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A Review on Sick Building Syndrome (SBS)

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Abstract

Sick building syndrome (SBS) constitutes a group of symptoms that occur in a building affecting occupants, but disappear mostly after leaving the building. Sometimes biological aspects cause SBS, sometimes the chemicals present in your building, but human biological systems are affected. This paper reveal a review of SBS, including symptoms, causes, effects, work-related illnesses, prevention, and control. Sick Building Syndrome (SBS) is a medical condition where people experience unexplained symptoms of illness or discomfort while occupying a building. The severity of these symptoms tends to worsen with prolonged stay in the building, but improves or disappears once they leave. SBS can have significant consequences, including: Impaired work or school performance, strained personal relationships, Reduced attendance, Decreased productivity. SBS can occur in various settings, such as: Offices, Homes, Schools, Nurseries. Common symptoms of SBS include: Eye problems (irritation, watering, dryness), Respiratory issues (runny or blocked nose, sore throat), Skin problems (itching, dryness), Headaches, Fatigue, Lethargy, Poor concentration. Overall, SBS can have a significant impact on an individual's quality of life and productivity, making it essential to identify and address the underlying causes of the condition.

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Keywords: Sick Building Syndrome, Health, Symptoms, Building, Performance, Indoor Air, Mould

Introduction

Sick building syndrome (SBS) is an explanation of a medical condition characterized by people living in a building suffering from symptoms of unwell or illness for no apparent cause (Rahayu et al., 2023). The severity in the symptoms felt increase in relation to the increase in stay in the building. SBS leads to disturbance or reduction of performance at world or school, albeit it improves or disappear after leaving the building. SBS reduces personal relationship, attendance, and productivity (Sarkingobir et al., 2017). It can be experienced in offices, homes, schools, nurseries, etc. symptoms of SBS include, irritated, watering or dry eyes, tiredness, redness, irritated or runny or blocked nose, sore throat, itching or dry skin, headache, lethargy, and poor concentration (Nduka et al., 2021). Sick Building Syndrome (SBS) is characterized by a set of symptoms that occur within hours of entering a problematic building, only to disappear after leaving the building. However, in severe cases, the symptoms may persist for a longer period. SBS refers to a situation where occupants express dissatisfaction with the indoor environment, citing complaints such as headaches, eye irritation, fatigue, and nausea. Despite investigations, the causes and effects of SBS remain unclear (Ahmed, 2024). The symptoms are common and can be reported by occupants of any building. SBS is often used to describe a set of symptoms with unknown causes, primarily reported by office workers. Those affected by SBS report that symptoms occur when spending time indoors and dissipate when away from the building (Greer, 2007). This paper aimed to reveal a review of SBS, including symptoms, causes, effects, work-related illnesses, prevention, and control.

Symptoms of Sick Building Syndrome (SBS)

Symptoms of Sick Building Syndrome (SBS) can affect individuals and groups, and typically involve:

1. Eye problems: sore eyes, dryness, irritation, and strained eyes.

2. Upper respiratory issues: itching, bleeding, runny or stuffy nose, sneezing, hoarseness, and dry throat.

3. Lower respiratory problems: difficulty breathing, chest tightness.

4. Skin issues: dryness, rashes, and irritation.

5. Non-specific symptoms: blocked or stuffy nose, throat irritation, dry coughs, and thirst.

Additionally, SBS can cause:

1. Neuropsychiatric disturbances: fatigue, headaches, confusion, and dizziness.

2. Skin disorders: itching, dryness, and rashes.

3. Asthma-like symptoms: tight chest and difficulty breathing.

4. Unpleasant odor and taste sensations, which can cause nausea (WHO, 1993; Ohman & Eberly, 1998).

Causes of Sick Building Syndrome

Sick Building Syndrome (SBS) is often the result of a combination of factors that ultimately affect the health and well-being of building occupants (Pauncu et al., 2001). The main contributors to SBS include:

1. Poor Ventilation and Indoor Air Quality: Inadequate ventilation rates and ineffective air circulation can lead to the buildup of pollutants, including carbon monoxide, carbon dioxide, volatile organic compounds (VOCs), and particulates.

2. Volatile Organic Compounds (VOCs): VOCs are emitted by indoor appliances, such as photocopiers, printers, and cleaning materials. They can cause headaches, fatigue, shortness of breath, and other health problems.

3. Internal Sources of Pollution: Computers, photocopying machines, synthetic materials, improper cleaning and maintenance, and inefficient energy cooking appliances can all contribute to indoor pollution.

4. Poor Lighting: Inadequate or fluctuating lighting can cause eye strain, headaches, and other health problems.

5. Psychological Factors: Stress, anxiety, and other working hassles can contribute to SBS.

6. External Sources of Pollution: Emissions from cars, industrial pollutants, and other anthropogenic activities can compromise indoor air quality.

7. Temperature and Humidity: Extreme temperatures and humidity levels can cause physical discomfort, stress, and other health problems.

8. Noise: Noise levels within the building can add further stress to occupants.

9. Biological Contaminants: Microbes, insects, and bird or animal droppings can breed in moist environments and spread through the air, causing health problems (Sick WHO, 1993; Ahmed, 2024).

Effects of Sick Building Syndrome

The primary consequences of Sick Building Syndrome (SBS) are the deterioration of occupants' health, productivity, and comfort while within the affected building (Ayodeji et al., 2015).

Investigating SBS

To investigate SBS, the following steps can be taken (Joshi, 2008):

1. Conduct a walk-through inspection of the area to identify potential sources of contamination.

2. Investigate occupants' symptoms and possible contamination sources.

3. Evaluate and identify indoor air quality (IAQ) by sampling the air to detect potential contaminants.

4. Establish a cause-effect relationship between symptoms and IAQ.

5. Implement measures to address the problem and improve IAQ (Evans, 2008; Chester & Levine, 1997; Alzahrani & Alghamdi, 2020).

Workplace-Related Illnesses

Jack Rostron, who has carried out much work on SBS, stated that there are four main types of illness within the workplace (Rostron, 1998). These illnesses are as follows:

Sick Building Syndrome (SBS)

Building-Related Illness (BRI)

BRI is a condition associated with building while possessing known specific symptoms and also a known origin, examples are humidifier fever and Legionnaires disease.

These disorders are not associated with psychosocial conditions(stress) or building components such as lighting as influencing factors.

The source of BRI can be found through an investigation into the physical aspects of the building and the spread of symptoms.

Mass Psychogenic Illness (MPI)

MPI is a term referring to a situation when large numbers of people are stroked by a conglomeration of symptoms, but without an identifiable infectious agent. MPI shares common characteristics with all the other workplace illnesses.

MPI is most likely to occur as a result of psychological factors, rather than a specific disease. People who are affected by MPI tend to experience high stress and tension within the environment in which they work.

The main distinguishing trend between MPI and SBS is that the effects and symptoms of the condition are not dwindling when the person(s) afflicted vacates the building, and it spread via social network not building type Alzahrani & Alghamdi (2020).

Neurotoxic Disorder (NTD)

NTD is an abnormality cause by building polluted with nervous system toxicants such as heavy metals. The symptoms associated with this disorder include mood changes, motor and mental slowing, and memory and concentration problems.

NTD is different from SBS (and BRI) because of both physical and physiological distinctive changes experienced by occupants, although it may produce similar psychological reactions to SBS.

Roy (2010), argued that building related illnesses are far vicious than sick building syndrome because they do not placate when the person deserts the building or workplace. Roy lists building related illnesses as including the following: Building-related asthma. This is a hypersensitivity that has the symptoms of wheezing, coughing, shortness of breath and a tight chest. The symptoms may not appear until up to 12 h after exposure to the allergens in the building (The Property Council of Australia 2009).

Irritant or allergic dermatitis. Display of Skin rashes commonly brought by fiberglass or formaldehyde (Alzahrani & Alghamdi, 2023).

Humidity fever. Humidity fever is a flu-like abnormality with the following symptoms: fever, chills, muscle aches, cough, dyspnoea and fatigue. The symptoms usually occur 4–8 h after exposure. The symptoms normally alleviate when the person leaves the building but, in severe cases, can last 2–3 days. HF happens when humidifier is used with the air conditioner and bacteria or fungi are aerosolized in the air through the humidifier Abou-Elwafa & Alshammari (2023).

Hypersensitivity Pneumonitis. This is usually due to high fungal exposure in the building. It may also be due to regular dust exposure. It can be acute or chronic.

Pontiac Fever. This is caused by inhaling the gram negative bacilli Legionellae. Symptoms of Pontiac Fever are a rapidly rising fever alternating with chills. The infected person usually has anorexia, abdominal pain, malaise, myalgia, headaches, cough and diarrhea is common. Pontiac Fever usually affects healthy young people and they recover spontaneously in 2–3 days with no treatment (Chin, 2000).

Legionnaire's Disease. This disease is caused by gram negative bacilli Legionellae in a more harshly fashion than PF. These microbes lives in hot water systems, air conditioning cooling towers, evaporative air conditioners, hot and cold water taps, showers and any source of running water. Whereas the route of transmission to human is airborne. Legionnaire's Disease is predominantly in people above 50 years of age. LD causes pneumonia, brain/bowel and liver damage, and liver malfunction (Chin 2000; The Property Council of Australia 2009).

Aspergillosis. Aspergillus fumigates causes allergic broncho pulmonary aspergillosis in the lungs in individuals with compromised immunity or lowered immunity. This microbe can lead to lung abscess, emphysema or fungus balls to grow in the person's lungs (Chin 2000).

Greer (2007) and Chester and Levine (1997) found out that sick building syndrome can lead to Chronic Fatigue Syndrome with the individuals having this Syndrome seeing health improvements after leaving the building.

Multiple Chemical Sensitivity

Nakazawa et al. (2005), reported a case study of a Japanese woman inflicted with sick building syndrome due to formaldehyde and VOCs, who was then a clerical officer transferred into a new renovated building. From her inception into the place she experienced strong odor same as coworkers. Later she developed nausea and headache, then rash and fever and pharyngeal pain. Later, cough and nausea. These symptoms occurred progressively in three progressive months after inception. Consequently, she took a leave and her symptoms diminish to some level. Further, she started to notice sensitivity to some chemicals outside the workplace. After reporting to medical personnel, her condition was diagnosed as, multiple chemical sensitivity. She received compensation and treatment with Tachion 150 mg a day and recovered and back to work. MCS may take longer time before recovery Abou-Elwafa & Alshammari (2023).

Multiple Chemical Sensitivity, is a building related illness in people who are highly sensitive, or allergic, to substances in the environment. Odle (2010), states that Multiple Chemical Sensitivity was "accepted by World Health Organisation (WHO) as a medical condition in 1992." MCS is difficult to treat because different people have varied sensitivity to varied substances Abou-Elwafa & Alshammari (2020). Multiple Chemical Sensitivity (MCS) is a building-related illness characterized by hypersensitivity to substances in the environment (Nakazawa et al., 2005). MCS was recognized as a medical condition by the World Health Organization (WHO) in 1993 (Odle, 2010). According to Cullen (2002), below are pre-requisite yardsticks for MCS:

1. The syndrome is acquired, usually after the occurrence of a more clearly evident (although not necessarily serious) health event caused by environmental exposure, such as solvent intoxication, respiratory tract irritation, pesticide poisoning, or non-specific building related illness.

2. The patient experiences multiple symptoms referable to several organ systems, almost always including the central nervous system.

3. Although there may be persistent complaints between exposures, the symptoms are characteristically and predictably precipitated by a perceived environmental exposure.

4. The agents that may precipitate the symptoms are multiple and chemically diverse.

5. The doses of these agents that precipitate the symptoms are at least two orders of magnitude lower than the established thresholds for acute effects.

6. No test of physiologic function can explain the symptoms. Although there maybe clinical abnormalities, such as mild bronchospasm or neuropsychologic dysfunction, these are typically non-specific and insufficient to explain the full scope of the illness pattern.

7. No other organic disorder is present that can better explain the pattern of symptoms Mendell, (1993; Property Council of Australia, 2009).

Criteria for Multiple Chemical Sensitivity (MCS)

According to Cullen (2002), the following are the key criteria for diagnosing Multiple Chemical Sensitivity (MCS):

1. Acquired Syndrome: MCS is typically acquired after a significant environmental exposure, such as solvent intoxication or pesticide poisoning.

2. Multiple Symptoms: Patients experience a range of symptoms affecting multiple organ systems, including the central nervous system.

3. Triggered by Environmental Exposure: Symptoms are predictably triggered by perceived environmental exposures.

4. Multiple and Chemically Diverse Agents: A wide range of chemically diverse agents can trigger symptoms.

5. Low Dose Threshold: Symptoms are triggered by doses of these agents that are significantly lower than established thresholds for acute effects.

6. No Explaining Physiologic Test: No test of physiologic function can fully explain the symptoms.

7. No Underlying Organic Disorder: No other organic disorder is present that can better explain the pattern of symptoms (WHO, 1993; Roy, 2010; Ahmed, 2024).

Symptoms of MCS

Murphy (2006) identified some common symptoms of MCS, including:

- Shortness of breath

- Memory loss

- Dizziness

- Fainting

- Fatigue

- Depression

- Moodiness

- Nausea

- Skin rashes

MCS can significantly impact daily life, making it challenging for individuals to work or navigate buildings due to potential exposure to triggering substances. People living in new or refurbished buildings are more likely to develop MCS (Mendell, 1993).

Prevention of Sick Building Syndrome

Preventing SBS requires a multi-faceted approach that involves building design, maintenance, and occupancy practices. Here are some strategies to prevent SBS:

1. Proper Ventilation: Ensure good ventilation by installing a well-designed heating, ventilation, and air conditioning (HVAC) system. Regularly maintain and inspect the system to prevent contamination.

2. Indoor Air Quality (IAQ) Management: Implement an IAQ management plan that includes regular monitoring of indoor air pollutants, such as volatile organic compounds (VOCs), carbon monoxide, and particulate matter.

3. Moisture Control: Prevent moisture accumulation by ensuring proper drainage, using waterproof materials, and maintaining a relative humidity between 30-60%.

4. Cleaning and Maintenance: Establish a regular cleaning and maintenance schedule to prevent the buildup of dust, dirt, and other contaminants.

5. Source Control: Identify and control sources of indoor air pollution, such as VOC-emitting materials, pesticides, and radon.

6. Occupant Education: Educate building occupants about SBS, its causes, and prevention strategies to promote a healthy indoor environment.

7. Building Design: Incorporate SBS prevention strategies into building design, such as using non-toxic materials, designing for natural ventilation, and incorporating green spaces.

8. Regular Inspections: Conduct regular inspections to identify potential SBS causes, such as water damage, mold growth, or inadequate ventilation Abou-Elwafa, (2022).

9. Employee Participation: Encourage employee participation in SBS prevention efforts, such as reporting indoor air quality concerns or suggesting improvements.

10. Compliance with Regulations: Comply with relevant regulations and standards, such as the Americans with Disabilities Act (ADA) and the Occupational Safety and Health Administration (OSHA) guidelines (Levin, 1089; WHO, 1993; Mendell, 1993; Passarelli, 2009; Lu e al., 2015).

By implementing these prevention strategies, building owners, managers, and occupants can reduce the risk of SBS and create a healthier indoor environment (Mendell, 1993).

Control of Sick Building Syndrome

Controlling SBS requires a comprehensive approach that involves identifying and addressing the underlying causes of the problem. Here are some control measures to mitigate SBS:

Indoor Air Quality (IAQ) Control Measures

1. Improve Ventilation: Increase ventilation rates and ensure a consistent supply of fresh air.

2. Air Filtration: Install high-efficiency air filters to remove particulate matter, VOCs, and other pollutants.

3. Air Purification: Use air purifiers to remove gases, odors, and other pollutants (Regional Office for Europe, n.d.; WHO, 1993; The Environmental Illness Resource, 2007).

Source Control Measures

1. Identify and Remove Sources: Identify and remove sources of indoor air pollution, such as VOC-emitting materials, pesticides, and radon.

2. Use Non-Toxic Materials: Specify non-toxic materials for construction, renovation, and maintenance.

3. Implement Integrated Pest Management (IPM): Use IPM techniques to minimize pesticide use and prevent pest infestations (WHO, 1993).

Moisture Control Measures

1. Fix Leaks and Water Damage: Promptly repair leaks and water damage to prevent moisture accumulation.

2. Improve Drainage: Ensure proper drainage and grading around buildings to prevent water accumulation.

3. Use Moisture-Resistant Materials: Specify moisture-resistant materials for construction and renovation Alzahrani & Alghamdi (2020).

Occupant Education and Participation

1. Educate Occupants: Educate occupants about SBS, its causes, and control measures.

2. Encourage Occupant Participation: Encourage occupants to report indoor air quality concerns and suggest improvements Alzahrani & Alghamdi (2020).

Building Maintenance and Inspection

1. Regular Maintenance: Perform regular maintenance tasks, such as filter changes and HVAC system inspections.

2. Conduct Regular Inspections: Conduct regular inspections to identify potential SBS causes, such as water damage or mold growth.

Medical Response

1. Medical Evaluation: Provide medical evaluations for occupants experiencing SBS symptoms.

2. Develop a Medical Response Plan: Develop a medical response plan to address SBS-related health concerns.

By implementing these control measures, building owners, managers, and occupants can mitigate the effects of SBS and create a healthier indoor environment (Lu et al., 2015; Ogunde, 2015; Ahmed, 2024).

Conclusion

Sick Building Syndrome (SBS) refers to a cluster of symptoms experienced by building occupants that typically resolve once they leave the building. The causes of SBS can be attributed to either biological or chemical factors within the building, which ultimately impact the human biological system. This review provides a comprehensive overview of SBS, covering: 1. Symptoms: A detailed examination of the common symptoms associated with SBS, 2. Causes: An exploration of the biological and chemical factors that contribute to SBS, 3. Effects: A discussion on the impact of SBS on occupants' health and well-being, 4. Work-related illnesses: An investigation into the relationship between SBS and work-related illnesses, 5. Prevention: Strategies and measures to prevent SBS from occurring in buildings, 6. Control: Methods and techniques to control and mitigate the effects of SBS. By understanding the complexities of SBS, building owners, managers, and occupants can work together to create a healthier and more comfortable indoor environment.

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