



# RESEARCH BRIEF

January 2026 | Publication: 9 | ISBN 978-1-0670195-8-7

## Noise, sleep and stress in Auckland migrants

Phoebe Taptiklis, Rachel Simon-Kumar, Andrea Edwards & Kim Dirks

### EXECUTIVE SUMMARY

Recent research in migrant and ethnic concentrated neighbourhoods have highlighted evidence of environmental racialisation or inequalities in living circumstances of low-income minority populations attributable to intentional and unintentional structural factors. As an extension of this work, this study focuses on migrants living in inner city apartments to investigate their indoor living conditions and their exposures to risk and harm from their surroundings. We undertook indoor monitoring along with a survey to understand the impact of night-time traffic noise on respondents' sleep and wellbeing. We measured noise inside the living rooms of fifteen apartments in the central business district (CBD) of Tāmaki Makaurau, Auckland. Measured noise levels were found to be above maximum levels recommended by the World Health Organisation (WHO) for a healthy sleep environment in all fifteen apartments. Most respondents reported concern about the high noise levels, which were associated with longer sleep duration and more life stresses. Migrants who had arrived in Aotearoa, New Zealand more recently, as evidenced by holding a temporary work visa, were less concerned about high noise levels, despite their relatively higher exposure, pointing to the complex, bi-directional relationship between noise, sleep and stress. The study confirms disparities experienced by low-income migrant groups. However, it also raises new questions about the subjective experience of inequality and its implications for health outcomes.

*Research undertaken within the WERO: Working to End Racial Oppression research programme has been developed in relation to the Takarangi framework. The Takarangi is a double spiral pattern prominent in Māori carving that is also depicted in the background of this brief. In WERO, the Takarangi framework has shaped our work on the values and ethics of all research that we undertake to address racism. Further information on the Takarangi is available online: <https://wero.ac.nz/research/takarangi-wero-values-and-roadmap/>*

# INTRODUCTION

Recent research on environmental racialisation in Aotearoa New Zealand - i.e., the unintentional or deliberate systemic actions that lead to racially uneven spatial outcomes - has highlighted effects of disproportionate and inequitable urban development on migrants and ethnic minority populations within Tamaki Makaurau / Auckland (Edwards et al., 2025). Set within the CBD precincts of the city, where there is a significant concentration of especially low-income migrants from Asia, Latin America, and Africa, this study highlighted a range of mechanisms of exclusion and inclusion which play out in urban planning to restrict access to amenities while also increasing exposure to harms and risks.

Noise is a significant exposure experienced by these communities in the CBD. Traffic noise exposure is increasingly acknowledged as a significant public health concern in cities and urban areas (World Health Organisation (WHO), 2011). In recent decades, evidence has accumulated demonstrating the harmful effects of excessive noise exposure, including during sleep, on health and wellbeing, leading to the development of the WHO guidelines to help protect human health (Basner & McGuire, 2018).

The link between exposure and adverse health impacts has been found to be a complex causal pathway involving many factors (Yang et al., 2024). Road traffic noise exposure, particularly at night, has been linked with cardiovascular illness (Münzel et al., 2021) and depression (Gong et al., 2022). General noise exposure is also associated with cardiovascular illness, including ischaemic heart disease (Guha & Gokhale, 2023; World Health Organisation (WHO), 2011), in large population-based studies. Evidence is also emerging for a link to increased metabolic illness (e.g. diabetes) (Van Kamp et al., 2020; Yang et al., 2024), as well as both psychological and physiological stress (Münzel et al., 2021; Yang et al., 2024) and depression (Fang et al., 2019). Furthermore there is evidence suggesting cognitive and learning impacts for children growing up and going to school in noisy urban environments, as well as cognitive impairments in older adults (Thompson et al., 2022). In other words, living in a noisy environment can take a significant mental and physical toll.

Unlike many airborne exposures, of which we may often be unaware, noise is processed by our senses, and something, when awake, or awakened from

sleep, we are generally aware of (Muzet, 2007), leading to complaints by exposed populations (Muzet, 2007). Populations who have the financial freedom of having multiple residential options, have the means to avoid the areas of highest exposure, leading to exposures being higher amongst lower-socioeconomic (Muzet, 2007) and other groups with lower levels of mobility such as ethnic minorities and recent migrants (Taptiklis et al., 2025).

This paper looks at the links between reported noise concern, stress and sleep patterns in relation to monitored night-time noise levels as part of the Working to End Racial Oppression (WERO) research programme. The specific aim was to understand the relationship between monitored night-time noise levels and self-reported sleep disturbance, and stress in an urban migrant population.

# METHODS

Participants for this study were recruited from a broader survey which in turn is part of a larger study programme “Working to End Racial Oppression” (WERO) exploring institutional, social and economic racism in New Zealand (see other papers reporting on this data using other methods (Edwards et al., 2025; Taptiklis et al., 2025)). Ethical approval was gained from the Auckland Health Research Ethics Committee, approval number **AHPEC24940**. In total, 15 participants were recruited by means of invitation posters into the monitoring study, with a direct digital link to the survey, strategically located in residential areas close to the Auckland City centre. This included apartment foyers and areas where concentrations of migrant residents had been identified through informal discussions with local government bodies and community groups with knowledge of the area. The survey included details about their household and apartment characteristics, the number of occupants, the apartment level, floor area, and the nature of their window glazing (double or single), etc.

Indoor environmental monitoring was conducted from August to December 2023 (the late winter - late spring season in the Southern Hemisphere). Each apartment of the consenting participants was equipped with low-cost environmental sensors, measuring noise using a Sound Level Meter (Jaycar Pro Sound Level Meter with Calibrator), at an averaging time of one minute over a two-week

**Table 1. Survey questions and responses**

<i>Questions</i>	<i>Responses</i>
On average, how many hours of sleep do you get each night? (1-4) <i>Select one</i>	1 = Less than 5 2 = 5 to 7 3 = 7 to 9 4 = More than 9 hours
How concerned are you about traffic noise? (0-4) <i>Select one</i>	0 = Not at all 1 = A little 2 = Moderately 3 = Very much 4 = Extremely
Do you have any of these sleep-related issues? (0-6) <i>Select as many as apply</i>	Moodiness / irritability Poor concentration Delayed reactions / sluggishness Reduced work efficiency Reduced alertness Struggling to stay awake
What have you felt nervous, anxious or on edge about? (0-4) <i>Select as many as apply</i>	Home Work Family / friends Personal issues

period. The sensors were placed in the main living area of each apartment. In order to minimise the impact of noise generated within the apartments, we restricted our analysis to include only noise measured between midnight and 5am.

In addition to the environmental monitoring, a survey prompted respondents to consider what life factors caused them to feel nervous or worried. Respondents were also asked about how many hours of sleep they typically got each night, and whether they had any of the suggested sleep-related issues during their waking hours. The specific survey questions used, and options presented for responses, are presented in Table 1, along with the category values used in the analysis.

## RESULTS

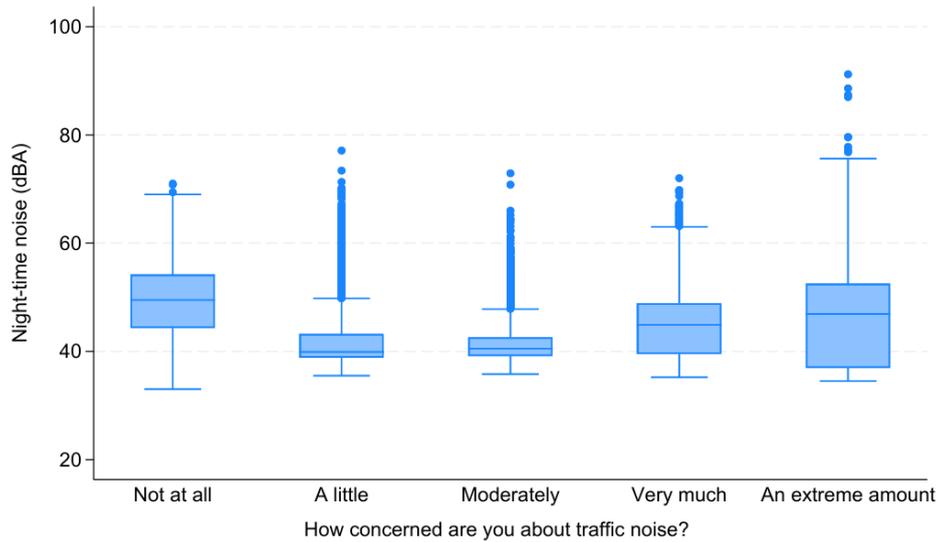
Noise was found to be a significant concern for a large proportion of our sample. Four of the fifteen respondents who participated in indoor monitoring reported that they were extremely concerned about road traffic noise (25%), and ten participants (59%) were at least moderately concerned about traffic noise levels. For respondents reporting “A little” to “Extremely” concerned, measured noise levels were found to increase linearly with level of noise concern (Figure 1). However, for those who were “not at all concerned”, the average night-time noise levels were actually found to be the highest, suggesting

something more complex than a simple relationship.

We cannot exclude the fact that the high night-time noise levels in these apartments may be generated by the occupants themselves, which would explain the lack of concern. However, given the complex relationship between noise and stress highlighted above, it is worth considering how these results relate to self-reported sleep problems and personal worries, and also the impact of the precarity of their New Zealand residency.

### **Results by visa status**

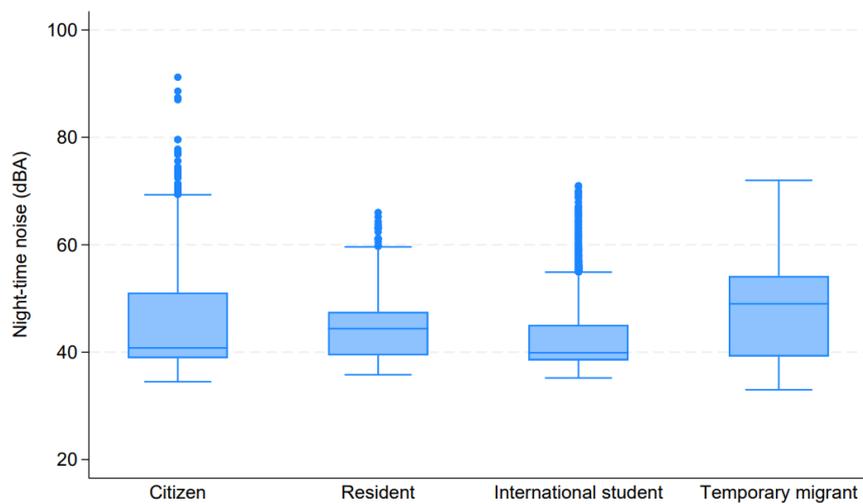
When considered by visa status, a proxy for length of time residing in New Zealand (Citizen; Resident; International Student; and Temporary Migrant visas), we can see that each of the groups’ median levels are above 40 dBA. The WHO recommends night-time noise (or noise levels for sleeping) of 30 dBA or lower. At levels of 40dBA to 55 dBA, negative health effects are observed, most frequently amongst vulnerable populations, and “many people have to adapt their lives to cope with the noise at night” (Basner & McGuire, 2018). It should be noted that not every apartment had a median night-time noise exposure over 40 dBA, as six of the fifteen apartments had a median exposure of between 38 and 40 dBA where, according to WHO guidelines, minor sleep disturbance is common (30-40 dBA), but may not rise to the levels associated with measurable health impacts (Basner & McGuire, 2018).



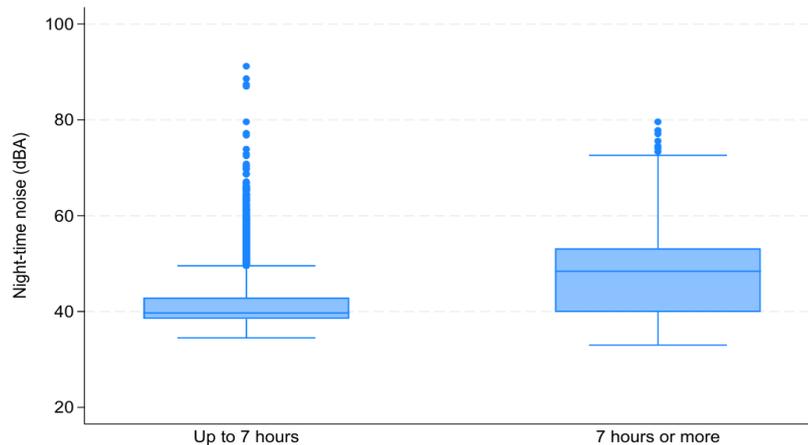
**Figure 1. Measured night-time noise by reported traffic noise annoyance**

**Table 2. Survey responses by visa status**

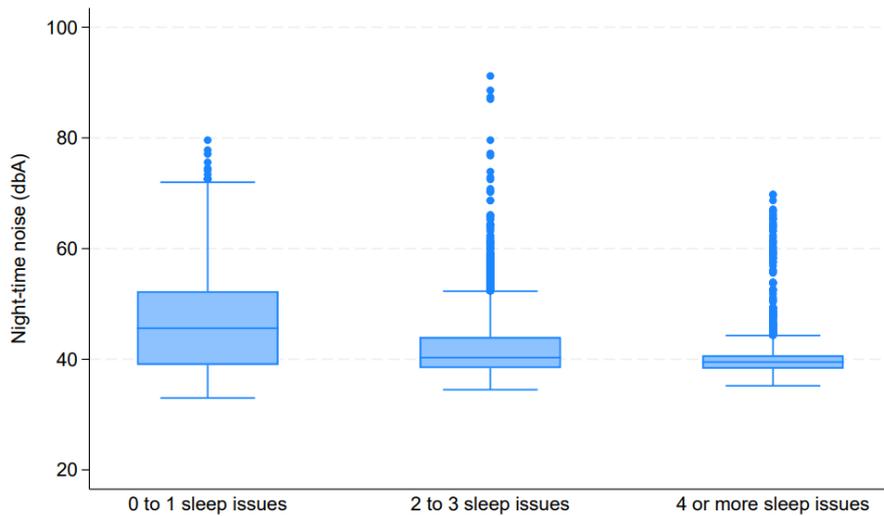
	Citizens	Residents	International Students	Temporary Migrants
Apartments (n)	6	2	4	3
Mean night-time noise (dBA)	43	44	42	47
Mean apartment level	5.3	6.4	9.6	1
Mean traffic noise concern (0-4)	2.4	3	1.4	1.3
Mean sleep duration (1-4)	2.4	1.6	2.4	3
Poor sleep effects (0-6)	3.2	1.5	1.4	-
Worries severity (1-3)	1.8	2.4	1.5	1.3



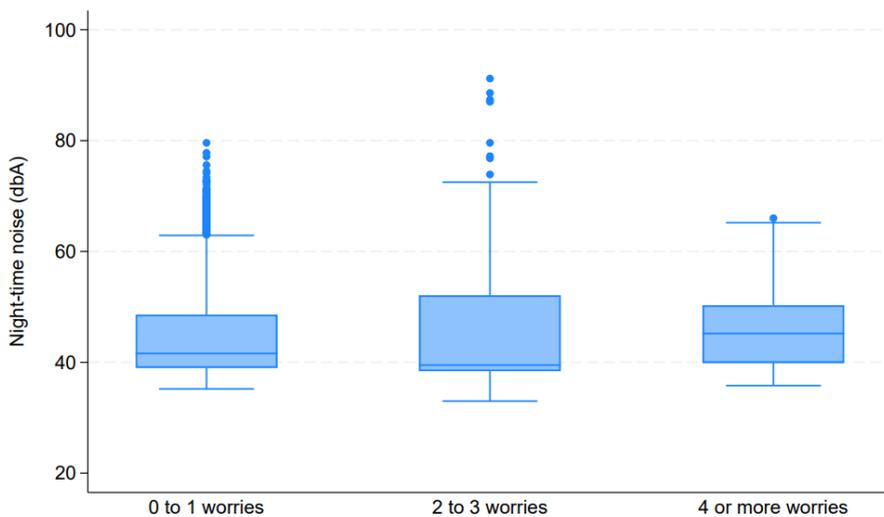
**Figure 2. Night-time noise by visa status**



**Figure 3. Night-time noise by sleep length**



**Figure 4. Night-time noise exposure by self-reported sleep issues**



**Figure 5. Night-time noise exposure by cumulative worries**

Night-time noise exposure is linked to apartment floor level (height-above-ground) with international students tending to live in apartments located at the highest levels (on average on Level 10), and experiencing the lowest night-time noise exposure, while those on temporary work visas tend to live in the lowest level apartments, on average, on Level 1, and experience the highest levels of exposure (Table 2). The average floor levels of Citizens and Residents are 5 to 6, respectively, with night-time noise levels falling near the middle of the spectrum for these groups. The International Students' somewhat lower level of concern, compared with other groups, is associated with lower levels of exposure (quieter apartments) - albeit, still within the range of exposure levels considered to be potentially harmful. Hence, in our sample, it appears that noise attenuates with height (also demonstrated elsewhere (Benocci et al., 2020; Wen et al., 2020).

### **Noise and sleep**

Seven hours of sleep is considered to be a minimum healthy amount of sleep for adults (Hirshkowitz et al., 2015). Therefore, data from the monitored population were separated into those who reported less sleep. When categorised this way, we observed that those experiencing "healthy" levels of sleep also experienced significantly higher night-time noise exposures (Figure 3). In fact, the median noise exposure in the group reporting five to seven hours or less is just below 40 dBA, which sits within the category which WHO guidelines suggests is associated with minor sleep disturbance (30 - 40 dBA (2)). In contrast, the group reporting seven to nine hours (or more) of sleep on average experienced night-time noise levels considerably higher than this, with a median exposure of 49 dBA, well within the exposure levels WHO associates with adverse health effects (Basner & McGuire, 2018).

## DISCUSSION

The urban migrant population who participated in this study reported a high frequency of adverse impacts from poor sleep (i.e. irritability, poor concentration, etc.), especially those from the Citizens and Residents groups consisting of individuals who have been in the country the longest. The Citizens and Residents also reported the greatest level of concern with noise exposure, despite experiencing relatively lower levels compared with the more recent arrivals (International Students and Temporary Migrants).

Stress and worry are subjective and contextual. Recent migrants may consider their problems to be small, simply because they are small compared with the challenge of initiating and undertaking migration to a new country. Especially given that the sample size of this study was very small, any relationships should be interpreted with caution. Nevertheless, there is an interesting story presented here. The analysis is consistent with a population quite conscious of their noise exposure, and one that associates noise with sleep problems. We observe that those who experience the shortest sleep durations report the most waking problems due to poor sleep. Interestingly, this is not related to the measured night-time noise exposure levels. In fact, higher noise exposure was found to be associated with a longer sleep duration.

One important question these results prompt is “Does sleep duration increase in noise exposed populations because sleep quality has actually reduced?” While it is outside the scope of this study to answer this question, recent work on the relationship between noise exposure and sleep quality shows that poor sleep quality can be related to unconscious arousals. In other words, the subject does not fully awaken, and thereby become conscious of the noise levels (Smith et al., 2022). Instead, they are roused out of the deeper, most restorative and critical phases of sleep without fully waking and therefore becoming consciously aware that this is happening. It is certainly plausible, that this would cause people to sleep for a longer duration, so rather than an indicator of good sleep quality, perhaps sleep duration needs to be questioned more in terms of exactly what it indicates.

A second question these results prompt, is “Does noise decrease mental health independent of sleep duration or quality?” A substantial number of studies have demonstrated that increased noise exposure, and specifically traffic noise exposure, is linked to increased anxiety, depression and general mental health symptoms (Basner & McGuire, 2018; Gong et al., 2022). There is also a substantial body of research demonstrating physiological impacts such as damage to the heart and circulatory system (Münzel et al., 2021), and metabolic and hormonal regulatory systems (Yang et al., 2024), all of which are related to stress, and exposure to noise. A question remains as to how conscious individuals may be of this exposure, or whether the damage induced is similar between individuals, irrespective of sleep disturbance, or the individual’s knowledge or awareness. Indeed several studies have shown that subjective reporting on sleep quality does not correlate well with objective measurements which include sleep cycles and the length of sleep in both slow-wave and REM states (Muzet, 2007). Furthermore, the lodging of a noise complaint is associated with feeling stressed (Muzet, 2007), and it is not implausible that this stress, directly caused by noise, drives poor sleep, rather than the other way around, as is typically understood (Muzet, 2007).

Our research appears to reflect a population that is relatively conscious of exposure to noise, as evidenced by the tendency for migrants who have been in the country longer, to have moved into apartments located at higher levels which experience somewhat lower levels of measured night-time noise. This does not, however, correlate with the expected reduction in worries, instead being associated with more generalised worries, longer sleep duration and fewer reported problems caused by poor sleep. Perhaps our respondents relate shorter sleep duration with more waking sleep-related problems, as have many researchers in the past (Muzet, 2007), and are less likely to notice these issues in their waking life on days when they remember having a relatively long sleep. Perhaps, simultaneously and independently, the increased noise is in fact generating negative mental health consequences, but these are not linked by the individual directly to the noise, unlike sleep duration.

While sleep awakenings have been linked with noise

levels above 40dBA, the disturbance of normal sleep patterns, without full waking, has been associated with noise levels of just 30 - 40 dBA (Basner & McGuire, 2018), levels which impacted all our respondents (in terms of night-time median levels). This suggests that all of our respondents may be impacted by decreases in slow-wave and REM sleep duration, without the individual realizing their sleep had been disturbed, since they did not fully awaken.

Research shows that noise exposure is associated with changes in the amygdala, increasing or ramping up a person's generalised stress response, making them more sensitive and more reactive, not only to noise but to life in general. Our findings may reflect this increased sensitivity to stress in association with actual noise exposure. Our sampled population also appears to be actively trying to reduce their personal exposure levels (by moving to higher apartments). However, these attempts do not appear to have improved mental health effects, even though it may have helped with increasing sleep duration. This is consistent with research showing a bidirectional relationship between noise exposure and depression, where sensitivity increases over time because of this positive feedback effect (Fang et al., 2019). In fact, sleep disturbance is virtually universal in depression (Fang et al., 2019) to the point of being considered to be part of the syndrome. Perhaps in our sample, those reporting high or extreme levels of concern about noise levels, despite having lower measured exposure than others, is due not to noise exposure directly, but a secondary effect of the depression and reduced stress tolerance induced by that exposure over a longer period.

While these findings need to be tested in a larger sample, this research shows that urban migrant apartment dwellers, the most recent migrants in particular, are impacted by problematic night-time noise levels. While we cannot conclusively state that these trends reflect environmental racialisation, against the backdrop of widespread lack of access by migrant communities to robust and healthy housing and neighbourhoods, there is cause to examine if these are an outcome of systemic institutional failures to address racial inequalities. In particular, the results suggest that this important public health issue deserves greater attention. Next steps include the development of a study focused on apartment quality, noise exposure and physical and mental health symptoms in a larger and broader sample so

that differences between groups can be assessed.

## CONCLUSION

Migrants with higher measured night-time noise levels report more general stress, consistent with international scholarship. Those experiencing higher levels of noise exposure report longer sleep durations and fewer waking issues related to poor sleep, although noise was measured at above the recommended levels in all of the monitored apartments. When considering visa status as a proxy for time spent living in the country, results are consistent with longer-term exposure increasing noise sensitivity, meaning that even after migrants move to higher, less noise-exposed apartments, their sleep quality does not improve. These results should be interpreted as hypotheses rather than findings, and need testing in a larger sample for validation.

## REFERENCES

- Basner, M., & McGuire, S. (2018). WHO Environmental Noise Guidelines for the European Region: A Systematic Review on Environmental Noise and Effects on Sleep. *International Journal of Environmental Research and Public Health*, 15(3), 519. <https://doi.org/10.3390/ijerph15030519>
- Benocci, R., Bisceglie, A., Angelini, F., & Zambon, G. (2020). Influence of traffic noise from local and surrounding areas on high-rise buildings. *Applied Acoustics*, 166, 107362. <https://doi.org/10.1016/j.apacoust.2020.107362>
- Edwards, A., Lim, S., Dirks, K., & Simon-Kumar, R. (2025). Rethinking place in ethnic and migrant health outcomes: Environmental racialisation in Auckland City Centre. *Kōtuitui: New Zealand Journal of Social Sciences Online*, 20(3), 343-366. <https://doi.org/10.1080/1177083X.2025.2501284>
- Fang, H., Tu, S., Sheng, J., & Shao, A. (2019). Depression in sleep disturbance: A review on a bidirectional relationship, mechanisms and treatment. *Journal of Cellular and Molecular Medicine*, 23(4), 2324-2332. <https://doi.org/10.1111/jcmm.14170>
- Gong, X., Fenech, B., Blackmore, C., Chen, Y., Rodgers, G., Gulliver, J., & Hansell, A. L. (2022). Association between Noise Annoyance and Mental Health Outcomes: A

- Systematic Review and Meta-Analysis. *International Journal of Environmental Research and Public Health*, 19(5), 2696. <https://doi.org/10.3390/ijerph19052696>
- Guha, A. K., & Gokhale, S. (2023). Urban workers' cardiovascular health due to exposure to traffic-originated PM2.5 and noise pollution in different microenvironments. *Science of the Total Environment*, 859(160268). <https://doi.org/http://dx.doi.org/10.1016/j.scitotenv.2022.160268>
- Hirshkowitz, M., Whiton, K., Albert, S. M., Alessi, C., Bruni, O., DonCarlos, L., Hazen, N., Herman, J., Hillard Adams, P. J., Katz, E. S., Kheirandish-Goza, L., & Neubauer, D. N. (2015). National Sleep Foundation's updated sleep duration recommendations: Final report. *Sleep Health*, 1(4), 233-243.
- Münzel, T., Sørensen, M., & Daiber, A. (2021). Transportation noise pollution and cardiovascular disease. *Nature Reviews Cardiology*, 18(9), 619-636. <https://doi.org/10.1038/s41569-021-00532-5>
- Muzet, A. (2007). Environmental noise, sleep and health. *Sleep Medicine Reviews*, 11(2), 135-142. <https://doi.org/10.1016/j.smrv.2006.09.01>
- Smith, M. G., Cordoza, M., & Basner, M. (2022). Environmental Noise and Effects on Sleep: An Update to the WHO Systematic Review and Meta-Analysis. *Environmental Health Perspectives*, 130(7), 076001. <https://doi.org/10.1289/EHP10197>
- Taptiklis, P., Dirks, K., Edwards, A., Simon-Kumar, N., & Simon-Kumar, R. (2025). *Indoor environmental quality through the migrant pathway, in Tāmaki-Makaurau, Auckland New Zealand*. In Review. <https://doi.org/10.21203/rs.3.rs-8013389/v1>
- Thompson, R., Smith, R. B., Bou Karim, Y., Shen, C., Drummond, K., Teng, C., & Toledano, M. B. (2022). Noise pollution and human cognition: An updated systematic review and meta-analysis of recent evidence. *Environment International*, 158, 106905. <https://doi.org/10.1016/j.envint.2021.106905>
- Van Kamp, I., Simon, S., Notley, H., Baliatsas, C., & Van Kempen, E. (2020). Evidence Relating to Environmental Noise Exposure and Annoyance, Sleep Disturbance, Cardiovascular and Metabolic Health Outcomes in the Context of IGCB (N): A Scoping Review of New Evidence. *International Journal of Environmental Research and Public Health*, 17(9), 3016. <https://doi.org/10.3390/ijerph17093016>
- Wen, H., Gui, Z., Zhang, L., & Hui, E. C. M. (2020). An empirical study of the impact of vehicular traffic and floor level on property price. *Habitat International*, 97, 102132. <https://doi.org/10.1016/j.habitatint.2020.102132>
- World Health Organisation (WHO). (2011). *Burden of disease from environmental noise; quantification of healthy life years lost*.
- Yang, L., Gutierrez, D. E., & Guthrie, O. W. (2024b). Systemic health effects of noise exposure. *Journal of Toxicology and Environmental Health, Part B*, 27(1), 21-54. <https://doi.org/10.1080/10937404.2023.2280837>
- Boston, Amanda T. (2021). Manufacturing distress: Race, redevelopment, and the EB-5 Program in central Brooklyn. *Critical Sociology* 47(6):961-76.
- Byrns, R., & Berbary, L. A. (2022). Placemaking as unmaking: Settler colonialism, gentrification, and the myth of "revitalized" urban spaces. *Leisure Sciences*, 43(6), 644-660. <https://doi.org/10.1080/01490400.2020.1870592>
- City of Seattle OPCD Staff (Brennon Staley, Nicolas Welch, David Goldberg, Patrice Thomas, Katie Sheehy, Dakota Murray, Rico Quirindongo, and Lauren Flemister) (2023). City of Seattle Office of Planning and Community Development's understanding of and approach to displacement. In W. Curran, & L. Kern (Eds.), *A research agenda for gentrification* (pp. 211-229), Edward Elgar Publishing.
- Council of Europe (2020). *Managing gentrification*. Policy Brief. <https://rm.coe.int/managing-gentrification-icc-policy-brief-may-2020/16809e9af5>
- Curran, W., & Kern, L. (2023). Introduction. In W. Curran & L. Kern (Eds.), *A research agenda for gentrification* (pp. 1-13). Edward Elgar Publishing.

WERO is funded by the Ministry of Business, Innovation and Employment. The research programme is hosted by the University of Waikato with support from the following institutions: University of Auckland, Victoria University Wellington, Otago University, Motu Economic and Public Policy, University of Toronto, University of Washington.

**Corresponding author:** Phoebe Taptiklis. Email: [phoebe.taptiklis@motu.org.nz](mailto:phoebe.taptiklis@motu.org.nz)

**WERO - Working to End Racial Oppression**  
The University of Waikato, Private Bag 3105, Hamilton 3240  
Email: [enquiries@wero.ac.nz](mailto:enquiries@wero.ac.nz) | Phone: +64 7 838 4737  
[www.wero.ac.nz](http://www.wero.ac.nz)

---