

Noise Pollution

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Abstract

As apartment housing becomes more prevalent worldwide, noise disturbances have emerged as a common and significant issue. These disturbances include not only internal noise from neighboring units but also external noise, such as road traffic, which affects residents' mental and physical health. This research paper explores the unique challenges residents experience and proposes effective strategies that could mitigate noise disturbances. To get the best solutions, this paper divided the big idea of mitigation of noise disturbances into four case studies. The first and second case studies mention the effect of floor impact noises and an alternative to reduce heavy-weight floor impact noise.

On the other hand, the third and fourth case studies focus on urban noises and noise control strategies that minimize the noise. The recommended solutions include architectural modifications, community initiatives, policy recommendations, and technological innovation. However, despite these promising approaches, more studies should focus on the long-term effects of various mitigation strategies.

Introduction

Considering the hectic cityscape of areas with high population density, tall apartment blocks have become a common housing option. Nonetheless, there is a big problem that comes along with the convenience of vertical living; that is, apartment noise. Noise is a disturbance that affects the external environment, interferes with living conditions, and is detrimental to human health (Olamijulo et al. 115-116). Additionally, noise from flats in residential buildings has been identified as one of the most stressful issues amongst inhabitants and a significant source of

conflicts leading to serious consequences such as assault, lawsuits, and tension among community members. This study aims to investigate the complex nature of noise pollution in apartment buildings, which negatively affects residents' quality of life (117-120).

Noise pollution in apartments can be triggered by many factors including thin walls, sound-amplifying floors, home gadgets, and even normal household chores. These types of disruptions are universal problems that cause a lack of adequate sleep amongst people who experience them resulting in an increase in stress levels and general

deterioration in mental health. On some occasions, this has even resulted in physical fights or legal cases associated with disturbing noises thus calling for immediate action such as resolving these matters effectively before they escalate further.

This research paper will critically review the existing literature on noise pollution in residential apartments, focusing on the unique challenges people living in densely populated urban areas face. The article will offer a comprehensive understanding of mitigation strategies that have been employed by reviewing four case studies from different geographical areas. Using these case studies as reference points, suggestions will be made for practical and effective ways to help improve the living conditions of such dwellers. This paper intends not only to enlighten its audience about the seriousness of apartment noise pollution but also to provide useful recommendations on how to mitigate it.

Literary Review

Noise pollution has negative effects on both human health and society. Although many studies have explored how noise from industries, train stations, and airports affect urban dwellers, the majority of them concentrate on major cities, workplaces, and markets and their impacts on job performance afterward (Sirajus et al. 1719-1726; Yesufu et al. 159-171; Ogunseye et al. 257-264).

There are a few studies that delve into the topic of this paper, although they mostly pay attention to

particular kinds of noise pollution and not the ones coming from inside the apartment. For instance, Jan and Vojtěch investigated how railway and highway traffic noise affects residential environmental satisfaction and life satisfaction. These authors found out that traffic noise reduces residential environment satisfaction but does not impact heavily on global life satisfaction (1895-1915). Another study investigated the link between people's perspectives on construction and transport noises in Beijing with mental health symptoms among urban residents, concluding that both types of noise were significantly associated with psychological disorders (Ma et al. 1479).

The impact of noise on health, such as cardiovascular disease, hearing loss, hyperactivity, and lack of concentration has been highlighted in many studies (Stansfeld et al. 12735). According to Marquart et al. (3), noise pollution is now considered the second most detrimental environmental factor to human health after air pollution. Sleep disturbances, anxiety disorders or depression; worsened personal issues; and strained interpersonal relationships; among other major determinants of well-being and life satisfaction (Rahman et al. 1). Therefore, noise pollution is a great menace to both health and quality of life.

A Swedish study by Eriksson et al. recorded that road traffic noise and trains caused a considerable disease burden contributing to about 1000 myocardial infarctions per year (519). Several researches such as those done by Cole-Hunter et

al. indicate a connection between cardiovascular diseases and long-term exposure to noise as well as air pollution (247-249). These findings reflect the social costs of these risk factors hence advocating for stiff regulation against noise and air pollution.

Cities' urban development may be appraised either quantitatively, which involves economic growth, or qualitatively, which includes the well-being of the people and their involvement in community activities. To create ideal cities, it is important to strike a balance between these two dimensions (Song and Yim 677-694). Nonetheless, historical urban management has often promoted quantitative growth at the expense of qualitative improvement (Friedmann and Alonso). Consequently, many cities have good indicators shown by their numbers but have serious quality-of-life problems. Notably subjective quality of life in South Korea has been reported as low with OECD Better Life Index for 2018 ranking it 30th among 40 countries (OECD). This shows an immediate need to enhance the life standards within Korean society. For this purpose of improving residents' quality of life", recent urban regeneration programs in major Korean cities were initiated as noted by the Ministry of Land Infrastructure and Transport. Specifically, it aims to better residential environments that can affect different aspects of residents' lives (K. Y. Lee et al. 179-210; Lewicka 207-230). However, there is insufficient comprehensive research on how these environments affect the quality of life although

some studies have been conducted so far.

Housing plays a crucial role in maintaining and improving residents' health. Large-scale surveys in countries such as New Zealand, Sweden, and Japan have highlighted the relationship between housing conditions and health status. The WHO Housing and Health Guidelines, published in 2018, advocate for improving living environments to reduce disease and enhance quality of life, contributing to Sustainable Development Goals (SDGs) like SDG 3 and SDG 11. Data collection on housing environments and health continues, with studies showing that better environmental performance in detached houses correlates with lower disease prevalence (Kawakubo et al. 576). However, the effects on apartment dwellers remain unclear. Differences in structural properties, insulation, airtightness, and noise levels between detached houses and apartments significantly impact residents' health, making it vital to examine these variables. This study aims to evaluate the environmental performance of apartments in Japan and its effect on health compared to detached houses (577).

Case Study 1: Perception and reaction to floor impact noise in apartment buildings: A qualitative approach

Park, Sang Hee, et al. employed grounded theory to investigate the perceptions and reactions of apartment building residents to floor impact noise originating from upstairs. This theory is a qualitative research methodology that systematically derives theories from meticulously

gathered and analyzed data (2). Fourteen participants from different age groups, jobs, and lengths of stay at the complex were interviewed extensively during the study phase (5). Researchers then analyzed their findings carefully until they came up with a model that could describe the perception of floor impact noise.

The research found that light and heavy impact noise was greatly exposed to by the participants, where the sound of footsteps was mentioned most frequently (8).

Additionally, *“cognitive and avoidant coping strategies were initially adopted, and complaints were only thereafter registered if the noise persisted”* (2). Annoyance and disturbance were the negative perceptions of floor impact noise, which ranked as the second major cause of noise annoyance in living areas (10). When annoyance was at its peak, respondents resorted to proactive coping mechanisms like contacting neighbors, and security officers, or lodging official complaints (11). However, their effectiveness varied since some reported reduced irritation and increased satisfaction whereas others remained dissatisfied resulting in more harmful feelings (14). Moreover, attitudes toward neighbors were found to have changed greatly among the respondents because of the continuous loudness, which at times led to strained relations and tit-for-tat noise-making that only made things worse. This progression underscores the importance of addressing noise issues to prevent the exacerbation of interpersonal conflicts and maintain community harmony (17).

According to the study, it was also observed that noise exposure led to self-reported health problems and concerns. One of the participants shared *“I lost so much weight because I’ve been so stressed by the noise”*, while another one said, *“I have been experiencing dizziness before moving into this apartment, and it has become worse because I’ve been hearing the noise continuously”*. This is supported by scientific evidence, including the paper from Lercher and Kofler that mentions that residents exposed to noise above 55 dBA worried more about their health and had poorer health ratings (85-89).

While not necessarily defining how to solve the problem, this study does show us the perspective of people who face apartment noise constantly. The research chronicles the experiences and health problems of people who have been around different kinds of noise and highlights how much of an effect it can have on our everyday lives and general welfare as a society.

Case Study 2: Acoustic Retrofit Approach of an Apartment Living Room Using Multi-Perforated Gypsum Boards in Terms of Heavy-Weight Impact Sounds

This research presented by Yong-Hee Kim was designed to examine how well multi-perforated gypsum boards work in reducing heavy-weight floor impact noise in apartment buildings. Conducted under controlled conditions, the study involved testing different types of gypsum boards; these included those with sound-absorbing backing materials and various

installation methods on flat and coffered ceilings. The aim was to find out which configurations produced the greatest reduction in impact noise caused by banging machines as well as rubber balls while also looking for practical ways of improving indoor acoustics, especially within older apartments where conventional floating floors may not be viable. It mainly sought to establish if multi-perforated gypsum boards can be used as a simpler retrofitting option for achieving substantial noise reduction (1-2).

The study found that multi-perforated gypsum boards can effectively reduce heavy-weight impact noises. When used on flat-type ceilings without backing sound absorbers, these boards achieved a noise reduction of about 3 dB for bang machine sources and 4 dB for rubber ball sources respectively. This reduction was improved upon to reach a maximum level of 4 dB and 5 dB by adding porous sound absorbers as backing materials. The authors also showed that changes in the thicknesses of non-perforated gypsum boards or alterations in the perforation pattern did not cause any significant change in noise reduction which indicated that many small holes were better than few large ones (12).

The performance of multi-perforated gypsum boards on coffers was also remarkable. They only reduced noise by 1 dB when applied exclusively over the central part of the coffered ceiling concerning the bang machine source; whereas reductions ranging between one and four decibels were observed depending on where they were installed relative to rubber ball sources. Surface

finish methods were found to affect outcomes too; with water-based painting finishes being more effective than wallpaper finishes (9-11).

These findings have shown that indeed multi-perforated gypsum boards are capable of solving heavy-weight impact problems in old apartment buildings. According to this research, it can be deduced from their results that the number of modules fitted and hence covered area plays an important role in attaining the best noise reduction levels possible. Generally speaking, this study provides useful knowledge regarding the use of multi-perforated gypsum boards during acoustic retrofitting because they offer comparatively easy yet efficient means of dealing with such issues instead of tearing down entire floors which may require complex procedures not forgetting costly materials as well as labor inputs involved could be avoided if required surfaces are treated using appropriate types or models together with better floor coverings for different living areas. Therefore, more testing should be done on these module profiles to make them work better across various habitation types.

Case Study 3: Study on reducing urban noise in residential buildings

The study presented by Simion et al. investigates the effects of loud sounds on residents living in flats before and after soundproofing was done. In European cities where the majority live in towns with high traffic volumes, there are many densely populated areas, and noise coming from outside becomes a big threat to a good life (747).

The research evaluates the efficiency of insulation systems fitted into old blocks of flats that were not built with any soundproofing features like precast or monolithic concrete structures. It also identifies the best ways of reducing residential area noise by use of frequency bands analysis coupled with sound absorbing materials application. Such actions protect inhabitants against sleeplessness caused by city noises among other problems such as stress and poor health thereby indicating that it is necessary to combine acoustic convenience enhancement measures during building repairs alongside general improvements for this case (747-748).

The research shows that in cities, human activities have a great impact on noise levels which in turn affects negatively the indoor and outdoor environment qualities. Buildings must be insulated against sound effectively with context-based approaches as there are no off-the-shelf solutions to it. Noise absorbing systems should be fitted in existing structures to minimize impacts on people's lives caused by loudness and also improve living standards at the same time. Evenly distributed insulation not only protects residents from noise but also requires fewer repairs. Additionally, mapping out areas with high levels of noise within towns and industries is important for planning actions aimed at lowering exposure to it thus enhancing acoustic comfort hence leading to a better quality of life in general (753).

Case Study 4: Investigation of The Impact of Noise Control Strategies in Sustainable Building Design

This study presented by Adewale and Stephanie, identified and analyzed various noise control strategies that were incorporated at the design stage of mixed-use buildings in Lagos State, Nigeria. It was found that many effective noise reduction measures have been included by designers and planners such as windows that are double or triple-glazed, sound-absorbing materials, mechanical ventilation systems etcetera (1-2). These methods work well because they keep off external noise pollution which improves the quality of people's lives within such areas. Using sustainable materials with good sound absorption abilities like recycled rubber and natural fibers was mentioned to be very efficient too. Furthermore, soundproofing is crucial in preventing traffic sounds from infiltrating into building interiors among other sources of outside sounds (3).

The investigation also proposes that urban designers together with architects should make sure that they give priority to integrating noise control strategies at the initial planning stages to attain sustainable urban development. This implies utilizing environmentally friendly materials that provide effective insulation against unwanted sounds concurrently (3-4). The research recommends policymakers alongside local authorities enforce legislation requiring adherence to noise mitigation measures during construction processes for any new buildings, especially those located in areas exposed to high levels of noise pollution from various sources including transport systems among others.

Continuous advancement through more studies about acoustic materials is necessary due to changes in landscapes caused by city growth (9).

Discussion: Proposed Solutions

Architectural Modifications: Effective noise mitigation in apartment complexes begins with well-crafted architectural strategies. In Case Study 2, they used multi-perforated gypsum boards as one of the methods. These boards were able to reduce heavy-weight impact noise up to a certain level if combined with sound-absorbing backing materials and therefore could be installed in existing buildings. Moreover, floating floors with carpets or other floor coverings that absorb sound waves can greatly reduce floor impact noise too.

Community Initiatives: Apartment noise can be greatly reduced through efforts made by communities. Among the ways is setting up a noise committee in residential areas which gives an official channel for dealing with complaints about noise as well as enhancing good relations among neighbors. Educational programs raising awareness about the impacts of noise pollution and encouraging mutually respectful behavior can also foster an environment of tolerance and understanding. Additionally, it would also create an atmosphere for patience and acceptance if occasionally surveys were carried out among inhabitants concerning their opinions about what constitutes too much noise around them thereby preventing necessary steps towards its control from being taken.

Policy Recommendations: Policy interventions

are crucial in mandating noise reduction measures during the construction and maintenance of apartment buildings. Authorities ought to implement more stringent construction regulations that demand soundproofing materials be used in places with high population density. Additionally, it may be necessary to provide grants or other financial benefits that will encourage landlords to fit their old properties with sound insulators.

Technological Innovations: Progress in technology allows for a variety of chances to create something new in noise reduction. One way is by including intelligent sound sensors that record the level of noise and give an immediate response when it goes beyond the set limit. Additionally, developing and implementing new sound-absorbing materials that can be easily installed within existing structures can provide efficient and minimally invasive solutions.

By incorporating this multidimensional approach, it is possible to reduce the problem of noise pollution in apartments to a great extent and as a result, help people living in cities have more comfortable lives.

Conclusion

In conclusion, this paper has highlighted the pressing issue of noise pollution in apartment buildings and its substantial negative impact on residents' quality of life. Through analysis of different examples and research, it was found that some effective techniques can be used to control noise pollution. For instance, the use of multi-

perforated gypsum boards or floating floors among other sound-absorbing materials can greatly reduce noise levels within residential units. Similarly, community-based programs and policy interventions are necessary for promoting cooperation while ensuring strict adherence to building codes.

Apartment noise pollution is a very serious matter because it affects physical health as well as mental wellbeing not only that but also social integration which leads to overall happiness in cities. More studies should be carried out to know the long-term effects brought about by different approaches towards mitigating this problem and come up with innovative ways that can cut down on noise levels faster taking into account changing urban landscapes over time. If we can adopt a comprehensive approach to dealing with sound disturbances then our towns will become more serene places to live in thereby improving the general welfare of all inhabitants living in urban environments.

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