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## PRISON SOUNDSCAPES AND HEALTH EFFECTS: INSIGHTS FROM THE LITERATURE

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### ABSTRACT

This narrative review, based on academic articles and grey literature published over the last two decades, examines the soundscape characteristics of prisons and their effects on the health and well-being of inmates. While it is well-established that noise exposure in residential settings is associated with adverse psychological and physiological effects, evidence on the impact of sound on prison populations is limited. The results are presented through four themes: the sound environment; health impacts; health equity and contextual factors; and the mitigation of noise. Prisons can be noisy environments from activities and routine operations, with sounds occurring unpredictably at any time. Reported health effects attributed (directly or indirectly) to noise include sleep disturbances, self-harm, social withdrawal and negative effects on mental well-being. People in prison can encounter health inequalities, exacerbated by non-acoustic factors of individual sound sensitivity and coping capacities, particularly among population subgroups that may be at a higher risk, such as the elderly or those with pre-existing health conditions. Currently, there is a lack of specific standards addressing the sound environment of prisons. Intervention strategies targeting both the physical building and behaviours may contribute to improving the prison soundscape and reducing the adverse impacts of noise on health.

**Keywords:** *health equity, noise, non-acoustic factors, prison acoustics, well-being*

### 1. INTRODUCTION

Noise exposure can trigger physiological fight-or-flight responses [1, 2] and cause chronic annoyance, noise-induced stress and sleep disturbances. It is well-established that noise exposure in residential settings is linked to adverse psychological and physiological health effects [3-8], but there is limited evidence on the effects of noise on minority subgroups of the population, such as prison inmates.

In 2022, the global prison population was estimated to be 11.5 million [9]. There are different types of prisons. For example, in England and Wales, male prisons are classified into four categories, from Category A with the highest security to Category D which are open prisons. Women and young adults are categorised and held in either closed conditions or open conditions, according to their risks and needs. Offenders aged 18-21 are placed in Young Offender Institutions (YOIs) and those under 18 in Youth Custody establishments [10]. This review examines the available literature on the sound environment of prisons and the health impacts of noise exposure on inmates.

### 2. METHODS

A narrative review was conducted to explore the sound environment of prisons and its health impact on inmates. A literature search was performed between November 2024 and January 2025 using Scopus, Web of Science, MEDLINE, Embase, Google Scholar and Google. To

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# FORUM ACUSTICUM EURONOISE 2025

obtain an overview and gather insights into the current state of evidence, the search included both academic and grey literature published from the year 2000 onward. The search terms included keywords related to prison (e.g., prison, jail, correctional facilities, incarcerated space, detention centre), the population (prisoner, inmates), sound (sound, noise, vibration), and/or health (e.g., health effect, well-being, sleep, stress, mental health). Additional literature was identified through backward snowballing. The selection criteria focused on studies addressing sounds in prisons and the health effects of noise exposure on inmates. Commentaries and letters to editors were excluded, and only studies published in English were considered.

### 3. RESULTS

The review identified four themes related to sounds in prisons and associated health effects on inmates: characteristics of the sound environment; health impacts of noise exposure; health equity and contextual factors; and mitigation strategies and their potential benefits.

#### 3.1 Sound Environment of Prisons

Prisons comprise various types of spaces such as room/cell, landing, library, faith area, education classroom, gym, visit hall, workshop room and/or outdoor area. While imprisonment may evoke a sense of isolation and segregation, prisons are frequently characterised as noisy due to constant activities and routine operations. Common sound sources reported in the literature include clanking metal gates, slamming doors, rattling keys, alarms, staff radios, announcements, overlapping conversations, shouting, footsteps, televisions or radios, squeaking bed parts and the hum of HVAC (heating, ventilation and air conditioning) systems [11-14]. These sounds can occur unpredictably at any time, day or night. Sound levels depend on factors such as density of occupancy and the architectural design of the building. For example, sounds can be intensified by the reverberant environment due to acoustically hard materials and high ceilings typically found in prisons [13, 15].

#### 3.2 Health Impacts of Noise Exposure

In an incarcerated environment with limited visibility, sounds can serve as crucial indicators of events and tools to expand one's perceived space [11, 14, 16]. On the other hand, the absence of sounds due to confinement, intended for behaviour control or to protect others, can be distressing [16]. In general, the literature supported the argument that

noise can negatively affect the health of people in prisons [13, 17, 18].

In a survey conducted at HMP Berwyn, North Wales responded by 309 male inmates, noise was reported as top building design feature that negatively impacted their well-being [15]. A descriptive evaluation of the sound environment at HMP Five Wells, Northamptonshire identified distracting sounds near the library and classrooms, as well as anxiety and sleep disturbances caused by sounds from the building fabric [12]. Noise was one of the environmental factors that caused sleep disturbances in a women's prison in the United States [19] and increased insomnia in two prisons for adult men and one prison for young and adult women in the UK [20]. Among prisoners experiencing insomnia in a French facility, 66% identified noise as one of the causes of their poor sleep quality [21]. Some studies have reported that sleep deprivation among inmates can lead to increased aggression [22, 23]. There were also reported experiences that noise from other inmates, such as shouting and loud music, led to conflicts and harm [11, 16].

Six respondents from a prison in Denmark mentioned outdoor noise as a factor contributing to dissatisfaction when trying to ventilate their cells by opening windows [24]. In a study in England and Wales, the combined effects of noise and air pollution from a nearby major road were reported to diminish the ability of greenspace to alleviate self-harm. However, noise was not measured directly and a proxy variable (major road present or not) was used [25].

For visitation rooms, studies in the UK reported individual experiences that excessive noise can complicate communication and hinder the willingness to meet up, detracting from the potential benefits of mutual support and maintaining relationships between inmates and visitors [26, 27]. A study in Scotland reported the following experiences: "he [father] does not want visits ..., he cannot cope with the volume [in the visits hall] ... if [he] finds out about the visits, he'll cancel them" and "she had post-traumatic stress disorder and how the noise of visits ... could be a trigger, causing further anxiety and distress" [26].

#### 3.3 Health Equity and Contextual Factors

The WHO defines health equity as "the absence of unfair, avoidable or remediable differences among groups of people, whether those groups are defined socially, economically, demographically, or geographically or by other dimensions of inequality" [28]. Factors to individual health and well-being include wider determinants of health (e.g., the environment, access to services), psycho-social





# FORUM ACUSTICUM EURONOISE 2025

factors (e.g., social support, self-esteem, perceived control), health behaviours (e.g., diet, physical activity) and physiological impacts (e.g., anxiety, multimorbidity) [29]. Since health is influenced by living conditions, many determinants of health are beyond individual control [30]. Inequitable health outcomes can occur when groups differ in their exposure to hazards, susceptibility to adverse effects, and/or access to health protection.

Individuals in prisons can encounter significant health inequalities [31, 32]. The literature suggests that noise exposure can be an additional dimension that ought to be taken into consideration.

As noted in Section 3.1, prisoners are at risk of exposure to noise that differs from that in a typical residential setting [11-14]. The health effects of noise are known to be moderated and mediated by a variety of contextual factors, also known as non-acoustic factors, such as individual sensitivity and coping capacity [33-36]. Inmates with increased vulnerability to the negative outcomes of noise may be the elderly, those from socially disadvantaged groups, individuals who carry a higher burden of disease as well as those with pre-existing physical and mental health issues [8, 37-42]. For example, a meta-analysis showed that the prevalence of ADHD (attention deficit hyperactivity disorder) is reported to be five times higher among youth and ten times higher among adults in prison compared to the general population [43]. In the UK, the Ministry of Justice reported that “almost 60% of female offenders have experienced domestic abuse” [44]. Additionally, a study across 18 prisons in England and Wales found that excessive noise on the wings deterred some older prisoners from social interactions, leading them to remain in their cells [45]. In another study involving prisoners aged 50 and over across 39 prisons in the UK, respondents reported that constant noise from younger prisoners on the landings and the lack of quiet places negatively impacted mental well-being, and also posed challenges for recovery after undergoing medical treatments [46].

The prison environment offers inmates limited control over their noise exposure, with few opportunities for respite or access to quiet spaces, which can increase one’s susceptibility to the adverse impacts of noise. For example, at HMP Five Wells, prisoners described “a sense of powerlessness at not being able to silence the alarms themselves ... they were [also] unable to locate the source [of loud music], move away from it, or ask whoever was playing it to turn it down” [12]. It has also been noted that “prisoners are entirely dependent on the staff of prisons and detention centres for all aspects of their daily lives, as well as for protection and safety. This dependence must be understood by the staff” [47].

### 3.4 Mitigation Strategies and Potential Benefits

WHO (2014) stated that one of the significant measures for health protection is “a reduction of hazards in the environment” [47]. A healthier sound environment can protect health, promote well-being, foster individuals’ engagement with support services and reduce health inequalities [15, 47-49]. Integrating good acoustic design principles in the building designs has the potential to reduce noise and its negative impacts [12, 15, 48, 50].

Our review identified a limited number of documents setting standards for the acoustic design of prisons, and these tended to be for specific spaces within prisons. The American Correctional Association set the standard that, “facilities for classroom instruction should be ... free from distracting noise” and “noise levels in inmate housing units do not exceed 70 dBA (A Scale) in daytime and 45 dBA (A Scale) at night” [51]. Boland and Farley (2024) commented that, “While spaces inside prison are used for sleeping, teaching and healthcare, the characteristics of the cohort and the particular use of sound in this environment, mean that the acoustic design of prisons should be considered differently”, and suggested “using the existing relevant guidance from other sources as a starting point” [50].

Reducing reverberation time via the physical design of internal spaces and surface finishes can decrease ambient noise and minimizes the need for raised voices [15, 50]. Managing sound events and implementing strategies, such as reducing door slamming or using earpieces instead of speakers, can also lower noise levels [52]. A survey among prison staff in the US indicated that better physical conditions, including lower noise levels, reduced violence among inmates [53]. Moreover, green spaces within and outside prisons can provide relief from noise [12, 54]. A positive soundscape in visitation rooms can enhance connections, which could contribute to reduced depressive symptoms and decreased risk of recidivism [55-57].

The approach to sound mitigation needs to consider other aspects such as the required level of security in prisons. For example, while green spaces may promote well-being, they could introduce security challenges. Additionally, the location of prisons with outdoor green areas in rural places might restrict transport accessibility, which could affect the frequency of visits [58].

## 4. DISCUSSION AND CONCLUSION

Prisons consist of different spaces and noise has been reported to be associated with issues such as sleep disturbance, insomnia, anxiety, self-harm, conflict and social withdrawal. Non-acoustic factors, such as hearing





# FORUM ACUSTICUM EURONOISE 2025

sensitivities, perceived control, pre-existing health conditions and social circumstances can influence susceptibility to the negative impacts of noise exposure. Prisoners can experience health inequalities due to the sound environment, vulnerability of the population, and the limited control in the incarcerated setting. Suggested measures include reducing reverberation levels, providing access to quiet or green spaces and managing sounds via behavioural interventions.

The state of evidence regarding noise in prisons and the associated health impact on inmates is limited, with the majority of the evidence consisting of cross-sectional studies and qualitative data analysis. Several studies examined combined exposures to different environmental factors, and it is not possible to disentangle the specific effects attributable to noise. Whilst health inequalities were reported in prisons, their direct association with noise exposure has not been extensively studied. Additionally, the design and management practices vary across prisons and countries, which may limit the applicability of findings to other contexts. Therefore, extrapolating findings across different geographical regions or settings should be approached with caution. Considering the growing evidence on the association between noise exposure and physical and mental health problems [4, 5, 8], the role of prison noise as a contributing factor to negative health impacts among people in prison necessitates further investigation.

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# FORUM ACUSTICUM EURONOISE 2025

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# FORUM ACUSTICUM EURONOISE 2025

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