjustment for gender and occupation. The floor or room type of the occupant were not associated with symptom prevalence either.

Women suffered more symptoms (PSI = 2.91, BSI = 2.09) than men (PSI = 1.35, BSI = 1.00), as tested by the Wilcoxon Two-Sample Test (PSI; t$_{20}$ = 3.125, p < 0.001). Unadjusted odds ratios (aOR) indicated that women or nurses suffered significantly more lethargy (3.35, 95% CI 1.4–8.1), blocked nose (3.29, 95% CI 1.2–8.9), dry eyes (8.57, 95% CI 2.4–30.5) and irritated skin (4.47, 95% CI 1.1–14.9).

Job position was also associated with PSI$_{H}$ (H$_{4}$ = 249, p < 0.0001). Senior academic staff suffered significantly more symptoms (PSI = 1.09) than library staff (PSI = 1.63), followed by clerical/secretarial (PSI = 2.89), research (PSI = 3.12), managerial (PSI = 3.33), and technical staff, who suffered most (PSI = 4.28). Several other factors were associated with PSI$_{H}$ on univariate analysis. An attempt was made to correct for the large number of interacting factors, using sequential logistic regression. The result modelled the odds of suffering each symptom, adjusted for gender: job position, smoking status, location of indoor air quality, air movement, lighting and overall comfort, computer use, photocopier, and history of asthma, rhinitis or conjunctivitis. The adjusted odds ratios (aOR; which for gender were not significantly different to 1.0, with the exception of dry eyes, which women were 7.69 times more likely to suffer after adjusting for other factors, 95% CI 1.80–32.8). Some other symptoms appeared associated with gender (e.g. lethargy aOR = 4.15, 95% CI 0.93–18.6; dry throat aOR = 0.46, 95% CI 0.11–1.87) but the model did not have sufficient power to detect this.

A total of 57% of respondents reported at least two work-related symptoms, a similar...
A possible source of selection bias in this study was the e-mail delivery method, which excluded workers without e-mail. These workers would have different work characteristics (and thus may suffer more or fewer SBS symptoms), but it was not possible to assess these differences accurately. The e-mail method also targeted redundant addresses, and introduced avoidable problems of subject identification and localization. All of these problems could be corrected in future studies by defining the accessible population with human resources data, and then identifying their e-mail addresses if available. The modest response rate of 53% makes selection bias a greater possibility, and is another limitation of this study. However, the methods used in this study have been shown to have validity and reliability in previous international research.

Within WSMHS, no areas were found to have significantly worse SBS symptoms than others, despite a wide range of values (BSI scores). Within WSMHS, no areas were found to have significantly worse SBS symptoms than others, despite a wide range of values (BSI scores). Within WSMHS, no areas were found to have significantly worse SBS symptoms than others, despite a wide range of values (BSI scores). Within WSMHS, no areas were found to have significantly worse SBS symptoms than others, despite a wide range of values (BSI scores). Within WSMHS, no areas were found to have significantly worse SBS symptoms than others, despite a wide range of values (BSI scores). Within WSMHS, no areas were found to have significantly worse SBS symptoms than others, despite a wide range of values (BSI scores). Within WSMHS, no areas were found to have significantly worse SBS symptoms than others, despite a wide range of values (BSI scores). Within WSMHS, no areas were found to have significantly worse SBS symptoms than others, despite a wide range of values (BSI scores). Within WSMHS, no areas were found to have significantly worse SBS symptoms than others, despite a wide range of values (BSI scores). Within WSMHS, no areas were found to have significantly worse SBS symptoms than others, despite a wide range of values (BSI scores). Within WSMHS, no areas were found to have significantly worse SBS symptoms than others, despite a wide range of values (BSI scores). Within WSMHS, no areas were found to have significantly worse SBS symptoms than others, despite a wide range of values (BSI scores). Within WSMHS, no areas were found to have significantly worse SBS symptoms than others, despite a wide range of values (BSI scores). Within WSMHS, no areas were found to have significantly worse SBS symptoms than others, despite a wide range of values (BSI scores). Within WSMHS, no areas were found to have significantly worse SBS symptoms than others, despite a wide range of values (BSI scores). Within WSMHS, no areas were found to have significantly worse SBS symptoms than others, despite a wide range of values (BSI scores). Within WSMHS, no areas were found to have significantly worse SBS symptoms than others, despite a wide range of values (BSI scores).

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In summary, SBS symptom rates in WSMHS facilities were found to be comparable to office buildings studied in Britain and New Zealand. In buildings where SBS is suspected, detailed investigation is required to provide evidence from which building management decisions can be made.

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REFERENCES