Job-specific workers’ health surveillance for construction workers
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Chapter 1.

General Introduction
Workers’ health surveillance

The safety, health and well-being of people engaged in work or employment is the field of occupational health.\(^1\) Due to the numerous aspects interacting between work and health, occupational health care consists of several strategies involved to promote and maintain occupational health.

A strategy applied in preventive occupational health care, is identifying occupational risks and hazards and the adverse health effects associated with them.\(^2\) Systematic surveillance can address various aspects of work and health. Two types of surveillance can be distinguished. First, *working environment surveillance* aims to identify environmental factors that may affect workers’ health, such as the hygienic circumstances, the organisation of the work, psychosocial factors related to work, the ergonomic environment and exposure to hazardous substances, among others. Second, *workers’ health surveillance* (WHS) aims to assess workers’ health by detecting any clinical or preclinical abnormalities to verify whether the occupational exposures have any detrimental effect on the health of workers and whether the worker is fit for the job. Systematic monitoring of workers can provide valuable epidemiologic information on a population level, allow for an evaluation of preventive measures or reveal underlying problems for work-related diseases.\(^3\) While this approach is at the population level, WHS aimed at the individual worker is a generic term that covers procedures and assessments of workers’ health and work ability to detect and identify any signals of a change in health.\(^4\) WHS is often referred to as periodic occupational health examination. In a WHS programme, both primary and secondary preventive purposes are included and thereby provide an important element of occupational health care. Selective (targeted) prevention aims to avoid the development of an occupational or work-related disease by addressing excessive work demands or exposures through early detection and intervention for health issues that may be caused by occupational exposures or affect the workers’ functioning.\(^5\) A further deterioration in the health status or work ability of the worker can then be prevented. In summary, the purpose of WHS is to reduce the burden of occupational and work-related diseases through targeted interventions. When aiming to improve the occupational safety and health of workers, surveillance, case finding, monitoring and intervention should be combined and sequentially implemented.\(^5\)

History of workers’ health surveillance in the Netherlands

The Netherlands has a long history of WHS dating back to the early years of the twentieth century.\(^6\) WHS programmes during that time were mainly aimed at early diagnosis of epidemic diseases that affected all people, such as tuberculosis. In 1930, Philips started a health service that focused on preventive health care, and employees were periodically screened by X-ray to diagnose tuberculosis early. However, some occupational physicians
started to address occupational diseases and adverse health effects caused by the job, such as lead poisoning and black lung disease. Furthermore, attempts were made to assess the physical abilities of the individual worker by means of exercise tests. When tuberculosis rates were decreasing, cardiovascular diseases started to reach epidemic dimensions; therefore, the prevention of cardiovascular diseases became a high priority. During the 1980s, the population of workers as a whole became more of an interest than the individual workers. The periodic monitoring of workers was mainly aimed to gather information about groups of workers to detect work-related problems, both in work and health.6

Overall, WHS programmes have been conducted in many different ways and with different aims.7 In 1989, the European legislation required employers to make WHS available to all workers. In 1994, this legislation was included in the Dutch Occupational Health and Safety Act.7 The most recent development dates from 2005, when the professional Dutch Guideline for Preventive Medical Examination was presented.8

This guideline follows the guidelines of the International Labour Organization (ILO)4, in which the goals of WHS for individual workers are specified as follows: (i) to prevent the onset, recurrence and/or worsening of work-related diseases; (ii) to monitor and promote individuals’ health in relation to work; and (iii) to monitor and promote work functioning and deployment. The WHS, including assessments, tests, and investigations, must be based on these goals. In other words, a careful method in which conscious choices are made must be in place before a WHS programme is implemented. Accordingly, each WHS will be designed to be relevant to the nature of the demands and health effects of the occupation of interest.4,9

A stepwise approach for designing a job-specific workers’ health surveillance

Surveillance is often applied to workers in certain occupations who are known to be at risk for adverse health effects due to their occupational exposure. For example, painters are screened for chronic solvent induced encephalopathy due to their increased risk after long-term exposure to organic solvents10, agriculture workers are screened for oxidative stress biochemical markers related to the use of copper based-pesticides11 and underground coal miners are offered periodic chest x-rays to assess them for coal workers’ pneumoconiosis.12

In a job-specific approach, all aspects related to the health and safety of the worker in a specific occupation are taken into consideration. For example, Plat13 studied a WHS programme for fire fighters that assessed whether the workers could meet the psychological requirements, physical requirements, and sense-related requirements, among other aspects, relevant for
work functioning. Another example of a job-specific approach was a WHS programme aimed to improve the work functioning of nurses and allied health professionals by means of a mental health module.\textsuperscript{14} The job-specific approach has been advocated to be superior for various occupations.\textsuperscript{13-15} The rationale for the superiority of this approach is twofold. First, the surveillance needs to be restricted to those issues that are relevant for the workers’ health and work functioning. Workers should be protected from an abundance of screening tests and assessments that are not relevant for performing their job.\textsuperscript{9} Second, interventions should be an integrated part of a WHS programme. The better the surveillance is attuned to the occupation of interest, the more valuable the gathered information will be and the more likely the WHS will result in potentially effective interventions for the worker in a specific occupation.

In Figure 1, the above-stated concept of job-specific WHS is illustrated in a scheme that depicts how occupational job demands may affect workers’ health.\textsuperscript{16,17} The exposures that are possibly related to the risk of health complaints or related to the safety of the individual worker and other workers should be assessed. Furthermore, more knowledge should be obtained on the health effects for which the workers are at increased risk and the implication of these health effects on work functioning or the safety of the individual worker and other workers. Based on the demands and health effects, the health requirements can be

![Figure 1: Scheme of job-specific workers’ health surveillance.](image-url)
determined, and appropriate surveillance instruments and measures can be selected. When necessary, the occupational physician should select potentially effective recommendations and stimulate preventive actions. Preventive actions can be aimed at decreasing associated adverse occupational demands or improving health and work functioning by means of individual actions or actions taken at the technical or organisational level. Furthermore, job-specific recommendations and actions can be distinguished from recommendations and actions aimed at general health related to work functioning.

Until now, the scientific basis of WHS has not been well documented, and little is known about the effectiveness of surveillance and whether it actually leads to preventive actions and ultimately to an improvement in workers’ health. As in other areas of health care, there is a need to define good practice and to assess its effectiveness in occupational health.

**Workers’ health surveillance for construction workers**

The construction industry has high rates of occupational injuries and deaths: this industry has the most fatal on-the-job injuries and high numbers of nonfatal occupational injuries and illnesses involving days away from work. In the Netherlands, approximately 8,400 workers (4% of the workforce) are involved in an accident every year, and 6% of the industry’s workforce has been on sick leave, compared to 4% of the general working population.

The construction industry is classically characterised by physical work and exposure to noise, dust and cold. In addition, technical and administrative personnel have a high psychosocial load. Research among all types of construction workers shows that the workers are, for example, at increased risk for musculoskeletal disorders, noise-induced hearing loss, lung disease and skin problems, such as contact dermatitis. Over the years, much research has focused on developing control measures and effective primary prevention. Moreover, maximum exposure limits have been established by legislation in several countries: for example, limits have been created for dust, noise and the use of vibrating tools. However, the risk of adverse health effects has not been eliminated: control measures may not be sufficient, exposure may still be too high, or effective control measures may not effectively prevent the exposure. Therefore, periodic monitoring of possible adverse health effects might be warranted. Hence, a job-specific health surveillance programme for construction workers appears to be a complementary approach for guarding the health of workers. Over the years, several varieties of WHS for construction workers have been designed and described in the literature.
From 2004 to 2006, a total of 1,724 UK construction workers attended a voluntary, general health check programme by visiting a mobile testing unit facility. The key finding was that approximately one-third of those participating in the health checks had occupational health issues. Approximately 30% of those participating needed to be referred to their general practitioner for further action and/or follow-up.47 Within the scope of the pilot study, it was not possible to conduct a large scale follow-up of those workers referred to their general practitioner. However, a range of differences was found among the different types of occupations47, indicating that for construction workers, the job-specific approach is needed to be considered instead of a generic approach.

Data gathered from medical examinations among 72,008 German construction workers showed that this surveillance led to at least one recommendation by the occupational physician for 84% of the construction workers.48 For the older construction workers, this proportion increased to 96%. The recommendations concerned both medical findings and changes in lifestyle. Again, approximately one-third of the workers were referred to a general practitioner. However, as in the UK study, no follow-up was conducted, and it remains unknown to what extent the recommendations were acted upon by the workers or what gain in health status can be expected as a result of the WHS.

In the Netherlands, every construction worker in employment has the right to a health surveillance once in every four years (for workers under the age of 40) or once in every two years (for workers over 40 years old). In 2011, 38,000 workers made use of this occupational health service.49 The content of this health surveillance was specified by the sector organisation, The Dutch Health and Safety Institute in the Construction Industry. Designated occupational health services implement the health surveillance and the resulting health care activities. Because WHS is an important key to prevention, it seems legitimate to improve the WHS programme for construction workers by revising the current WHS to the standards of WHS programmes4,8 and evidence based health care. The development and evaluation of a job-specific approach instead of a generic approach is the focus of this thesis.9,13,14

Focus on two construction occupations

The construction industry includes over 100 different jobs. A high proportion (approximately 55-70%) of the workforce is composed of manual skilled workers (such as bricklayers, carpenters, electricians). The remaining workforce (30-45%) has managerial roles, including managers and supervisors.50,51 When developing and evaluating a job-specific WHS programme for construction workers, it seems reasonable to focus on occupations from both kinds of construction work. For the purpose of this thesis, the occupation of bricklayer was selected as a physically demanding, manual occupation, and the occupation of construction supervisor was selected to represent the managerial occupations within
the construction industry. In the Netherlands, approximately 20,000 bricklayers (in 2005) worked in the construction of houses, buildings, tunnels or bridges. These workers are also referred to as brick masons, or masons. Bricklayers use clay bricks, concrete blocks and other types of building materials in mortar. These individuals work in the construction of new buildings, and on reconstructions and renovations. Most bricklayers work as part of a team together with assistants.

In the Netherlands, approximately 15,000 construction supervisors work in ground, road and water construction or in commercial and industrial building. Construction supervisors manage crews of workers at construction sites. Supervisors, also known as foremen, are usually experienced construction workers but can also be specifically trained through higher education for the occupation of supervisor. Supervisors plan and schedule work and report on personnel, costs, and safety. Especially on small projects, supervisors work alongside their crews and are called working supervisors in this context; for large projects, supervisors spend their time on management.

**Aim, objective & research questions**

This thesis focuses on two construction occupations: bricklayers and construction supervisors, as representatives of a more physically or more mentally demanding occupation, respectively. When developing a job-specific WHS for those occupations, the first gap in knowledge that needs to be addressed is the evidence base of occupational demands and health effects of the two occupations. As indicated with the scheme presented in Figure 1, this evidence base provides the input to design a job-specific WHS for each occupation. Then, whether the job-specific content of the WHS leads to more preventive recommendations and thereby to more preventive actions among the bricklayers and supervisors can be assessed.

The aim of this thesis was to develop and evaluate a job-specific WHS for bricklayers and supervisors. Hence, the objectives of this thesis were twofold:

i. To provide evidence for a job-specific WHS for bricklayers and construction supervisors;

ii. To evaluate a job-specific WHS for bricklayers and construction supervisors compared to the generic WHS currently employed.

The following research questions were formulated:

1. What are the occupational demands and health effects for bricklayers and construction supervisors?
2. What is the content of the job-specific WHS for bricklayers and construction supervisors?
3. Does a job-specific WHS for construction workers lead more workers to undertake preventive actions than the generic WHS that is currently employed?
Regarding the first two questions, it was hypothesised that the occupational demands and health effects between the occupations would differ and that the content of the WHS therefore would be specific for each of the two occupations. With regard to the third question, it was hypothesised that a job-specific WHS would ultimately lead to more workers undertaking preventive actions.

**Outline of this thesis**

The first five chapters provide an evidence base for a job-specific WHS for bricklayers and supervisors and answer the first two research questions. First, a systematic review is presented, which identifies occupational demands and health effects for bricklayers and supervisors on an international basis (Chapter 2). Next, we explore the best strategy to conduct a survey among construction workers that allowed us to gather more knowledge on specific work and health issues among both occupations (Chapter 3). In Chapter 4, the psychosocial work environment for both occupations and the association with the mental health of the workers is assessed. In Chapter 5, we study the impact of mental health complaints on work ability. In Chapter 6, we focus on musculoskeletal complaints and starting points for job-specific targeting of preventive measures.

The content of the job-specific WHS for bricklayers and construction supervisors (research question 2) and the study protocol applied in Chapter 8 to 10, are described in Chapter 7. In Chapter 8, we present at the case level the evaluation of physical work ability as a part of a job-specific WHS. Chapter 9 and 10 allow for an evaluation of the job-specific WHS (research question 3). In Chapter 9, we present the process evaluation for starting a job-specific WHS. We evaluate the job-specific WHS compared to the generic WHS as currently employed in the Dutch construction industry in terms of the proportion of workers who undertook preventive actions in Chapter 10.

Finally, Chapter 11 presents the conclusions and general discussion of this thesis, along with recommendations for research and practice.
References


