Do underground workspaces impact workers health?

Citation for published version (APA):


Document status and date:
Published: 01/01/2021

DOI:
10.26481/dis.20210628gd

Document Version:
Publisher's PDF, also known as Version of record

Please check the document version of this publication:

• A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
• The final author version and the galley proof are versions of the publication after peer review.
• The final published version features the final layout of the paper including the volume, issue and page numbers.

Link to publication

General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

• Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
• You may not further distribute the material or use it for any profit-making activity or commercial gain
• You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the “Taverne” license above, please follow below link for the End User Agreement:
www.umlib.nl/taverne-license

Take down policy
If you believe that this document breaches copyright please contact us at:
repository@maastrichtuniversity.nl
providing details and we will investigate your claim.

Download date: 02 Nov. 2023
As urbanization continues to rise, two-thirds of the world’s population is projected to live in cities by 2050. Singapore, and cities across the world, are seeing subterranean development as a strategy to meet the challenge of accommodating a greater population density. Underground spaces can have a wide range of functions, including public use (e.g., shopping centres), personal use (e.g., garages), transportation (e.g., subways), utilities (e.g., water), and storage (e.g., oil), and can also serve as workspaces (e.g., offices).

In terms of workspaces, underground workspaces pose some potential, but unexplored risks in comparison to above-ground workspaces, such as the limited or lack of exposure to sunlight, sounds from the outside world and potentially worse air quality. The partial or full absence of daylight in underground workspaces which may be additional demand in inadequately light poses a major concern, as light is the most important biological zeitgeber. Reduced time spent under natural light has been associated with several health outcomes, including sleep disorders, poor mental health, health-related quality of life and vitamin D deficiency. However, there is a limited number of studies examining the health effects of working in underground spaces. The majority of these reports have focused on the study of miners and train drivers, while research for other occupations is lacking.

The overarching goal of this thesis is to examine the health effects of underground workspaces compared to above-ground workspaces. For this purpose, this thesis is structured around three main parts, beginning with the initial cohort profile of the workplace study in Singapore to the main findings of the cohort study in Part 2 and 3 of the thesis.

Part 1. Understanding the workplace cohort in Singapore

To study the potential health effects of working in underground workspaces, we developed a cohort study and recruited participants working comparable job types in underground and above-ground workspaces.

Chapter 2 describes the rationale, study design, data collection, and baseline characteristics of the cohort. The study revealed that, at baseline, there were no differences in the health parameters assessed between individuals working in underground and above-ground workspaces. The findings also showed that there was a high burden of NCD risk factors among this population. Findings also indicated that there was no difference in the light intensity in
Part 2. Sleep quality in a working population in Singapore

In the second part of the thesis, we examined different methods to assess aspects of sleep and how it relates to workers’ health—related quality of life, and whether working underground is associated with health-related quality of life.

Chapter 3 demonstrates that there is an association between sleep, whether measured subjectively and objectively, and health-related quality of life. This chapter also revealed that there was no difference in health-related quality of life between those working in underground and aboveground workspaces.

In Chapter 4, we evaluated the underlying factor structure of the Pittsburgh Sleep Quality Index (PSQI) in a working population in Singapore. Findings show that the PSQI encompasses two factors (perceived sleep quality and sleep efficiency) in a working population in Singapore. The analysis illustrated that a two-factor model provides an acceptable fit to the data and was highly superior to the single-factor model. These findings, therefore, suggest that the two-factor model may be more appropriate to use when assessing sleep quality in working populations in Singapore.

Part 3. Health and underground workspaces

In the third part of this thesis, we examined whether working in underground workspaces was associated with psychological distress, ‘perceived sleep quality’ and ‘sleep efficiency’.

Chapter 5 compares the prevalence of psychological distress over time in aboveground and five indoor environment quality parameters and work-related factors with psychological distress. The study revealed that there was no difference in the prevalence of psychological distress between workers in underground and aboveground workspaces. The findings also indicated that dissatisfaction with indoor air quality, temperature, noise and lighting in the workplace was associated with psychological distress, regardless of whether a worker worked in underground or aboveground workspaces. Additionally, we observed that working longer hours per day was a risk factor for psychological distress.
Chapter 6 compares the sleep quality of workers in underground and above-ground workplaces over time using the two-factor model of the PSQI. The study also examines the demographic, lifestyle, and workplace factors associated with the two-factor PSQI model, namely ‘perceived sleep quality’ and ‘sleep efficiency’. This study found that working underground was not associated with worse ‘perceived sleep quality’ or ‘sleep efficiency’. While working underground was not associated with the two sleep quality factors studied, significant associations were observed between a number of workplace factors and ‘perceived sleep quality’ and ‘sleep efficiency’. Longer duration of employment, working in the workshop and greater satisfaction with lighting in the workplace were associated with better ‘perceived sleep quality’, while greater levels of stress at work and being a shift worker were associated with worse ‘perceived sleep quality’.

This thesis sheds light on the health effects of underground workplaces. We studied workers with comparable job types in similar underground and above-ground workplaces. The findings of this thesis suggest there are no negative health effects of working in modern underground workplaces when they are comparable to those above-ground. However, the poor sleep health, the high prevalence of psychological distress, and the high burden of NCDs found among workers in this cohort study, suggest workplace policies are needed to improve the health of workers regardless of working in underground or above-ground settings. Also, irrespective of working in underground or above-ground settings, indoor environmental parameters were associated with psychological distress and worse ‘perceived sleep quality’, highlighting the key role that this workplace factor has on health, and the need to consider indoor environmental parameters in designing more health-promoting workplaces.


