The role of sleep in ethnic inequalities in health: Cardiovascular disease and risk factors
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Chapter 8

GENERAL DISCUSSION

This chapter highlights the key findings of the studies in this thesis, and discusses the methodological issues pertaining to the design of HELIUS study and ABCD study whose databases were used for the studies in this thesis, including strengths and limitations. We also discuss the methodological issues for assessing sleep duration in adults and children as recommended by the joint consensus of the National Sleep Foundation (NSF), American Academy of Sleep Medicine (AASM), and Sleep Research Society (SRS). Finally, we reflect on the key findings, relating it to the formulated model, and ends with implications for future research, with recommendations for further studies.

KEY FINDINGS

Differences in sleep duration/patterns between ethnic groups in Netherlands

The prevalence of short sleep was higher in all ethnic minority groups than the Dutch in both adults (chapter 2) and children (chapter 3). Among adults the prevalence of short sleep was 2 to 3 times higher in ethnic minority groups than in Dutch people both in men and women. Similarly, the prevalence of short sleep was 3 to 4 times higher in ethnic minority children than in Dutch children. The prevalence of long sleep was 2 times higher in all ethnic minority women (except in African Surinamese and South-Asian Surinamese) than in Dutch women. The prevalence of long sleep was also higher in ethnic minority men (except in African Surinamese and Ghanaians) than in Dutch.

Factors associated with the sleep patterns among ethnic minority groups

SES and shift work are factors found to be associated with sleep in all ethnic groups. As a consequence, these factors accounted for a small part of ethnic differences in short sleep. This implies that ethnic inequalities in sleep are not simply a reflection of differences in socio-economic position of various ethnic groups. Ethnic specific factors might play a role as well, such as the higher prevalence of depressed mood in ethnic minority groups. Depressed
mood accounted for 3-16% of the prevalence of short sleep depending on the ethnic group involved, and moderate part of the prevalence of long sleep in Dutch and Moroccans (chapter 7).

**Consequences of the observed sleep patterns among adults and preschool children of ethnic minority groups**

Short sleep was associated with obesity and diabetes, and this association was partly consistent across ethnic groups (chapter 4), whereas the association between short sleep and dyslipidaemia differs between ethnic groups and depends on the particular CVD risk factors involved.

Short sleep was associated with overweight in Dutch and Moroccan preschool children in the unadjusted analysis, but this association was mediated by SES (education). Short sleep was not associated with raised BP in all ethnic minority preschool children except in African Surinamese.

Short and long sleep duration was not associated with arterial stiffness as measured with pulse wave velocity (PWV) in all ethnic minority groups (chapter 5), suggesting that the link between sleep duration and CVD outcomes does not seem to operate through arterial stiffness.

Short sleep was consistently associated with increased prevalence of CVD in all ethnic groups (chapter 6), and accounted for 10-15%, to the increased risk of CVD in South-Asian Surinamese, African Surinamese, Ghanaians, and 5% to the increased risk of the Turks and Moroccans, independent of conventional CVD risk factors. Conventional CVD risk factors jointly accounted for 10-24% to the increased risk of CVD in ethnic minority populations.

**Distinction in results between adults and preschool children of ethnic groups.**

There are some similarities in results between ethnic minority adults and preschool children in this thesis. For instance, both ethnic minority adults and their preschool children sleep shorter than ethnic Dutch (chapter 2 and 3). This highlights similar trends in sleep patterns between adults and children of ethnic minority groups. Additional similar finding between
adults and preschool children was that short sleep duration was associated with obesity in adults, (chapter 4) and overweight in preschool children (chapter 3). This indicates that short sleep may be a common risk factor for obesity/overweight in both adult and children of ethnic minority groups. On the other hand, there are differences in results between ethnic minority adults and preschool children noticed in this thesis, including: Lack of significant association between short sleep and blood pressure in preschool children (except in African Surinamese in which association of short sleep with raised BP was observed), whereas an association of short sleep with BP(hypertension) was found for some ethnic minority adults. This study also found additional similarities between adults and preschool children, for example, among ethnic minority groups, the prevalence of short sleep was 2-3 times as high in adults and preschool children compared with ethnic Dutch.

METHODOLOGICAL CONSIDERATIONS

Cross-sectional data

The dataset used for this thesis came from the Healthy Life in an Urban Setting (HELIUS) and Amsterdam Born Children and their Development (ABCD) studies. The data used from both studies were cross-sectional, although the studies have been designed prospectively. Methodological issues regarding the methods and designs, strengths and limitations of the studies have been discussed in various chapters of this thesis. Additional detailed explanation is given for the strengths and limitations.

Strengths

Healthy Life in an Urban Setting (HELIUS) study and Amsterdam Born Child and their Development (ABCD) study were differently designed to conform and meet specific purposes. HELIUS study is one of the largest population-based cohort studies in Europe with focus on major ethnic minority groups resident in Amsterdam, the Netherlands [1]. The Amsterdam Born Children and their Development study (ABCD) is a large prospective population-based study established in 2003 to examine the association between maternal lifestyle, medical, psychosocial and environmental conditions during pregnancy and children’s health at birth, as well as later in life in Amsterdam, the Netherlands [2]. Both studies share
certain common features by focusing on same ethnic groups (except for South-Asian Surinamese in ABCD study). This provides a homogenous population which makes it possible to make comparisons in results. Also both studies contain information on important variables such as sleep duration and other health related variables such as obesity/overweight and blood pressure/hypertension, which makes it possible to see similarities and differences in results between adults and children.

Limitations

The major limitation of studies in this thesis is the use of self-report data for sleep duration. Whereas in HELIUS study, information on sleep duration was provided by adult participants through the use of a questionnaire, for the children in ABCD study, information on sleep duration was provided by the parents of the children. As both studies are cross-sectional, it has the implication of introducing bias as well as making causal inference impossible for the obtained results.

In the HELIUS study, the sleep variable was obtained subjectively through self-reported questionnaire with an item which requested participants to indicate “on average, the number of hours of sleep per night”. For ABCD study, participants were asked to indicate “on average the number of hours the child sleep per night on school days and during weekend”. The use of self-reported data is prone to recall bias, as participants may under- or over-report sleep duration. Such bias could be minimized or eliminated by the use of objective sleep measures such as polysomnography (PSG), electroencephalograph (EEG), and actigraphy which provide accurate and more reliable measures. However, despite the self-reported nature of the sleep variable, subjective sleep measures (questionnaires, diary) are still widely used, hence use of self-reported data seem justified, given what we know on validity. For instance, it has been shown that perceived inadequate sleep data obtained subjectively was similar to objective sleep measures provided in a primary care setting [3]. In addition, while some other research has indicated that self-reported data on sleep duration typically overestimates the true duration of sleep, it has been demonstrated that the reporting bias is non-differential across sex and ethnic groups [4].

Another methodological issue that relates to sleep studies generally, and which also relate to studies in this thesis is the inconsistency in the definition/
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classification of short and long sleep duration. In various studies involving sleep duration, several authors have used different definitions for short and long sleep duration. There is discordance in the definition of short and long sleep duration due to non-harmonization of standard definition for healthy sleep by the National Sleep Foundation (NSF). For instance, in population-based study investigating ethnic differences in self-reported sleep duration, Hale et al 2007, classified short sleep as sleeping \( \leq 6 \) hours /night [5]; whereas in another study, Stamatakis et al 2007 [6] defined short sleep as sleeping \(< 7\) hours/night. In another instance, Whinnery et al (2014) [7] used a more extreme definition of \( \leq 5 \) hours/night commonly referred to as “very short ” sleep duration. It was not until 2015, that the NSF, American Academy of Sleep Medicine (AASM) and Sleep Research Society (SRS) jointly agreed on a more universally accepted definition for healthy sleep duration for different age categories/groups as can be seen in the table 1 [8]. For the sole purpose of this thesis, sleep duration generally recommended as healthy for adults (7-8 hours per night) and preschool children (10-11 hours/night) were used [9]. Accordingly, short sleep was defined as \(< 7\) hours of sleep/night for adults, and \(< 10\) hours/night for preschool children; and this definition was used throughout the entire study. Whereas, long sleep was defined as either \( > 9 \) hours, or \( \geq 9 \) hours per night depending on the period (year) the study was carried out and also on the number of participants within the long sleep range (sample size). The new recommendations for defining sleep duration for adults and children came into effect in the midst of this research, when some studies have already been concluded and when there was no harmonization of sleep guidelines. For instance, in chapters 2, 5, and 7, long sleep duration was defined as \( \geq 9 \) hours/night, whereas the new guidelines emphasized \( > 9 \) hours/night. In addition, although, the new guidelines clearly differentiated between young adults (18-25 years), adults (26-64 years) and older adults (\( \geq 65 \) years), and recommended 7-9 hours/night as healthy for young adults and adults, and 7-8 hours/night for older adults. However, throughout the entire study, participants were not stratified by age according to the new classifications, and thus, the results may not apply to all age groups, and should be interpreted with caution. The new classification also included the number of hours which `may be appropriate` for different age groups (Table 1). On one hand, this may suggest that if ethnic minority groups sleep less than the recommended hours but had a good quality sleep, that it may not be much a problem as sleep quality is important too. On the other hand, that people from either of the ethnic groups may sleep longer than the recommended hours could be an indication of health status (ill-health) and not necessarily a problem of
long sleeping. The differences in the definition of sleep had no implication for the comparability of our results with other studies, as this also applies to other studies carried out within the same period. However, the definition issue is a general concern to overall studies involving sleep duration, hence it is expected that expert bodies should further improve on the definition of sleep to capture both quantity and quality of sleep.

**Table 1:** the recommended hours of sleep per night for preschool children and adults

<table>
<thead>
<tr>
<th>Age</th>
<th>Recommended</th>
<th>May be appropriate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preschoolers 3-5 years</td>
<td>10-13 hours</td>
<td>8-9 hours/14 hours</td>
</tr>
<tr>
<td>Young adults 18-25 years</td>
<td>7-9 hours</td>
<td>6 hours/10-11 hours</td>
</tr>
<tr>
<td>Adults 26-64 years</td>
<td>7-9 hours</td>
<td>6 hours/10 hours</td>
</tr>
<tr>
<td>Older adults &gt;65 years</td>
<td>7-8 hours</td>
<td>5-6 hours/9 hours</td>
</tr>
</tbody>
</table>

*Derived from the website of National Sleep Foundation: NSF sleep duration recommendation [9]*

**Why did we focus on short sleep and less on long sleep?**

The studies in this thesis focused more on short sleep rather than long sleep because ethnic differences in short sleep were most apparent. Whereas ethnic differences in short sleep persisted even after adjusting for covariates (chapter 2), ethnic differences in long sleep disappeared after adjusting for SES, indicating that SES explains ethnic differences in long sleep but, not in short sleep. This suggests that the major problem specific for ethnic minority groups is short sleep duration. However, the fact that SES explains ethnic differences in long sleep does not necessarily mean that long sleep is not a problem among ethnic minority groups, hence it was also investigated alongside short sleep in chapters 5 and 7. Also, emphasis was laid on short sleep because, although long sleep may be associated with adverse health outcomes, previous studies found that short sleep was more consistently related to CVD risk factors compared to long sleep [10, 11].

**How generalizable are the results to other ethnic groups?**

One important question emerging from the assessment of results contained in this thesis is how generalizable the results are to other ethnic minority groups, i.e. other than those considered in this study? Considering the design
and the overall strengths of the studies in this thesis which included, (but not limited to) large sample size, which allows for more reliable estimations of population characteristics being studied, use of same methodology to investigate multiple ethnic groups that reside in one city, conducting appropriate statistical analysis, etc., which affirms internal validity of our study. At the same time, this study identified factors which are determinants of sleep duration, such as SES (education and employment), shift work, etc. which were also basic characteristics of other ethnic minority groups identified in other studies [12, 13, 14]. As the findings of this thesis is similar to those of previous studies conducted in cities based on common characteristics and determinants, our results are likely to be generalizable to other ethnic minority groups living in comparable urban centres. It may however, differ for specific groups with different living circumstances.

REFLECTIONS ON THE KEY FINDINGS IN THIS THESIS

This thesis succinctly demonstrates significant role of sleep in ethnic inequalities in health specifically on CVD and risk factors. This section further expatiates on the key findings by reflecting on three basic themes as shown below.

Why is short sleep more prevalent among ethnic minority groups in the Netherlands?

According to the findings of this thesis, SES and shift work explained a little part of the ethnic differences in sleep duration. Ethnic minority groups have low educational levels, low employment, more often do shift work. These factors are recognized drivers of short sleep duration among ethnic minority groups, and have been discussed in the various chapters of this thesis. Similarly, other studies have shown that low SES and shift work are common among ethnic minority groups, and are among the reasons for increased prevalence of short sleep [15-19]. Our findings therefore partly agree with these studies. Additional factors, found as potential reasons for increased prevalence of short sleep among ethnic minority groups include cultural factors such as co-sleeping, disregard for napping, and the belief that hardworking and successful people require short sleep [20, 21], environmental factors such as noise, light, poor air quality/pollution, temperature [22,23,24], unsafe residential quarters/disadvantaged neighborhoods [25], acculturation [7], immigration (leaving one’s country to reside in a different country) [26],
stress [27], use of electronic devices in the hour before bedtime, household size [28,29, 20,30], genetics and perceived discrimination [31]. Although these have not been studied in this thesis, they might be hypothesized part of the observed inequalities in sleep patterns.

A potential explanatory factor that has been studied in this thesis is depression (Chapter 7). Depressed mood was consistently associated with the prevalence of short sleep in all ethnic groups, and accounted substantially for the prevalence of short sleep in all ethnic groups; and long sleep especially in Moroccans and Dutch groups. This finding highlights depression, as relevant in ethnic inequalities in sleep patterns.

Also migration itself could be a factor to reckon with for increased prevalence of short sleep among ethnic minority groups [26], but this has not been clearly explained in literature. Does it mean that exposure to different environment as a result of migration may potentially alter the circadian rhythm? For instance, a recent study conducted in South Africa showed that European South Africans reported shorter sleep than other population groups consisting of native Africans, Indians/Asian Africans, and multi-ancestral groups [32]. These findings may suggest that the notion that non-European groups sleep shorter than Europeans may not always hold true. The question arises as to whether migration has a significant role to play in differences in sleep patterns among migrant/ethnic groups, for European South-Africans have at some point migrated to South Africa. Or could it be that the stress associated with migration, as reported in earlier studies [27], may have influenced the sleep patterns of migrants, irrespective of their ethnic background? Or could it be that changes in circadian rhythm is influenced when people migrate to another country? Yet, previous study has shown that American Indians sleep shorter than European Americans [33], indicating that some unmeasured factors may play a role. Further studies should unravel the potential role of migration and stress on differences in sleep patterns among various ethnic groups.

**How important is sleep for ethnic inequalities in health?**

This thesis showed a clear difference in sleep patterns among various ethnic groups, such that all ethnic minority groups sleep shorter than their Dutch counterparts in both adults and preschool children in both males and females. This finding is consistent with previous studies in the U.S.
which also reported shorter sleep duration among ethnic minority groups than White Americans [34]. The question arises as to what this findings actually mean for ethnic inequalities in health. This thesis attempted to address this questions in the findings of chapter 6 and 5 respectively, with results showing that short sleep was consistently associated with CVD in all the ethnic groups, and partly associated with CVD risk factors in specific ethnic groups respectively. These novel findings seem to suggest that ethnic minority groups with increased prevalence of short sleep may be more prone to develop CVD. In addition, we studied to what extent short sleep contributed to the observed ethnic inequalities in CVD. We have shown that sleep alone statistically accounted for 5-15%, to the ethnic differences in CVD, suggesting that the prevalence of CVD could be reduced by these amounts if short sleep was eliminated. This finding that sleep, independent of other CVD risk factors accounted for ethnic differences in CVD is very crucial, judging from the general beliefs of people that sleep affects CVD through these conventional CVD risk factors. Again, considering the many intervention studies focusing on obesity, diabetes, hypertension, dyslipidaemia, and certain health behaviours for the management or prevention of CVD in various populations, does it mean that giving a similar attention to sleep could result in a better management/prevention of CVD compared to the former? These are potential questions which future research may address.

Is sleep an important entry point for reducing health inequalities?

A thorough examination of the results of studies presented in this thesis showed that the results offer supportive evidence that sleep is a novel risk factor of CVD among various ethnic minority groups. Evidence from other studies have shown that by improving sleep, cardiovascular health might improve. For instance, a preliminary data which suggested that sleep extension may have the potential to improve cardiovascular risk factors has been reported [35]. For example, in a small pilot study in which 22 subjects with prehypertension and sleep duration of <7 hours per night were randomized to sleep extension or maintenance groups, with the aim of increasing sleep duration by 1 hour over 6 weeks. The result showed that though, there was a reduction in blood pressure in both groups, it was greater in the group randomized to sleep extension although the difference was not statistically significant [35]. Also, results from a recent study has shown...
that improving sleep by treating sleep related disorder such as insomnia led to a decrease in participant’s blood pressure [36]. For example, in a study in which patients with insomnia and coronary heart disease (CHD) were randomized to 6 weeks of web-based cognitive behavioral therapy – wCBT-1 (You go to sleep) group compared with 6 weeks of a sleep education website, followed by wCBT-1 access (control group), the researchers found a 2.9mm/Hg ± 19.2 reduction in systolic blood pressure in the treatment group compared to 0.6mm/Hg ± 6.6 increase in the control group. This suggests that improving sleep via wCBT improved both insomnia and blood pressure in patients with comorbid CHD, indicating how improved sleep may lead to improving adverse health outcomes. From the results of this thesis, promoting a healthy sleep pattern in ethnic minority groups could be expected to help in reducing ethnic inequalities in CVD and risk factors. This, in combination with the intervention studies showing an effect of sleep in improving health outcomes, clearly indicate that sleep may serve as entry point to reducing health inequalities. In other words, measures aiming to reduce ethnic inequalities in health outcomes, including CVD and risk factors therefore should include improvement in healthy sleep, as supported by the results in this thesis.

When promoting healthy sleep patterns in these groups it is of course important to consider the living condition of the people. Situations where ethnic minority groups live in crowded homes [30], poor neighbourhood/environments [25], and poor lifestyles should be improved. Improvement of these factor may have positive impact on sleep health and subsequent effect on health outcomes.

IMPLICATIONS FOR PUBLIC HEALTH AND RECOMMENDATIONS FOR FUTURE RESEARCH

Implications for public health (policy and practice)

The public health burden of sleep short sleep is immense [37, 38, 39, 40, 41], as can be partly attested from the findings in this thesis which revealed impending adverse health outcome among ethnic minority groups that may result from short sleep. The findings that all ethnic minority groups reported shorter sleep duration than ethnic Dutch in both men and women, and in preschool children revealed a relevant aspect of unhealthy behavior among ethnic minority groups. As a result of the high prevalence of short sleep
among ethnic minority groups, they are likely to become more exposed to potential adverse health outcomes associated with short sleep duration. To avoid this unwanted development, there is the need for an urgent call for action so as to avert (if not eliminate) eventual consequences in the future.

When compared with other risk factors such as smoking, excess consumption of alcohol, physical activity and obesity which have been giving much priority, sleep received less or no attention in the public health sphere and clinical settings. The reason is not far-fetched, and is primarily due to lack of awareness as sleep problems and sleep disorders are usually undiagnosed [42,43,44]. Lack of awareness among the general public, and ethnic minority groups in particular, concerning sleep health creates a lacuna of knowledge about adverse health impacts of short sleep, and the required amount of sleep needed for optimal health [39]. Also health care providers and health care professionals often do not give counselling to their patients about healthy sleep habits [45]. In addition, sleep is not usually included in health screenings as opposed to other health behaviour such as smoking, alcohol consumption, physical activity and healthy eating [40]. Exclusion of sleep in screening programmes may be related with clinician`s and public health professionals lack of knowledge of the importance of sleep [46]. This lack of knowledge often exposes ethnic minority groups to potential risks of diseases attributed to short sleep, and this has the overriding effects of further worsening their health, as ethnic minority groups already have increased prevalence of CVD and risk factors. It is therefore necessary to create public awareness effective enough to inform and inculcate the need for a change to a healthy behavior towards sleep health. I would suggest the use of strategies involving public education and enlightenment campaigns. This can be carried out at national, local and community levels (including churches); and also in colleges, universities and work places. Parents can also transfer the knowledge to their children by ensuring that they achieve sufficient healthy sleep which is very important for mental development and improved academic performance. Also, health care providers should not focus only on patients known medical conditions during consultation, but also they should inquire about sleep problems as patients themselves, do not seem to recognize and discuss the potential of their poor sleep habits. In addition, there is also the need to further identify specific determinants of poor sleep in low-income populations/minority groups for instance, by focusing on factors operating in households and work places, and behaviours that influence parents and their children which might make them vulnerable to having short sleep. Moreover, there is the need for
more standardized sleep health interventional studies to demonstrate the modifiable role of sleep in health disparities among ethnic groups, especially at grassroots levels, as exemplified by Jean-Louis and colleagues [47] whose community-based intervention tagged “culturally-tailored education/approach” create awareness about sleep health through interactive campaign, for example, in a church congregation or in schools, barber shops, beauty salons, etc. whereby, factors that interfere with healthy sleep were discussed, accompanied by counselling and suggesting ways for improvement. People could also be recruited for focus group discussion concerning sleep health. Other ways of creating awareness is via educational by means of website where relevant information about sleep shall be disseminated. Awareness could also be provided by distributing relevant information about sleep through various media, such as TV, radios, and other social networks.

Another recommendation is to embark on sleep screening exercise so as to identify individuals with symptoms associated with sleep-related problems, and who may be at risk of possible adverse health outcomes related with sleep. Finally, stakeholders such as general practitioners can ask questions relating to sleep habits of patients and giving the necessary counsel where applicable.

Implications for future research

With few exceptions, most research involving ethnic disparities in sleep and its association with CVD and risk factors were conducted with the use of cross-sectional data. Studies in this thesis also used cross-sectional data which makes it difficult to present a proof of causality. So far, the data on previous longitudinal studies were based on European populations. Therefore, there is a need to conduct further similar studies with longitudinal data among ethnic minority groups especially in Europe since the determinants may differ due to cultural factors. The studies shall also offer more supportive evidence for our results in demonstrating causality for the relationship between sleep and CVD and risk factors. Most population-based studies on sleep, including this thesis relied on self-reported data that may introduce recall bias, in which case, number of hours of sleep may have been inaccurately reported. Future studies should consider the use of objective sleep measurement obtained with actigraphy, polysomnography (PSG) and electroencephalography (EEG) which are not influenced by recall bias. Additionally, PSG equally provide information about quality of sleep, and
other aspects such as sleep timing and variability. If possible, future studies can combine both subjective and objective measurements in order to make room for easy comparisons of results. Also there is the need to standardize the measurement of sleep duration as well as other sleep characteristics used for the studies.

Other factors such as, environmental factors, acculturation, and generation type (first or second generation) of ethnic groups, all of which may affect sleep duration [7, 48], but which were not taken into account in this thesis, should be considered in future studies. Environmental factors such as place of residence, noise, pollution, temperature may differ among ethnic minority groups, and may have different impact on sleep duration, and could mediate the observed associations of sleep with CVD and risk factors. It is equally important to identify other unmeasured confounders and introduce them during analysis so as to further comprehend the extent sleep duration is related with CVD and risk factors, and its usefulness as a possible target for public health intervention. It is therefore recommended that future studies include these factors in their analysis.

Interventional studies are also necessary to examine the extent by which the prevalence of CVD and risk factors could be reduced with improved sleep duration in ethnic minority populations in particular. Such intervention studies should consider in its inclusion, all other factors that improve lifestyle such as diet and physical activity which, alongside improved sleep, would assist to realize the overall health improvement. In addition, the factors that might be particularly important in shaping sleep patterns in ethnic minority populations, such as crowded housing conditions, shift work and depression, should be taken into account. A recent intervention study has been successfully conducted for promoting awareness about sleep and sleep-related disorders in African American community-based settings [49]. The study, which made use of tailored website for promoting awareness about sleep and sleep-related disorders among African American in a community-based settings included the use of visuals, key messages, video narratives, in-depth interviews, usability procedures and brief surveys; reported that this tailored approach instilled in participants, knowledge on improving sleep, and it also has potential for serving as a tool for advancing health equity [49]. This method could also be employed to address the problem of awareness among ethnic minority groups discussed in Europe. In addition, since there exists some similarities in sleep patterns, and association of short sleep with obesity/overweight between adults and preschool children of
some ethnic groups as demonstrated in our study, it may be a good idea to develop a family intervention strategy that would integrate both adults and preschool children, taking into account these common determinants of short sleep among ethnic groups.

**Overall conclusion**

This thesis has ushered in new information/knowledge about sleep health and its related adverse health outcomes observed among various ethnic groups resident in the Netherlands. Based on the results in this thesis, it can be concluded that all ethnic minority groups, on average, reported shorter sleep duration than ethnic Dutch in both men and women, and among preschool children. Short sleep was associated with CVD and risk factors (obesity, diabetes, hypertension and dyslipidaemia), and contributed significantly to ethnic inequalities in CVD independently of other well-known CVD risk factors. The observed high prevalence of short sleep among ethnic minority groups, and its association/relationship with CVD and risk factors revealed an important consequence pattern of health behaviour with likely concomitant adverse consequences, and which may predispose to unwanted health outcomes. There is a need to provide the necessary information to the public, to guard and ensure healthy sleep patterns. Applying proper and effective strategy with major attention, paid to ethnic minority groups could help to disseminate this knowledge. This could be followed by carrying out intervention studies designed to address the impending problems of short sleep. If successfully executed, part of the increased prevalence of CVD and risk factors, attribute to sleep would be reduced, hence leading to better health. It is also important to consider the inclusion of sleep when designing intervention studies for CVD and risk factors, taking adverse living conditions that shape sleep patterns into account.
REFERENCES


