SUMMARY
Summary
Advances in technology along with ‘grey ing’ of our population, as well as changes in the ethnic and gender composition of our workforce have influenced the work setting dramatically. Moreover, other forms of employment have been implemented over the last decade such as teleworking, temporary work and part-time work. These changes have made working life more challenging and poses a strong demand on the cycle of rest and recovery of employees. Need for recovery (NFR) represents the short-term effects of a day at work and is described as the need to recuperate and unwind from work-induced effort. Incomplete recovery is more likely to occur in jobs with high work load, long working days and low control. Insufficient recovery has been associated with an increased risk of developing a burn-out, cardiovascular diseases and musculoskeletal disorders. Given that adequate recovery from work is important to protect workers’ health and well-being, there is a strong need to develop interventions to reduce the need for recovery (NFR) (chapter 1).

The main objectives of this thesis were (1) to investigate associations between the NFR and overweight/obesity, self-perceived health, physical activity, detachment and relaxation during and after a workday (chapter 2 and 3); (2) to systematically develop and describe the design of a worksite social and physical environmental intervention program for office employees to reduce the NFR (chapter 4); (3) to investigate the measurement properties of the Detachment and Relaxation At Work (DRAW) scale (chapter 5) and to assess the responsiveness of the Individual Work Performance Questionnaire (IWPQ) (chapter 6); (4) to evaluate the process of implementation of the worksite social and physical environmental intervention program (chapter 7); and (5) to study the (cost-) effectiveness of the worksite social and physical environmental intervention program (chapter 8, 9, 10). In chapter 11, the results of this thesis were summarized and discussed.

Objective 1: Associations between NFR and several outcome variables

With both a high NFR and overweight/obesity being a potential burden for organizations (i.e., productivity loss and sickness absence), the aim was to investigate associations between overweight/obesity and several other health measures (general health, mental health, sleep quality, stress and vitality) with the NFR (Chapter 2). For this, baseline data of a randomised controlled trial aimed at improving the NFR (the
Summary

Be Active & Relax study) in 412 office employees at a financial service provider were used. The study showed a significant positive association between stress and NFR. General health, mental health, sleep quality and vitality were negatively associated with NFR. Analyses also showed a significant positive association between obesity and NFR, but not between overweight and NFR. Our findings confirmed our hypotheses that obesity is associated with a high NFR and that health measures indicating a better health are associated with a lower NFR.
Research on NFR has mainly focussed on engaging in activities for recovery after work. However, breaks during work are essential to restore personal resources for future demands. A break during work can be in the form of physical activity, relaxation or both; e.g., taking a walk or having a coffee with colleagues. In Chapter 3, an association between during and after work hours physical activity and relaxation and the NFR was described. Results showed that a lower NFR was independently associated with a higher frequency of stair climbing, more minutes spent in leisure activities, more detachment at work, more physical detachment at work, and more detachment and relaxation at home.

Objective 2: Design program
The structured development and design of a worksite social and physical environmental intervention (i.e., the Be Active & Relax study) to improve the NFR was outlined in chapter 4. The intervention was systematically developed, based on parts of the Intervention Mapping (IM) protocol. A blueprint of the environmental interventions was developed in close cooperation with the employees and by combining scientific evidence with practice-based information of the target population. Key determinants for physical activity (e.g., attitude, subjective norm, perceived barriers) and relaxation (e.g., awareness, attitude, subjective norm) were derived from the target population. Following the principles of the IM protocol, the first step resulted in two program objectives to improve the NFR: (1) to increase physical activity during work hours; (2) to increase relaxation during work hours. Additionally, the best methods were selected to improve physical activity and relaxation during work hours. Methods as self-regulation, self-monitoring, mobilizing social support, reinforcement, goal setting and environmental changes were applied for improving the determinants of daily
physical activity and relaxation. Then strategies were selected for these determinants and methods, including Group Motivational Interviewing (GMI). Another strategy was to modify the environment.

The program was evaluated using a 2x2 modified factorial design. The two factors were (1) a social environmental intervention and (2) a physical environmental intervention, of which the social environmental intervention was randomised at department level and the physical environmental intervention was stratified at department level, i.e., one stratum with environmental modifications and the other stratum without environmental modifications. The social environmental intervention consisted of Group Motivational Interviewing (GMI), led by the teamleaders, and was supported by a social media platform. GMI is a counseling method that focuses on behavioural change in groups and is derived from Motivational Interviewing at the individual level. We developed a two-day GMI-training, four GMI-sessions with employees, and supporting materials which were all pilot tested with intended users (teamleaders of another division of the financial service provider). The physical environmental intervention consisted of several environmental modifications (i.e., modifications in coffee corners, table tennis, lounge chairs, sitting balls, standing meeting tables and footsteps). Due to time and budget constraints, the environmental modifications were not pilot-tested. The program consisted of four research groups: (1) combined social environmental and physical environmental intervention group; (2) social environmental intervention group; (3) physical environmental intervention group; (4) no intervention group (control group). Questionnaire data on the primary outcome (NFR) and secondary outcomes (physical activity, sedentary behaviour, relaxation/detachment, work- and health-related factors) was gathered at baseline (T0), at 6 months (T1), and at 12 months (T2) follow-up. In addition, an economic and a process evaluation was performed.

**Objective 3: Measurement properties DRAW and responsiveness IWPQ**

Previous research has focused mainly on recovery after the workday. As the short-term benefits of within workday breaks are restorative, refreshing and energizing, making breaks with sufficient detachment and relaxation part of the workday could have positive spill-over effects to after workday recovery. A questionnaire that measures
detachment and relaxation within a workday was not available yet. Therefore, we adapted the subscales detachment and relaxation from the Recovery Experience Questionnaire (i.e., instruction and response categories) into a within workday context: the Detachment And Relaxation At Work (DRAW) scale. This scale consists of four subscales: within workday detachment, within workday relaxation, after workday detachment and after workday relaxation, of which the measurement properties had to be tested. In Chapter 5, the evaluation of the measurement properties of the DRAW scale was described, i.e., the internal consistency, floor- and ceiling effects, test-retest reliability, construct validity and responsiveness (using data from the Be Active & Relax study). For test-retest reliability, 121 participants completed the DRAW scale twice within 5-7 days. A 4-factor model fitted the data (i.e., Confirmatory Factor Analysis). The internal consistency (Cronbach’s alpha) ranged from 0.87-0.94. The Intraclass Correlation Coefficient for test-retest reliability ranged from 0.57-0.84. In the present study, a priori hypotheses were formulated for each of the four subscales based on three general assumptions. First, we hypothesized moderate ($r: 0.30-0.50$) correlations between the DRAW scale and related questionnaires. Second, we hypothesized weak ($r<0.30$) correlations between the DRAW scale and more distantly related questionnaires. Third, as the DRAW scale was expected to be most closely related to the NFR, we hypothesized that correlations between the DRAW scale and the NFR should be higher than correlations between the DRAW scale and exhaustion, vigour, absorption, and dedication. The same hypotheses and three general assumptions formulated for construct validity were applied to measure responsiveness. It was revealed that all four subscales of the DRAW scale were internally consistent, reliable and had moderate (50-75% confirmed hypotheses) construct validity. Results for responsiveness were disappointing for within workday detachment and relaxation (<25% confirmed hypotheses), and moderate (50-75% confirmed hypotheses) for after workday detachment and relaxation. For now, the scale does not seem to be responsive enough and therefore should not be used in the current format in intervention studies. Further research is needed to improve the items to enhance responsiveness. Individual work performance, defined as “employee behaviours or actions that are relevant to the goals of the organization”, is an important outcome measure in studies focusing at the workplace. Nevertheless,
its conceptualization and measurement has proven to be challenging. For this the Individual Work Performance Questionnaire (IWPQ) was developed. In chapter 6, the responsiveness of the IWPQ was described. Data were used from the Be Active & Relax randomised controlled trial. In total, 39 hypotheses were formulated concerning correlations between changes in the IWPQ scales and changes in similar constructs (e.g., presenteeism) and distinct constructs (e.g., NFR) used in the trial. In total, 260 Participants completed the IWPQ at both baseline and 12 months of follow-up. For the IWPQ scales, 23% (task performance) 15% (contextual performance), and 38% (counterproductive work behavior) of the hypotheses could be confirmed. However, in general, the correlations between change scores were weaker than expected. These weaker than expected correlations may be accounted for by characteristics of the intervention study, such as the relatively healthy, well-functioning study population, and the fact that the intervention was not primarily aimed at individual work performance. Based on the results of this study, no firm conclusions can be drawn about the responsiveness of the IWPQ.

Objective 4: Process evaluation program
Within an organization, various factors can influence the implementation of an intervention, such as organizational readiness to change, individual and organizational competence, and manager’s and employee’s attitude towards the intervention. It is therefore highly recommended to conduct a process evaluation to investigate the course of the implementation of a worksite social and physical environmental intervention. Until now, literature on a process evaluation is sparse when it concerns combining both social and physical environmental interventions. Chapter 7 presented the process evaluation. The process evaluation was conducted based on the framework of Steckler and Linnan (15). The following process components were measured; context (organizational factors and support that may influence implementation of the intervention), recruitment (procedure and number of higher management, teamleaders and employees that is approached), dose delivered (extent to which the interventions were delivered to teamleaders and employees (%)), fidelity (extent to which the interventions were implemented according to the protocol (%)), reach (percentage of teamleaders and employees
that respectively attended or used the interventions at least once), dose received (frequency of use of each intervention component by teamleaders and employees), satisfaction (teamleaders’ and employees’ satisfaction with the intervention on a 0-10 scale) and barriers (percentage of teamleaders and employees that scored yes on predefined categories of barriers). The reach for the social and physical environmental interventions ranged between 45-75% and was considered to be reasonable, compared to other workplace health promotion programs (mostly below 50%). Mean satisfaction for the social environmental intervention was 6.0, for the physical environmental intervention 7.0 and for the combined intervention 6.9 on a 0-10 scale. A significant higher overall rating for the GMI-sessions was given by teamleaders compared to employees. Mean dose delivered was 92% in the social environmental intervention group and 88% in the physical environmental intervention group. Although the delivery of our interventions was less than 100%, we considered the dose delivered as acceptable, although there remains room for improvement. Fidelity was 83% in the social environmental intervention group and 60% in the physical environmental group. During the present study, the intervention protocol was slightly adjusted several times with the aim to improve the implementation. This was the case especially for the physical environmental intervention, because some practical issues had to be solved at the spot, e.g., the plant in the coffee corner needed more light and the tennis table was transferred to another floor due to noise overload. Further, the social media platform was not implemented well, i.e., several constraints were mentioned; e.g., no time available, lack of integration of the platform with organizational policy and lack of knowledge about how to use the platform. From this process evaluation, two main lessons can be learned: 1. Not only during the development but also during the implementation, both teamleaders and employees should be involved. 2. It seems beneficial to add a social environmental intervention to a physical environmental intervention to better embed the physical environmental intervention.

**Objective 5: (Cost)- Effectiveness program**

Chapter 8 and 9 presented the effect evaluation of the worksite social and physical environmental intervention. A total of 19 departments (412 employees) participated
in the trial (i.e., the Be Active & Relax study). The randomisation procedure allocated 92 employees (of three departments) to the combined intervention, 118 employees (of seven departments) to the social environmental intervention, 96 employees (of three departments) to the physical environmental intervention and 106 employees (of six departments) to the control group. Since randomisation was at department level, the groups were not equal in size. After 12 months, the loss-to-follow up was 20% (329 participants completed the data for the primary outcome measure i.e., NFR). It was hypothesized that the combined intervention would be more effective than the separate interventions compared to the control group. Multilevel analyses were performed to investigate the effects of the three interventions compared to the control group separately. In Chapter 8 we concluded that none of the interventions was effective in improving the NFR. It should however be noted that the combined intervention revealed a nearly significant result with (-6.8; 95%CI -14.0 to 0.4; based on Maximum Likelihood). We did find that in the combined environmental intervention group, exhaustion and minutes spent in vigorous physical activities decreased significantly, and that the number of small breaks at work and minutes spent in active commuting increased significantly compared to the control group. The social environmental intervention group showed a significant reduction in exhaustion, minutes spent sedentary at work and a significant increase in the number of small breaks at work and minutes spent in leisure activities compared to the control group. In the physical environmental intervention group, frequency of stair climbing at work and minutes spent in active commuting significantly increased, and minutes spent sedentary at work decreased significantly compared to the control group. Chapter 9 described the results of the effectiveness of the social and physical environmental intervention on presenteeism, absenteeism, work performance (i.e., task performance, contextual performance, and counterproductive work behaviour) and work engagement (i.e., vigour, dedication, and absorption). The combined intervention showed a decrease in contextual performance and dedication. The social environmental intervention showed an improvement in task performance. The physical environmental intervention was associated with an improvement in absorption.
Generally, resources for worksite health promotion programs are scarce. Therefore, company decision makers are not just interested in the effectiveness of such interventions, but also in their resource implications in terms of time, effort and money. As such, evidence is needed on the cost-effectiveness and/or cost-benefit of the social and physical environmental intervention which was described in chapter 10. Data on NFR, general vitality, and job satisfaction were collected at baseline, six, and 12 months. Salary and sickness absence data were collected from company records. Data on healthcare utilization and expenses on sports memberships, sports equipment and active commuting equipment were collected using 3-monthly questionnaires. Using linear multilevel analyses, cost-effectiveness analyses were conducted from the societal and employer’s perspective, and return-on-investment analyses from that of the employer. Uncertainty was assessed using bootstrapping techniques, and shown in cost-effectiveness planes and cost-effectiveness acceptability curves. At 12 months, combined intervention group participants significantly improved their NFR compared to the control group (-8.4; 95%CI -14.6 to -2.2; based on Multiple Imputation). For NFR, the combined intervention became the preferred option in comparison with the other interventions at willingness-to-pay values of € 170 (societal perspective) and € 300 (employer’s perspective) per point improvement, after which its probability of cost-effectiveness gradually increased to 0.85. Whether the combined intervention can be regarded as cost-effective in improving NFR from both the societal and employer’s perspective depends on the respective decision-makers’ willingness-to-pay per point improvement, as well as the probability of cost-effectiveness that they consider acceptable. Both separate interventions were not cost-effective in improving this outcome. Moreover, all interventions were neither cost-effective in improving general vitality (societal perspective) and job satisfaction (employer’s perspective), nor cost saving to the employer.

Finally, chapter 11 presented the general discussion. First, the main findings are discussed in light of each study objective. Further, reflections on the findings are given by discussing methodological issues and the possibilities of a program and/or theory failure.
Main conclusions that can be derived from this thesis are:

1. The social and physical environmental interventions were not able to induce significant effects on the primary outcome measure NFR in office employees compared to the control group. Although, we did find a non-significant trend in the reduction of the NFR among all intervention groups.

2. Compared to the control group, significant intervention effects were found for that participants were less exhausted, improved their task performance, improved their absorption in work, took more small breaks, increased their active commuting time, took more frequently the stairs at work, reduced their time spent sedentary at work, and increased their time spent in leisure activities. Unexpected significant intervention effects were found for that participants reduced their time spent in vigorous physical activities, reduced their contextual performance and reduced their dedication.

3. Depending on the decision-makers’ willingness-to-pay and the probability of cost-effectiveness that they consider acceptable, the combined intervention may be considered cost-effective in improving the NFR. Further, all interventions were neither cost-effective in improving general vitality (societal perspective) and job satisfaction (employer’s perspective), nor cost saving to the employer.

Implementation of the social and physical environmental intervention in its current form is not recommended. Several recommendations for research and practice are given to possibly improve its effectiveness in the future (see framework following page).
### Summary

#### Design study (Chapter 4)

<table>
<thead>
<tr>
<th>Group</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Combined social and physical environmental group</td>
<td>3 departments, 92 employees</td>
</tr>
<tr>
<td>2. Social environmental group*</td>
<td>7 departments, 118 employees</td>
</tr>
<tr>
<td>3. Physical environmental group*</td>
<td>3 departments, 96 employees</td>
</tr>
<tr>
<td>4. Control group</td>
<td>6 departments, 106 employees</td>
</tr>
</tbody>
</table>

#### Results compared to control group (Chapter 8, 9 & 10)

- More small breaks
- Reduced exhaustion
- More walking/cycling to work
- Less vigorous physical activity
- Reduced contextual performance
- Reduced dedication work
- More walking/stairs at work
- Reduced sedentary time at work
- More leisure activities
- Higher task performance
- More absorption in work

#### Recommendations (Chapter 11)

- Development of a reliable, valid and responsive measurement instrument for detachment and relaxation during work hours (+ objective measurement)
- Development uniform guideline to measure responsiveness
- Objective measurement of physical activity and sedentary behavior (accelerometer/heart rate/gps)
- Collection and application of (qualitative) information from supervisors/employees during implementation
- Investigate the effectiveness of interventions among a high-risk population (a high need for recovery)
- Investigate the effectiveness among subgroups (i.e., age and education) using Quint
- Better understanding of non-economic benefits of a lifestyle program

#### Science

- For implementation, company's structures and procedures should be considered (i.e., HR department could be of help)
- Improve skills of employees/supervisors to follow or to deliver lifestyle program
- Integration of health program into daily operations line managers and link health objectives to business objectives
- Employing groups paradigm (i.e., focus group interviews/group training) for developing and implementing lifestyle programs
- Higher frequency of GMI-sessions + better integration of social media platform (e.g., Facebook & Twitter)
- More drastic physical environmental adaptations (e.g., restructuring entire department)

#### Practice

- Social environmental program* = Group Motivational Interviewing (GMI) on physical activity and relaxation given by supervisor supported by a social media platform; Physical environmental program = i.e., modifications in coffee corners, table tennis, lounge chairs, sitting balls, standing meeting tables and footsteps.

---

*Overall:*
- Non-significant reduction in need for recovery in all intervention groups.
- Cost-effectiveness of combined group depends on decision-makers' willingness to pay per point improvement in need for recovery.
- Implementation of the program in its current form is not recommended.