The Impact of Sick Building Syndrome on Call Centre Agents' Effectiveness

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Abstract: This study assessed the impact of Sick Building Syndrome (layout, ergonomic design of workstation, lighting/ventilation, health and performance, noise and aesthetics) on the effectiveness of Call Centre agents in managing customers and their needs. The study was undertaken in Durban, South Africa, and was conducted within a Public Sector service environment, which comprised of four major call centers employing 240 call centre agents. A sample of 151 call centre agents was drawn across using a simple random sampling technique and a 63% response rate was achieved. These call centre agents were responsible for inbound calls only. Data was collected using a self-developed, precoded questionnaire whose validity and reliability were statistically determined using Factor Analysis and Cronbach's Coefficient Alpha respectively. Data was analyzed using descriptive and inferential statistics. The results indicate that the dimensions of Sick building Syndrome have the potential to impact on agents' performance. Based on the results of the study a graphical representation has been designed and presents recommendations that, when implemented in call centre environments, have the potential to enhance agents' effectiveness in managing customers and their needs.

Key words: *Sick building syndrome, ergonomic design of workstation, lighting, noise, health, performance*

1. Introduction

The term sick building syndrome (SBS) is applied to conditions where a combination of factors such as chemicals, smoke, fumes and other components of building materials create poor indoor air quality causing various health complaints (Ilozor, Treloar, Olomolaiye & Okoroh, 2001). Indoor air quality is influenced by over 900 different organic compounds. SBS can occur in all offices to varying degrees but it has the most notable impact in open-plan type offices where the majority of employees are most likely to be working (Ilozor *et al.*, 2001). Typically, the majority of customer call centers operate out of open-plan offices making them very susceptible to this phenomenon. Since the call centre is the hub of many business enterprises, this study aims to evaluate the impact of the layout, ergonomic design of workstation, lighting/ventilation, noise and aesthetics on the health and effectiveness of agents in managing customers and their needs.

Components of Sick Building Syndrome: Sick buildings have been blamed for an inadequate supply of outside air, chemicals and other pollutants and microorganisms in humidifiers. Other factors that have been implicated include noise, artificial lighting, static electricity, ions, electromagnetic fields and psychological effects (Thomas-Mobley, Roper & Oberle, 2005). Ilozor *et al.* (2001) found that volatile organic compounds (VOC's), synthetic compounds, biological bacteria, fungi, molds and viruses are readily found in emissions from office equipment, building materials, dust, cigarettes and office supplies such as solvents, glues and cleaning agents for interior workspaces. Many large offices are air-conditioned but these installations rarely work well making it either too hot or too cold. There is often a draught making the air too dry, so windows have to then be opened to allow people to breathe properly (Yu, Hu, Liu, Yang, Kong & Liu, 2009). Another problem is that artificial light has to be used all the time, which is regarded as unhealthy as people often find it too bright and glaring and complain about headaches or eye strains (Yao, Zhang, Hand & Perram, 2009).

Symptoms of Sick Building Syndrome: The many symptoms of SBS include tired or strained eyes (Aerias Air Quality Sciences, 2010), unusual tiredness (Pitt, 2008; Rooley, 1995), fatigue or drowsiness (National Safety Council, 2010), headaches (Boykin & Sauer, 1996; Muzi, Abbritti, Accattoli & dell' Omo, 1997), tension (Yu *et al.*, 2009), irritability or nervousness (US Environmental Protection Agency, 2012), sinus congestion (Bachmann, Turck & Myers, 1995), chest tightness (Aerias Air Quality Sciences, 2010; Muzi *et al.*, 1997),

wheezing (Global Healing Centre, 2012), skin dryness (Bachmann *et al.*, 1995; Muzi *et al.*, 1997) and gastrointestinal complaints (Pitt, 2008). These symptoms were summarized by the World Health Organization (WHO) in its June 1982 report (Brown, 2004; Boykin & Sauer, 1996; Fernberg, 1989; Ilozor *et al.*, 2001; Rooley, 1995). SBS occurs in a workspace where a significant number of occupants complain of sickness and/or discomfort. These symptoms vanish or diminish when they leave the workspace. In order to enhance employee comfort, Magyar (1999) suggests that management needs to address the following questions:

- Is the work area too hot or cold?
- Does the temperature adversely affect job performance and behavior?
- Is noise a factor?
- Does it affect communication or cause confusion?
- Is light sufficient?
- Is secondary lighting needed in order to satisfactorily perform work?
- Is air movement or exchange sufficient (US Environmental Protection Agency, 2012)?
- Is an adequate volume of outside make-up air provided?
- Is humidity controlled (Global Healing Centre, 2012)?
- Is workflow coordinated or does it cause frustration?
- Is the work area congested?
- Do physical obstacles hinder job performance?

Besides employee health and safety being jeopardized by noise and crowding in open-plan offices (Carnevale, 1992; Fernberg, 1989; Holman, 2003; Muzi *et al.*, 1997; Yao *et al.*, 2009), SBS affects productivity and people's morale. Associated office complaints cause annoyance and stress which can affect the efficiency and absenteeism of staff (Bachmann & Myers, 1995; Boykin & Sauer, 1996; Saunders, 1993; Muzi *et al.*, 1997). In his study, Leaman (1992) noted that due to workplace layouts of open-plan offices being large, they require more services to temper and cool the air and artificially light the spaces away from windows. He also noted that if offices are not properly managed through ignorance, lack of funds or due to neglect then they can become unpleasant for occupants.

Regulations to control SBS: In South Africa, a number of Regulations are applicable to control SBS and its impact on employee performance. Rooley (1997) highlighted the following three main regulations:

A. Health and Safety (Display Screen Equipment) Regulation 1992. This was meant to protect staff that use computers as a significant part of their work. It is aimed at preventing damage to upper limbs, eyestrain, fatigue and stress. Employers must provide the right equipment and environment and must:

- Assess and reduce the risks;
- Ensure workstations meet minimum requirements;
- Plan work to include breaks or changes of activity,
- Arrange eye tests and provide glasses;
- Inform and train users.

B. Workplace (Health, Safety and Welfare) Regulation 1992. This provides clear regulations on the working environment an employer should ensure such as good lighting and clean toilets. Employers must be responsible for:

- Good working environment, including temperature, ventilation and lighting;
- Safety of the environment including safe openings and glass in windows, unobstructed passageways;
- Maintenance and cleanliness of the workplace;
- Facilities such as eating areas and toilets.

C. Provision and use of Work Equipment Regulations 1992. The regulation aims to give employers responsibility for the safe use of equipment. Employers must:

- Take into account the working conditions and risks in selecting equipment;
- Make sure equipment is suitable for use;

- Provide appropriate lighting, warning and markings for using equipment;
- Provide adequate information and training;
- Provide protection from dangerous parts of machinery.

This study aims to assess the impact of Sick Building Syndrome (layout, ergonomic design of workstation, lighting/ventilation, noise and aesthetics, health and performance) on the effectiveness of Call Centre agents in managing customers and their needs.

2. Literature Review

Layout: Call centre environments usually have an open-plan office setting, rather than individual offices, where multiple employees work together in the same space. A critical factor in open-plan space is office layout as it has implications for the business in terms of cost, communication, the working environment and employee privacy. Research indicates that open-plan offices do have positive effects in terms of increased employee communication and interaction, flexibility, ability to house more employees and reduced set-up and renovation times (Brennan, Chugh & Kline, 2002; O'Neill, 2008; Maher and von Hippel, 2005) as well as encouraging collaboration through teamwork. However, open-plan offices also have negative consequences such as increased noise (Treasure, 2011), distractions (Treasure, 2011), perceived crowding and decreased privacy (Brennan *et al.*, 2002; O'Neill, 2008; Maher and von Hippel, 2005) and such layout is not considered to be energy efficient as it can generate extra utility costs in terms of heating and lighting. All Business Consulting (2010) emphasized the role of spatial arrangement and emphasizes that there must be a balance between private offices and open plans. Naturally quiet spaces are needed for those engaging in critical thinking that requires immense concentration. They also found that productivity levels were also much higher when people worked in isolation as opposed to within an open plan office setup (All Business Consulting, 2010). However, output will also be influenced by other aspects of workplace layout such as the position of, and accessibility to, laser copiers and printers. If photocopiers are badly positioned, poorly maintained and used frequently or for long runs, there are risks to the health of office workers because of chemicals associated with the use of this equipment such as ozone, volatile organic compounds and toner. Al-Anzi (2009) notes that office design or layout must take cognisance of furniture, noise, flexibility, comfort, communication, lighting, temperature and air quality.

Ergonomic design of workstation: Over the last four decades, the ergonomics of office-to-employee fit, that is, the science of designing the workplace to suit the worker has gradually evolved. Improving the quality of office environments through user-centered design can provide enormous health, social and economic benefits. Carefully designed offices take cognizance of including comfortable features such as large windows, control systems, temperature, relaxing break areas, desks that are specifically designed to encourage interaction between team members and chairs that are designed to suit the contour of the body and adhere to the guidelines of correct posture. However, in open-plan offices the rationale has been more about economics than ergonomics (Brand, 2008). Bachmann and Myers (1995), Joshi (2008) and Muzi *et al.* (1997) found that poor ergonomics is often seen to be associated with SBS. Likewise, the City of Cape Town (2012) recommends that to reduce SBS, buildings should take cognizance of ergonomic design. In this regard, Maher and von Hippel (2005) emphasized the importance of individual differences and salient job characteristics, as well as the discrepancy between visual-symbolic nature of partial enclosures (cubicles) and their actual effectiveness as acoustic barriers.

Lighting/ventilation: Bachmann and Myers (1995), Joshi (2008) and Muzi *et al.* (1997) found that inappropriate lighting with the absence of sunlight and humidity are often seen to be associated with SBS. All Business Consulting (2010) reported that productivity differences between comfortable and uncomfortable staff are as high as twenty-five percent so controlling variables such as air quality; lighting and temperature can increase productivity. According to Aerias Air Quality Sciences (2010), Joshi (2008) and National Safety Council (2010), there needs to be an increase in ventilation rates and air distribution. The heating, ventilation and air-conditioning systems (HVAC) should be designed to meet ventilation standards in the local building codes. The HVAC system should be operated and maintained to ensure that proper ventilation rates are maintained especially in areas where strong pollutants can accumulate such as restrooms, copy rooms and

printing facilities. In addition, the removal of pollutant sources can be carried out by routine maintenance of HVAC systems, replacing water stained ceiling tiles and carpets, using stone, ceramic or hardwood flooring, proper water proofing, avoiding synthetic or treated upholstery fabrics, minimizing the use of electronic equipment and unplugging idle devices, venting contaminants to the outside, storing paints, solvents and adhesives in closed containers in well ventilated areas and using these pollutant sources in periods of lower or no occupancy (City of Cape Town, 2012; Global Healing Centre, 2012; Joshi, 2008; Rostron, 2008; Yu *et al.*, 2009). Air cleaning can also be useful to control air pollution by ensuring uncongested interiors with open-plan office designs, using frosted glasses and skylights to allow access to natural light, and terrace gardens, community spaces and indoor plants absorb carbon monoxide and formaldehyde in the air (Global Healing Centre, 2012; Joshi, 2008; Matthes, 1992). Education and communication are also critical to air quality management programs to work effectively and efficiently to prevent and solve health problems. The banning of smoking in the workplace or restricting smoking to designated well-ventilated areas can also help reduce SBS (Edwards & Edwards, 1991; Joshi, 2008; Matthes, 1992). Industrial cleaning by a specialized service provider involving trained staff with specialist equipment and detergents also help to reduce the symptoms of SBS (Boykin & Sauer, 1996; Matthes, 1992). The City of Cape Town (2012) recommends that to reduce SBS, buildings should utilize natural ventilation, natural light, good acoustics and ergonomics.

The Occupational Health and Safety Resource Centre at Canada's University of Western Ontario have devised a routine 5-point survey for occupational hygienists to follow when investigating air quality complaints (Joshi, 2008). The features include the following:

- A walk through inspection to look for sources of contamination such as photocopiers, insulation and cleaning materials.
- A measurement of temperature, humidity, air movement and other comfort parameters.
- A measurement of carbon dioxide to assess the ventilation efficiency.
- Measurement of formaldehyde, carbon monoxide, ozone and respirable particles.
- An examination of ventilation systems for causes of poor distribution.

Noise and aesthetics: According to Rostron (2008), noise transmission and speech privacy is complex. Traffic or external noise is not usually a problem in air-conditioned buildings with sealed windows but in older buildings that rely on opening windows for ventilation, noise can be serious. Low noise emission is acceptable and may even be useful to dampen the general noise level in open planned offices; however, when noise levels are intrusive a suitable contaminant or hearing protection partition can be used to drown out noise from office equipment (Joshi, 2008; Passarelli, 2009; Rostron, 2008). Research by Langston, Song and Purdey (2008) and All Business Consulting (2010) found that office noise is a potential obstacle to job satisfaction as it contributes to dissatisfaction within the physical environment and may filter through to the job. Significant correlates were also noted between noise and disruption in concentration (Banbury & Berry, 2005) and noise and stress (Evans & Johnson, 2000; Leather, Beale & Sullivan, 2003; Wallenius, 2004).

Health and performance: Originally, open-plan offices and cubicles were invented by architects and designers to break down the social walls that divide people; however, research is increasingly finding that open plans cause conflict, high blood pressure and increased staff turnover (Musser, 2009) as well increase the chances of getting ill, feeling stressed and becoming aggressive. In offices with a high density of occupancy, airborne diseases spread rapidly among workers, which can be fueled by air-conditioners that recirculate pathogens and spread them throughout the building. In their study associated with SBS and musculoskeletal pain in an African office environment, Bachmann *et al.* (1995) found that the effects of indoor quality air on SBS symptoms may not be as severe in an African climate where less heating and humidification of air is needed compared to European conditions. Furthermore, gadgets as if the microwave, television and computers emit electromagnetic radiation, which ionizes the air, can cause cancer (Bachmann and Myers, 1995; Joshi, 2008; Muzi *et al.*, 1997). The problem is aggravated if the open-plan office has elements of a sick building. Rooley (1997), Global Healing Centre (2012) and US Environmental Protection Agency (2012) identified a few indoor pollutants that could adversely affect performance. These include the presence of formaldehyde, which is a colorless gas and can be found in particleboards, adhesives and some textiles. In addition, allergens also present sensitivity and exposure can result in asthma, rhinitis and dermatitis or eczema. Examples of allergens include house dust mites, moulds and animal proteins (Brown, 2004). Another

major factor affecting comfort is perceived odour, which can cause irritation of the mucous membranes. New products emit volatile organic compounds (VOC's) during the first months or years of installation and steps need to be taken to "cure" these products (Passarelli, 2009; Rooley, 1995; Rooley, 1997). Environmental tobacco smoke is the most obvious indoor pollutant. It is difficult to control by dilution with outdoor air if smokers and non-smokers are in close proximity. In addition, Joshi (2008), Global Healing Centre (2012) and US Environmental Protection Agency (2012) also identified contaminants from outside like pollutants from motor vehicle exhausts, plumbing vents and building exhausts (bathrooms and kitchens) that can enter the building through poorly located air vents, windows and other openings.

Other common components of VOC's are adhesives, upholstery, carpentry, copy machines, manufactured wood products, pesticides and cleaning agents (Fernberg, 1989; Yao *et al.*, 2009; Muzi *et al.*, 1997). Joshi (2008) also identified biological contaminants such as pollen, bacteria, viruses, and fungus, which breed in stagnant water that collects in ducts or on ceiling tiles, insulation, carpets and upholstery. VOC's can cause damage to the human body in a variety of ways ranging from headaches and fatigue to shortness of breath when exposed to significant levels (Passarelli, 2009; Yao *et al.*, 2009; Yu *et al.*, 2009). Insect and bird droppings are another source of biological contamination, which can cause fever, chills, tight chest and muscle aches in people (Boykin & Sauer, 1996). In a South African study by Heslop (2003), there was evidence that the more prevalent the symptoms of SBS in a building, the greater the corresponding reduction in productivity. Modern buildings tend to be less comfortable than traditional buildings and one can measure the cost/benefit by analyzing the sick leave and absenteeism ratios (Muzi *et al.*, 1997). Pejtersen, Feveile, Christensen and Burr (2011) found that employees sharing an office and employees in open-plan offices (> 6 occupants) had significantly more days of sickness absence than those in cellular offices. Although SBS does not cause serious damage to health it does have the potential to cause problematic situations for organizations faced with it. SBS can cause severe loss in productivity levels, a high level of absenteeism due to illness and can be de-motivating for staff experiencing it. If the unhealthy environment persists then staff is often compelled to leave work seeking attractive employment elsewhere thereby contributing to increased staff turnover. Aside from the symptoms presented by physical and chemical components (Bachmann & Myers, 1995; Fernberg, 1989; Heslop, 2003; Langston *et al.* (2008); Muzi *et al.*, 1997; Rooley, 1997), there is evidence that job stress and dissatisfaction can also exacerbate SBS if management fails to take cognizance of this in the workplace (Holman, 2003; Rostron, 2008; All Business Consulting, 2010).

2. Methodology

Respondents: The population comprised of all call centre agents employed by this Public Service organization within its four-call centre's in the Durban area. The population size is estimated at 239 call centre agents. Using Sekaran's (2003) population-to-sample size table, a corresponding sample of 148 was needed. The study however utilized a sample of 151 agents, thereby confirming the adequacy and appropriateness of the sample. In this research, a probability sampling technique known as cluster sampling was chosen. According to Sekaran (2003), groups or chunks of elements that have heterogeneity among members within each group are chosen for study in cluster sampling. The adequacy of the sample was determined using the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (0.880) and the Barlett's Test of Sphericity (1765.538, $p = 0.000$) for factors impacting on Infrastructure/Sick Building Syndrome, which respectively indicated suitability and significance. The results indicate that the normality and homoscedasticity preconditions are satisfied. In terms of the composition of the sample, there were more females (57%) than males (43%). The majority of the sample were between 20-29 years (67.5%), followed by 30-39 years (20.5%) and then 40-49 years (10.6%), thereby indicating that the sample is predominantly young, which is typical of employment in a call centre environment. Black agents constituted the majority (55.6%), followed by Indian (25.2%), Colored (15.9%) and then White (3.3%) employees. The majority of the agents were in service for 1-3 years (51.7%) with more or less an equal distribution of years of service in the other categories (1-11 months, 4-6 years and 7 years and over). The majority of the agents have a high school qualification (56.3%) followed by those with a diploma (36.4%), whilst only 7.3% has a degree. More agents are employed on a full-time (66.2%) as opposed to a part-time basis (33.8%). In terms of call variables, the majority of agents take an average of 100-109 calls a day (21.2%), followed by 70-79 calls a day (19.9%), have a waiting time (length of time a customer waits on the line before his/her call is answered by an agent)

of 0-5 minutes (55.6%), have an abandonment rate (number of callers that eventually disconnect) of 0-5% (86.1%), secure a talk time (duration of call) of 0-5 minutes (84.2%), a wrap-up time of 0-5 minutes (98.7%) and report a queue time of 0-5 minutes (96.7%).

Measuring Instrument: Data was collected using a self-developed, pre-coded, self-administered questionnaire consisting of two sections. Section A dealt purely with the biographical (gender, age, race, tenure, education and employment status) and operational data of call centre agents. Section B related to the sub-dimension of Infrastructure/Sick Building Syndrome and tapped agent's perceptions of layout of office, ergonomic design of workstations, lighting/ventilation, health and performance and noise on their level of overall performance within the call centre. Whilst Section A was nominally scaled with precoded option categories, Section B required respondents to rate each item using the Likert Scale ranging from strongly disagree (1) to strongly agree (5). The questionnaire was formulated based on identifying recurring themes that surfaced while conducting the literature review. These ensured face and content validity. Furthermore, in-house pretesting was adopted to assess the suitability of the instrument. Pilot testing was also carried out on twenty call centre agents to test the appropriateness of questions and their understanding. No inadequacies were reported and the final questionnaire was considered appropriate in terms of relevance and construction.

Research procedure: The research was only conducted after ethical clearance was obtained for the study and upon completion of the pilot study.

Measures/statistical analysis of the questionnaire: The validity of the questionnaire was assessed using Factor Analysis. A principal component analysis was used to extract initial factors and an iterated principle factor analysis was performed using SPSS with an Orthogonal Varimax Rotation. In terms of the validity, 5 factors affecting Infrastructure/Sick Building Syndrome with latent roots greater than unity were identified (4.202, 3.576, 3.269, 2.070, and 1.807). The items were also reflected as having a very high level of internal consistency and reliability, with the Cronbach's Coefficient Alpha being 0.916 with item reliabilities ranging from 0.910 to 0.919.

Administration of the measuring instrument: The survey was confined to the call centre agents employed within the four-call centers in Durban, South Africa. The questionnaire was personally administered to a sample of call centre agents in Durban, South Africa. The agents were required to completely answer Sections A to E of the questionnaire and then physically submit their questionnaires (in a sealed envelope to ensure confidentiality) to their respective team leaders who are designated to receive their responses. Informed consent was obtained by an authorization letter that accompanied the questionnaire. All participation was voluntary.

Statistical analysis of the data: Descriptive statistics (mean, variance, standard deviation) and inferential statistics (correlation, t-test, ANOVA, Post hoc Scheffe's test and multiple regressions) were used to evaluate the objectives and hypothesis of the study.

4. Results

Descriptive Statistics: Agent's perception of the quality of their work environment was evaluated using a 1-5 point Likert scale. The higher the mean score value, the more satisfied agents are with the specific aspect of the work environment (Table 1).

Table 1: Descriptive statistics - Sub-dimensions of Infrastructure/Sick building syndrome

Sub-dimension	Mean	Std Deviation	Minimum	Maximum
Layout	3.426	0.6818	1.25	5.00
Ergonomic design	3.233	0.8167	1.00	5.00
Lighting and ventilation	3.196	0.7793	1.00	5.00
Health and performance	3.317	0.7658	1.60	5.00
Noise and aesthetics	2.880	0.7756	1.00	5.00
Overall score	3.210	0.6464	1.53	5.00

Table 1 indicates that agents' perceptions of their work environment vary which in decreasing level of satisfaction in terms of having a positive influence on call centre effectiveness are:-

- Layout (Mean = 3.426)
- Health and performance (Mean = 3.317)
- Ergonomic design (Mean = 3.233)
- Lighting and ventilation (Mean = 3.196)
- Noise and aesthetics (Mean = 2.880)

The overall score indicates only a moderate level of perceived positive influence (Mean = 3.210) within the work environment. Against the maximum attainable score of 5, it is evident that there is room for improvement in terms of all of the sub-dimensions of infrastructure/sick building syndrome with the greatest amount of attention needed in terms of noise and aesthetics. In order to assess the areas for improvement, frequency analyses were conducted for each of the sub-dimensions. In terms of layout, 14.6% of the agents disagreed and a further 9.9% strongly disagreed with the statement that although laser copiers and printers are placed away from individuals, they are not inconvenient for them to access. Apart from the inconvenience of access, this finding suggests that emissions from the copiers and printers are prevalent and hence, layout and style of the office has the potential to impact on employee health and performance. Furthermore, 17.9% of the agents disagreed and a further 5.3% strongly disagreed that the layout of the office allows them to perform their job well. In terms of ergonomic design, 23.2% of agents disagreed and a further 23.2% strongly disagreed that their office chair is comfortable and easily adjustable. In addition, 21.9% of agents disagreed and a further 7.9% strongly disagreed that their workstation equipment allows them to perform their job easily. In terms of lighting and ventilation, 22.5% of agents disagreed and a further 21.2% strongly disagreed that the temperature is constantly suitable in the office (does not get too hot or cold). Additionally, 19.2% of agents disagreed and 13.9% strongly disagreed that the bright lights allow them to work well. Finally, 19.9% of agents disagreed and a further 9.3% strongly disagreed that they are always surrounded by a fresh supply of air. In terms of health and performance, 16.6% of agents disagreed, 13.9% strongly disagreed those conditions in their work environment such as bright computer screens, and bright lighting does not cause headaches and eyestrains nor hinders their performance. The implication is that agents believe that brightness and glare in their work environment contributes to physiological problems such as headaches and eyestrains and consequently, affects their performance. Furthermore, 18.5% of agents disagreed and a further 8.6% strongly disagreed that they are pleased with the general cleanliness of the office space. In terms of the final sub-dimension of noise and aesthetics, 25.2% of agents disagreed and a further 16.6% strongly disagreed that the décor of the workstation is aesthetically pleasing to produce a functional environment. Furthermore, 23.8% of agents disagreed and a further 30.5% strongly disagreed that the cafeteria contributes to a relaxed environment.

Inferential statistics

Hypothesis 1: There exists significant intercorrelations amongst the sub dimensions of infrastructure/sick building syndrome (layout, ergonomic design, lighting and ventilation, health and performance, noise and aesthetics) respectively.

Influence of Biographical data: The influence of the biographical variables (age, race, tenure, and gender and employment status) on agents' perceptions of infrastructure/sick building syndrome was assessed using ANOVA and t-tests (Table 3 - Table 9).

Hypothesis 2: Agents varying in biographical profiles (age, race, tenure, and gender and employment status) significantly differ in their perceptions of the sub-dimensions of infrastructure/sick building syndrome respectively.

Table 2: Pearson Correlation (r): Intercorrelations of the sub-dimensions of Infrastructure/Sick building syndrome (N = 151)

Sub-dimension	r/p	Layout	Ergonomic design	Lighting and ventilation	Health and performance	Noise and aesthetics
Layout	R	1				
Ergonomic design	r	0.662	1			
	p	0.000**				
Lighting & ventilation	r	0.630	0.674	1		
	p	0.000**	0.000**			
Health & performance	r	0.581	0.673	0.722	1	
	p	0.000**	0.000**	0.000**		
Noise and aesthetics	r	0.552	0.604	0.672	0.659	1
	p	0.000**	0.000**	0.000**	0.000**	

** P < 0.01

Table 2 indicates that the sub-dimensions of infrastructure/sick building syndrome significantly intercorrelate with each other at the 1% level of significance. Therefore, hypothesis 1 may be accepted.

Table 3: ANOVA: Age and sub-dimensions of Infrastructure/Sick Building Syndrome

Sub-dimension	N	Mean	Std Deviation	F	p
Layout	151	3.426	0.68178	0.670	0.513
Ergonomic design	151	3.233	0.81696	0.457	0.634
Lighting and Ventilation	151	3.196	0.77926	1.135	0.324
Health and performance					
20-29	102	3.365	0.74057		
30-39	31	3.407	0.81073		
40+	18	2.889	0.72994		
Total	151	3.317	0.76572	3.323	0.039*
Noise and aesthetics	151	2.881	0.77558	1.320	0.270

* P < 0.05

Table 3 indicates that agents varying in age differ significantly in their perception of the influence of infrastructure/sick building syndrome on their health and performance in executing their jobs at the 5% level of significance. However, age does not influence agents' perceptions of the other dimensions of infrastructure/sick building syndrome. Hence, hypothesis 2 may only be partially accepted in terms of age. In order to assess exactly where the difference lies in terms of age, health, and performance, mean analyses were conducted. Table 3 indicates that employees who are between the ages of 30–39 years (Mean = 3.407) are more convinced than those who are 40 years and over (Mean = 2.889) that infrastructure/sick building syndrome influences their health and performance.

Table 4: ANOVA: Race and the sub-dimensions of Infrastructure/Sick Building Syndrome

Sub-dimension	N	Mean	Std Deviation	F	p
Layout	151	3.426	0.68178	0.734	0.533
Ergonomic design	151	3.233	0.81696	1.759	0.158
Lighting and Ventilation					
Black	84	3.085	0.81573		
White	5	3.286	0.58029		
Indian	38	3.169	0.76741		
Colored	24	3.607	0.57337		
Total	151	3.196	0.77926	2.942	0.035*
Health and performance	151	3.317	0.76572	1.582	0.196
Noise and aesthetics	151	2.881	0.77558	1.449	0.231

* P < 0.05

Table 4 indicates that agents varying in race differ significantly in their perceptions of lighting and ventilation in the work environment at the 5% level of significance. However, race does not influence the agents' perceptions of the other sub-dimensions of infrastructure/sick building syndrome. Hence, hypothesis 2 may be partially accepted in terms of race. In order to assess exactly where the difference lies in terms of race and lighting and ventilation the Post hoc Scheffe's test was conducted (Table 5).

Table 5: Post hoc Scheffe's test: Race and Lighting and Ventilation

Lighting and Ventilation		Mean	Std. Error		p	95% Confidence Interval	
(I) Race	(J) Race	Mean Difference (I-J)				Lower Bound	Upper Bound
Black	White	3.286	-0.20068	0.35195	0.955	-1.1960	0.7947
	Indian	3.169	-0.08414	0.14947	0.957	-0.5069	0.3386
	Colored	3.607	-0.52211*	0.17696	0.037	-1.0226	-0.0216

Table 5 indicates that Coloured agents (Mean = 3.607) have a stronger opinion that lighting and ventilation creates a suitable work environment and reduces the occurrence of infrastructure/sick building syndrome than their Black counterpart agents (Mean = 3.085). This finding reflects that Coloured agents believe more strongly than Black agents do that the work environment is well lit, well ventilated, has suitable temperatures and a fresh supply of air.

Table 6: ANOVA: Tenure and sub-dimensions of Infrastructure/Sick Building Syndrome

Sub-dimension	N	Mean	Std Deviation	F	p
Layout	151	3.426	0.68178	2.202	0.090
Ergonomic design	151	3.233	0.81696	2.402	0.070
Lighting and Ventilation	151	3.196	0.77926	2.336	0.076
Health and performance					
1 month - 11 months	23	3.583	0.73833		
1 - 3 years	78	3.400	0.75730		
4 - 6 years	25	3.336	0.71815		
7 years and over	25	2.792	0.65696		
Total	151	3.317	0.76572	5.627	0.001**
Noise and aesthetics					
1 month - 11 months	23	2.783	0.82333		
1 - 3 years	78	3.035	0.75240		
4 - 6 years	25	2.820	0.74134		
7 years and over	25	2.550	0.75346		
Total	151	2.881	0.77558	2.820	0.041*

* P < 0.05, ** P < 0.01

Table 6 indicates that agents varying in tenure differ significantly in their perceptions of the influence of infrastructure/sick building syndrome on their health and performance in executing their jobs at the 1% level of significance. Furthermore, agents varying in tenure differ significantly in their perceptions of noise and aesthetics in the work environment at the 5% level of significance. Table 6 also indicates that tenure does not significantly influence agents' perceptions of the other sub-dimensions of infrastructure/sick building syndrome. Hence, hypothesis 2 may only be partially accepted in terms of tenure. In order to assess exactly where the difference lies in terms of tenure and noise and aesthetics mean analyses were conducted (Table 6). Table 6 indicates that agents employed between 1-3 years (Mean = 3.035) are more convinced than those employed for 7 years and over (Mean = 2.550) that noise and aesthetics influence infrastructure/sick building syndrome. In order to assess where the difference lies in terms of tenure and health and performance, the Post hoc Scheffe's test was conducted (Table 7).

Table 7: Post hoc Scheffe's test: Tenure and Health and Performance

(I) Tenure	(J) Tenure	Mean	Mean Difference (I-J)	Std. Error	p	95% Confidence Interval	
						Lower Bound	Upper Bound
1 months	111 - 3 years	3.400	0.18261	0.17382	0.776	-0.3090	0.6742
	4-6 years	3.336	0.24661	0.21166	0.716	-0.3520	0.8452
	7 years +	2.792	0.79061*	0.21166	0.004	0.1920	1.3892

Table 7 indicates that agents employed under 1 year (Mean = 3.583) have a stronger opinion that infrastructure/sick building syndrome negatively influences their health and performance than those employed for 7 years and over (Mean = 2.792).

Table 8: t-test: Gender and sub-dimensions of Infrastructure/Sick Building Syndrome

Sub-dimension	Gender	N	Mean	Std. Deviation	t	Df	p
Layout	Male	65	3.523	0.56721	1.536	149	0.127
	Female	86	3.352	0.75184			
Ergonomic Design	Male	65	3.345	0.77501	1.464	149	0.145
	Female	86	3.149	0.84195			
Lighting and Ventilation	Male	65	3.337	0.75188	1.943	149	0.054
	Female	86	3.089	0.78706			
Health and Performance	Male	65	3.452	0.66075	1.911	149	0.058
	Female	86	3.214	0.82536			
Noise and Aesthetics	Male	65	3.019	0.70753	1.924	149	0.056
	Female	86	2.777	0.81171			

Table 8 indicates that male and female agents do not differ significantly in their perceptions of the sub-dimensions of infrastructure/sick building syndrome. Hence, hypothesis 2 may not be accepted in terms of gender.

Table 9: t-test: Employment Status and sub-dimensions of Infrastructure/Sick Building Syndrome

Sub-dimension	Employment	N	Mean	Std. Deviation	t	df	p
Layout	Full time	100	3.390	0.68840	-0.895	149	0.372
	Part time	51	3.495	0.66987			
Ergonomic Design	Full time	100	3.134	0.79952	-2.111	149	0.036*
	Part time	51	3.428	0.82367			
Lighting and Ventilation	Full time	100	3.107	0.80387	-1.977	149	0.050*
	Part time	51	3.369	0.70403			
Health and Performance	Full time	100	3.192	0.75901	-2.865	149	0.005**
	Part time	51	3.561	0.72556			
Noise and Aesthetics	Full time	100	2.810	0.79940	-1.578	149	0.117
	Part time	51	3.019	0.71387			

**** P < 0.01, * P ≤ 0.05**

Table 9 indicates that full time and part time agents differ significantly in their perceptions of the influence of infrastructure/sick building syndrome on their health and performance in executing their jobs at the 1% level of significance, and of ergonomic design and lighting and ventilation at the 5% level of significance. However, employment status does not influence agent's perception of workplace layout and noise and aesthetics respectively. Hence, hypothesis 2 may only be partially accepted in terms of employment status. In order to assess exactly where the difference lies in terms of employment status, mean analyses may be conducted for each of the dimensions. In terms of the sub-dimensions of ergonomic design, lighting and ventilation and health and performance on agent's performance, part time employees are more satisfied than full time employees are; perhaps because they spend shorter hours in the work environment than full time employees do.

Hypothesis 3: The combined sub-dimensions (layout, ergonomic design, lighting and ventilation, health and performance and noise and aesthetics) significantly account for the variance in determining infrastructure/sick building syndrome.

Table 10: Multiple Regression: Infrastructure/Sick Building Syndrome

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.877 ^a	0.768	0.767	0.31216
2	0.949 ^b	0.901	0.899	0.20526
3	0.976 ^c	0.954	0.953	0.14078
4	0.989 ^d	0.978	0.978	0.09613
5	1.000 ^e	1.000	1.000	0.00000

Model	Dimension	Unstandardized Coefficients		Standardized Coefficients	t	p
		B	Std. Error	Beta		
1	(Constant)	0.886	0.108		8.241	0.000
	Lighting and Ventilation	0.727	0.033	0.877	22.232	0.000
2	(Constant)	0.507	0.076		6.692	0.000
	Lighting and Ventilation	0.452	0.029	0.545	15.526	0.000
	Ergonomic Design	0.389	0.028	0.492	14.022	0.000
3	(Constant)	0.376	0.053		7.098	0.000
	Lighting and Ventilation	0.322	0.022	0.388	14.400	0.000
	Ergonomic Design	0.318	0.020	0.402	16.059	0.000
	Noise and Aesthetics	0.270	0.021	0.324	12.946	0.000
4	(Constant)	0.107	0.042		2.576	0.011
	Lighting and Ventilation	0.270	0.016	0.326	17.151	0.000
	Ergonomic Design	0.247	0.015	0.312	16.894	0.000
	Noise and Aesthetics	0.246	0.014	0.296	17.182	0.000
	Layout	0.213	0.016	0.225	13.010	0.000
5	(Constant)	-1.513E-15	0.000		.	.
	Lighting and Ventilation	0.200	0.000	0.241	.	.
	Ergonomic Design	0.200	0.000	0.253	.	.
	Noise and Aesthetics	0.200	0.000	0.240	.	.
	Layout	0.200	0.000	0.211	.	.
	Health and Performance	0.200	0.000	0.237	.	.

Table 10 indicates that the combined sub-dimensions account for 100% (Adjusted $R^2 = 1.000$) of the variance in determining infrastructure/sick building syndrome. Table 10 also indicates that these dimensions impact on infrastructure/sick building syndrome to varying degrees as indicated in the Beta values which are as follows:-

- Ergonomic design (Beta = 0.253)
- Lighting and ventilation (Beta = 0.241)
- Noise and aesthetics (Beta = 0.240)
- Health and performance (Beta = 0.237)
- Layout (Beta = 0.211).

The results indicate that ergonomic design (Beta = 0.253) followed by lighting and ventilation (Beta = 0.241), negligibly followed by noise and aesthetics (Beta = 0.240), health and performance (Beta = 0.237) and layout (Beta = 0.211) are critical factors in creating a suitable work environment and if not considered will contribute to creating poor infrastructure or sick building syndrome.

Discussion of Results: It is clear from the results that agents believe that certain aspects of the work environment have a great influence on Infrastructure/Sick Building Syndrome. Their perception is that in a call centre environment prioritized attention should be given to office chair comfort, office temperature, lighting, décor and the availability of a cafeteria for relaxation. Pearson (2012) maintains that office furniture must be functional, comfortable and durable and believes that the best office chair for call centers is the

swivel chair with effective lumbar support, armrests, metal main materials and durable fabric upholstery that is firm enough to provide support yet soft enough to provide comfort. Research indicates that the office chair is a critical aspect in the workstation assembly and working environment and its design is key for the health and well-being of employees (Buildings and Workplace Design Guide, 2006). Furthermore, Mills, Tomkins and Schlangen (2007) found that the installation of new high correlated color temperature fluorescent lighting in a shift-working call centre contributed to wide ranging improvements in wellbeing, function and work performance. In addition, research reflects that café/restaurant facilities should not be in the building so that it can act as a rest room and should include a kitchen with a microwave oven, a television and an internet café (Buildings and Workplace Design Guide, 2006). Further attention needs to be given to the position of laser copiers and printers due to emissions, the effectiveness of workstation equipment and the quality of air supply (proper ventilation). Undoubtedly, discomfort or health effects may occur if copiers and printers are poorly sited, inadequately ventilated, poorly maintained or used by operators continually for prolonged periods. However, well-maintained modern machines located in properly ventilated areas, and with suitable and simple precautions taken, are rarely a hazard (Buildings and Workplace Design Guide, 2006). Bakó-Biró, Wargocki, Weschler and Fanger (2004) cautions that pollution from personal computers (PCs) has an important negative impact on the air quality.

The results of the study also indicate that significant intercorrelations exist amongst the key dimensions (layout, ergonomic design, lighting and ventilation, health and performance and noise and aesthetics) having the potential to influence Infrastructure/Sick Building syndrome. The implication is that the significant interaction amongst these variables has the potential to have a snowballing effect such that proper workplace layout, ergonomic design, lighting and ventilation, noise and aesthetics can have a positive impact on health and performance and reduce the occurrence of poor Infrastructure/Sick Building Syndrome. Conversely, any deficiencies in any of these aspects can have a rippling effect and enhance the occurrence of poor Infrastructure/Sick Building Syndrome. Research reflected that indoor-air quality is an imperative factor for the health of employees in buildings and their efficiency and effectiveness of their thinking and hence, it is important to invest in high-quality buildings that promote good airflow characteristics with natural, mechanical or air-conditioning systems (Clements-Croome, 2008). Milton, Glencross and Walters (2000) found that outdoor air supply rates close to levels recommended in standards resulted in short-term sick leave rates that were 50% higher than in work areas in the same building complexes that were receiving twice as much outdoor air. Fang, Wyon, Clausen and Fanger (2004) emphasize the importance of indoor air temperature and humidity on air quality and ventilation. Epstein (2008) suggests that to improve indoor air quality and reduce symptoms of SBS, adequate ventilation and fresh air, which will reduce volatile compounds, maintaining thermal comfort and adequate lighting should be ensured. The negative impact of speech disturbance, typical in open-plan offices, was also studied and it was found that subjective comfort was disturbed more easily than performance (Haka, Haapakangas, Keränen, Hakala, Keshinen and Hongisto, 2009) and hence, the authors suggest the use of proper acoustic design with high acoustic absorption and appropriate masking sound. Witterseh, Wyon and Clausen (2004) found that both air temperatures and noise distraction increase subjective distress and fatigue and researchers found that elevated temperatures and thermal discomfort have negative effects on health and performance (Lan Wargocki, Wyon & Lian, 2011; Lan, Lian & Pan, 2010). Al-Anzi (2009) found that the prime factor, which affects the performance of employees, is lighting in the office followed by spatial arrangement, noise, furniture and temperature.

A study undertaken by Kaarlela-Tuomaala, Helenius, Keskinen and Hongisto (2009) found that the benefits that are associated with open-plan offices did not appear, namely, cooperation became less pleasant and direct and information flow did not change; hence, the authors suggest taking cognizance of privacy, concentration and interaction before open-plan offices are designed. The results of the study reflect that males and females did not differ significantly in the perceptions of the key dimensions (layout, ergonomic design, lighting and ventilation, health and performance and noise and aesthetics) and their influence on poor Infrastructure/Sick Building Syndrome. A study undertaken by Al-Anzi (2009), however, reflected that male employees, unlike female employees, are affected by bad furniture in their offices and this affected their productivity. However, female employees are more distracted by noise and more conscious of spatial arrangements than their male counterparts are although neither affects their performance (Al-Anzi, 2009). Male employees, as opposed to female employees, also had greater difficulty in completing and concentrating

on their work and their productivity is affected by improper lighting (Al-Anzi, 2009). However, agents varying in biographical profiles age, race, and tenure and employment status reflected significant differences in their perceptions of the sub-dimensions of poor Infrastructure/Sick Building Syndrome. Age differences influenced the perceptions of health and performance, race differences affected on perceptions of lighting and ventilation, whilst varying tenure influenced perceptions of health and performance as well as noise and aesthetics. In addition, full time and part time agents varied in the perceptions of ergonomic design, lighting and ventilation and health and performance. Whilst a paucity of research correlating the sub-dimensions of SBS with biographical profiles was noted, Yildirim, Akalin-Baskaya and Celebi (2007) found that males responded more positively to open-plan offices than did females.

5. Conclusion and Recommendations

Globalization and increasing levels of competition have placed added pressures on organizations to survive and in the quagmire of aggressively chasing after marketing share, survival and profitability, executive management sometimes overlook the impact of poor infrastructure and the consequences of SBS. Whilst more and more organizations are realizing that the cutting edge to competition and beating one's rivals is service delivery, changes in infrastructure and the prevention of SBS involves careful planning and has budget implications. This however, is a much-needed investment in a call centre environment where call centre effectiveness predominantly lies in human resources and their health and performance is largely influenced by infrastructure and SBS issues. There is no doubt then that prioritized attention needs to be given on infrastructure issues in call centre environments, which operate in open-plan settings and are therefore, susceptible to the evils of SBS. Figure 1 depicts the impact of the sub-dimensions of infrastructure/SBS based on the results of the multiple regression analyses, with ergonomic design being at the innermost part of the figure indicating its greatest impact on infrastructure/SBS and hence, calls centre effectiveness. Likewise, based on the results of the multiple regressions, workstation layout lies in the outermost segment, as it is perceived to have the least impact on infrastructure/SBS and hence, call centre effectiveness. Hence, as one moves from the outermost segment to the innermost segment the impact of the sub-dimensions on infrastructure/SBS and hence, call centre effectiveness increases as indicated by the black, block arrow. Nevertheless, the model presents recommendations for enhancing each of the sub-dimensions determining infrastructure/SBS so that each could have a positive and rippling effect on the other thereby, ultimately enhancing call centre effectiveness (Figure 1). In addition, to taking cognizance of the recommendations, it is important to note that the management style of the organization and the characteristics of employees themselves are pivotal in ensuring a healthy work environment that supports performance and effectiveness. Creating the right work environment to enhance call centre effectiveness is as much the employees' responsibility as it is management's.

Figure 1: Recommendations to enhance infrastructure and reduce the prevalence of SBS

Recommendations for Future Research: This study has been undertaken in one public service call centre organization and hence, the results of the study have internal validity in this institution. In order to enhance generalizability, it would be useful to undertake a similar study in other call centre environments in a variety of service environments in both the public and private sectors. This study also includes a call centre environment where only in-bound calls are made and hence, it would be useful to assess similar dimensions in an out-bound call settings as speaking to someone who has chosen to interact with you is completely different from speaking to someone who was not expecting your interaction. Furthermore, it is valuable to assess the viability of open-plan offices in relation to the cognitive demand of the tasks of employees.

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