Towards improving workers’ health by matching work and workers
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Summary
From an occupational health perspective, the match between work and workers was the central topic in this thesis. The term ‘work’ was used to encompass a combination of physical, mental and psychosocial work demands. The term ‘workers’ represents the resources of workers, in terms of physical, psychological and social capacities, health status and age.

Studying the match between work and workers is essential for identifying highly demanding jobs requiring special requirements of the worker, and for identifying workers with specific health complaints, their associated impairments and desired adjustments. Identifying highly demanding jobs and work-related health complaints gives the opportunity to take preventive measures in the work situation in order to maintain workers’ health in their job, avoiding both increased risk of work-related complaints and an increasing burden of costs associated with health care, absenteeism and early retirement. The objective of this thesis was to gain knowledge on the match between work and workers in specific physically and mentally demanding work settings and specific worker populations (i.e. workers with disabilities and workers of different age groups).

The following research questions have been formulated:

1. Do work and workers match in specific work settings?
   a. Do physical work demands of specific physically demanding jobs exceed health guidelines?
   b. What psychological and cognitive requirements of workers match the mental demands of a specific job?

2. Do workers and work match in specific worker populations?
   c. Do the physical, psychological and social work capacities of workers with disabilities match their work demands?
   d. Are age-specific preventive measures desired to optimise the match between workers and work?
      i. Are age-specific differences found in musculoskeletal complaints, related work impairment and desirable adjustments in work?
      ii. Are age-specific differences found in the association between psychosocial work aspects and psychological health complaints?

3. To what extent does self-reporting of work-related illness match with expert assessment?
1. Do work and workers match in different work settings?

In the work setting of a Dutch railway company, some specific high physical and high mental demands were found, resulting in high risk for mismatches between work aspects and workers’ resources (Chapter 2) and specific requirements to match the job are defined (Chapter 3).

In Chapter 2, train conductors (n=36) and service electricians (n=41) were observed with the Task Recording and Analysis on Computer (TRAC) observation system, which provides real-time data on the duration and frequency of tasks, activities and body postures during work. It appeared that train conductors and service electricians were exposed to some high physical work demands. It was observed that train conductors were standing for 177 minutes on average during a working day, with seventy-five percent of this time being spent in a moving train, with frequent occurrences of disturbance of body balance due to the unexpected lateral movement of the train. Furthermore, train conductors were on average climbing 249 flights of stairs per day, with varied numbers of steps. The job of train conductors appeared to exceed health guidelines regarding the duration of standing and the frequency of climbing a flight of stairs, resulting in an increased risk of developing musculoskeletal complaints in the knees and hips. Service electricians were in a standing position for 264 minutes on average per working day. Additionally, service electricians were estimated to be kneeling and squatting for an average of 37 minutes, assume positions involving neck flexion for 60 minutes, to be working with their hands above shoulder height for 65 minutes and to climb a flight of stairs (consisting of at least three steps) 258 times each working day. Therefore, the job of service electricians also appeared to exceed health guidelines, e.g., duration of standing, the frequency of climbing a flight of stairs, kneeling and squatting and working in awkward postures, which are all risk factors for developing musculoskeletal complaints in knees, hips and shoulders.

In Chapter 3, a literature review was performed to assess the psychological work demands of train drivers and to define the psychological and cognitive requirements for their job. Emotional and mental demands seemed to be high and train drivers had low autonomy and skill discretion. In general, the fatigue complaints and need for recovery after work were of average levels compared to other jobs. However, severe sleepiness and high need for recovery were present in a considerable proportion of train drivers and this can cause changes in driving behaviour and driver errors. Therefore, some specific psychological requirements for train drivers were suggested for performing their job adequately and
safely. These suggestions include the ability to stay alert for long periods during a working day, to perceive, to interpret, to recognize, to anticipate and to act on environmental signals in specific situations. Furthermore, train drivers should have the ability to work in a concentrated manner, perform their work accurately and memorise relevant safety information. Selective, divided and sustained attention are required and the drivers should be capable of coping with emotional demands, low decision latitude and a solitary environment. Finally, they must have the ability to deal with and recover from feelings of fatigue.

2. Do workers and work match in different worker populations?
In the specific worker populations of workers with chronic disabilities (Chapter 4) and workers of different age groups (Chapter 5, 6), both matches and mismatches were found. The assessment of workers’ capacities and work demands provided useful information to assess whether workers with chronic disabilities can be placed and can continue to work in specific jobs while remaining healthy. Furthermore, age-specific differences were found in the association between work and health complaints.

In Chapter 4, it was investigated whether employees (n=46) with disabilities of a sheltered workshop were initially assigned to jobs with physical and psychological/social work demands that matched their physical and psychosocial work capacities at the moment of job placement. The employees underwent a post-offer and pre-placement assessment of work capacities, which was performed by occupational therapists. During the two days of the assessment, the instruments Ergo-Kit (EK) and the Melba-capacity-profile are used to assess physical and psychological/social capacities of employees. To investigate whether these employees were initially assigned to jobs that matched their capacities at the moment of job placement, the work demands of their first jobs were determined by performing workplace assessments using TRAC and the Melba-demands-profile. Matches between work capacities and work demands were found, but a considerable proportion of cases of under- and overload on specific physical activities and psychological/social characteristics were seen as well. The mismatches in terms of underload were mainly found in relatively low demanding physical activities (finger dexterity and manipulation) and psychological/social characteristics (speaking, reading and writing), in which underload do not seem harmful. Physical overload was most often due to activities involving lower weight lifting, middle weight lifting and standing. More than 90% of the employees showed overload on one or more psychological/social characteristics, most
often occurring on the characteristics of work execution (endurance, critical control and carefulness).

In Chapter 5 and 6 secondary analyses were performed on data derived from a large workload study among employees (n=2021) of different age groups, working for one large Dutch railway company.

In Chapter 5, differences between employees of four age groups (22-35, 36-45, 46-55 and 56-66 years) were calculated for musculoskeletal complaints in body regions, the resulting work impairment, and the desirable and feasible adjustments in their own work situation. Age-specific differences were found in the occurrence of musculoskeletal complaints, related work impairments and desirable adjustments in work. Age turned out to be relevant in musculoskeletal complaints in the neck, arm and at least one other body region, being most prevalent in the group of 46-55 year-olds. Age was also relevant for the reported impairments in work due to the musculoskeletal complaints for lower back complaints, occurring most often in the oldest age group. Regarding adjustments in work, proportionally more of the youngest employees with musculoskeletal complaints found it desirable and feasible to switch to another job in the company, whereas proportionally more employees in the oldest age group found it desirable and feasible to work fewer days per week.

In Chapter 6, the association between psychosocial workload and psychological health complaints in different age groups was explored. Age-specific differences were found in the association between some psychosocial work aspects and psychological health complaints. In the two youngest groups of employees, worse emotional workload was associated with a significant higher risk of having psychological complaints (OR = 5 for work-related fatigue, OR = 7 for stress and OR = 34 for burnout). In the two oldest groups of employees, lack of social support from both colleagues and supervisor was associated with a significant higher risk of having psychological health complaints (ORs = 3-4 for work-related fatigue, OR = 4 for stress and ORs = 3-6 for burnout).

3. To what extent does self-reporting of work-related illness match with expert assessment?

The match between workers’ self-report and an expert assessment of a health condition was found to be low to moderate. Little evidence has been published on the match between self-report and expert assessment of the work-relatedness of a health condition.
In **Chapter 7**, the diagnostic accuracy of the self-report of work-related illness as an indicator for the presence of a work-related disease as assessed by an expert, usually a physician, using clinical examination with or without further testing in working populations, was assessed performing a systematic literature review. Thirty-two studies were found that compared self-report of a health condition with expert opinion. The agreement was mainly low to moderate and the sensitivity and specificity highly variable. Only four studies were found in which workers were explicitly asked to self-assess the work-relatedness of their self-reported illness or symptoms, showing low to moderate agreement with expert assessment. The health condition, type of questionnaire, and the case definitions for both self-report and reference standards seem to have influenced the results of validation studies that were performed.

In **Chapter 8**, the main findings were described and discussed. Furthermore, methodological considerations and the interpretation of findings were presented.

Our studies and results may serve as examples of population-specific and work setting-specific research and may encourage this type of research in other industries to gain insight into the match between work and worker. Assessment of work demands was useful in order to examine whether health guidelines were exceeded and to encourage taking preventive measures. Furthermore, the translation of work demands and workload into work requirements is a rarely used method that seems useful for developing evidence-based screening of health requirements. The focus in this thesis on the specific populations of ‘workers with disabilities’ and ‘workers of different age groups’ was important from a societal perspective since both groups are spearheads of actual societal policies for occupational health.

Since mismatches between work and workers were found, implementation of interventions is needed. For interventions at the group level, age and disability should be considered as grouping variable. Additionally, individual attention for workers is needed. A combination of interventions at both the group and individual level seems the most effective strategy to optimise workers’ health.

A first recommendation for practice is to start detecting (mis)matches between work and workers. Therefore the interaction between employers and occupational health services needs to be improved, with both parties taking joint responsibility for detecting mismatches and initiating the development of interventions. Furthermore, high risk profiles for workers who really need individual attention and interventions must be established. A workers’ health surveillance is useful, with well-developed self-report
questionnaires being used to discover work-related health problems. The second recommendation for practice is to monitor the implementation of interventions. Age-specific interventions must be considered, and special attention for workers with disabilities is recommended.

For future research, it is recommended to develop better assessment methods to detect mismatches, and assessment methods for self-report of the work-relatedness of health problems. Finally it is recommended to study the effectiveness of individual- and group-level interventions on sustainable employability.