Presenteeism among an Industrial Population

The development and validation of a presenteeism scale
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KIMMO VÄNNI

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ABSTRACT

In numerous published studies, associations have been reported among sickness absence, health costs and productivity loss in industries. However, another emerging issue concerns presenteeism and productivity loss, which have gained increasing attention in the occupational health research during the last two decades. Originally, the term presenteeism was used to define the presence in the workplace of workers who were unable to work to full capacity because of poor health. However, the definition has evolved to include non-health-related factors, such as psychosocial issues and organisational practices.

It has been reported that an employee’s decreased health status is a factor in presenteeism, which is associated with an employee’s health status and work ability. The concept of work ability has been commonly used in the research on sickness absence, but not in the research on presenteeism. The present study aims to develop, test and validate a presenteeism scale based on work ability in order to assess the prevalence of presenteeism and productivity loss among an industrial population.

Three sub-studies are based on data collected from a Finnish food industry company. One study is based on data collected from one small and middle-sized enterprise in forestry harvesting. The number of subjects studied in the food industry ranged between 847 and 1,363. The number of subjects in the forestry harvesting study was 339, which consisted of 151 entrepreneurs and 188 workers.

Regarding the food industry, the data were collected through cross-sectional questionnaire surveys that were conducted in 2003, 2005 and 2007. The surveys included questions on perceived health status and perceived work ability as well as perceived leadership (Study III). The company’s personnel register data on sickness absence between 2003 and 2008 were linked to the questionnaire survey, and the net annual working days per employee were calculated by subtracting the number of sickness absence days from the number of annual working days. The register data were also used to assess the number of sickness absence days in relation to the total productivity loss incurred by both presenteeism and absenteeism. In this dissertation, productivity loss stands for subjective, perceived productivity loss, and presenteeism and productivity loss are considered synonymous. The productivity loss incurred by presenteeism was assessed by the developed presenteeism scale in this study, according to which the work ability score (WAS) of 8 on a scale from 0 to 10 indicates presenteeism, which corresponds to a productivity loss rate of 5%. With each downward step in the work ability scale, productivity loss is increased by
five percentage points. Perceived work ability scores of 9 and 10 corresponded to a zero-loss rate. A perceived WAS of less than 4 was excluded. The data were analysed using binary logistic regression and a generalised linear model (GLM) with a negative binomial assumption.

Regarding forestry harvesting, data were collected using a cross-sectional questionnaire survey of perceived work ability, perceived productivity loss, presenteeism, workload, economic risks and performance requirements. The data were analysed using a binary logistic regression, and the performance on the presenteeism of scale was analysed using receiver-operating characteristic (ROC) curves.

Perceived work ability was a robust indicator, and it was interchangeable with presenteeism. Work ability scores from 4 to 10 were quantified in terms of productivity loss percentages from 0% to 26%, which were used to assess the prevalence of presenteeism and productivity loss. The prevalence of presenteeism both in the food industry and among the forestry harvest workers was 48%. The productivity loss due to sickness absence (5.0%) was higher than the productivity loss due to presenteeism (3.7%) among the food factory workers. The self-estimated productivity loss was 7.4%. The corresponding loss, as assessed on the Presenteeism Scale, varied between 7.3% and 10.0% among forestry harvest workers. The results also showed that the annual productivity loss costs were remarkable compared to the company’s business figures. The employees with perceived work ability scores of 7 and 8 comprised the highest share of presenteeism days. The average percentage of presenteeism was higher among factory workers compared to office workers. The perceived leadership explained the variations in presenteeism between and among the factory and office workers. The perceived poor leadership was associated with a higher likelihood of presenteeism (rate ratio [RR] 1.64, 95% confidence intervals [CI] 1.51–1.78).

The results of this study showed that the concept of work ability and the work ability score-based instrument, the Presenteeism Scale, could be used to assess the prevalence of presenteeism and productivity loss among an industrial population as well as the related costs. The scale also could be used to assess the association between perceived leadership and presenteeism. Overall, the work ability concept is an effective framework for use in the presenteeism research, and the Presenteeism Scale is a valid instrument for use in predicting presenteeism and assessing productivity loss.
Monet tutkimukset ovat jo vuosikymmenten ajat raportoineet sairauspoissaolojen, tuottavuuden ja terveyskustannusten välisestä yhteydestä, mutta uusi näkökulma sairausläsnäolo eli presenteismi on ollut tutkijoiden kiinnostuksen kohteena vasta viimeisen kahden vuosikymmenen ajan. Alun perin presenteismi on tarkoittanut työntekijän sairausläsnäoloa työpaikalla ja alentunutta kapasiteettia suoritua työtehtävistä. Presenteismi-käsite on kuitenkin muotoutunut vuosien aikana ja nykyään presenteismin syinä on myös muita tekijöitä kuin työntekijän terveydentila, kuten työpaikan toimintatavat ja psykososiaaliset tekijät.

Tämän tutkimuksen tavoitteena on kehittää koettua työkykyyn ja sen osoittimena toimivaan työkykykypistytykseen perustuva presenteisimimittari (tuottavuuden menetys) sekä testata mitattia ja raportoida sen käytettävyydestä teollisuudessa. Työkykykonseptin ja työkykykypisteiden käyttö on ollut yleistä sairauspoissaolotutkimuksessa, mutta niiden käyttö on uutta presenteismitutkimuksessa. Tämä tutkimus olettaa, että presenteismi ja koetun tuottavuuden menetys ovat synonymeitä.

tehollisesta työajasta. Keräytetyt tiedot analysoitiin logistisen regressioanalyysin sekä yleisen lineaarisen mallin negatiivisen binomiregressi (GLM) avulla.


Tutkimus osoitti, että työkykykonseptia ja työkyypisteisiin perustuvaa mittaria voidaan käyttää presenteismin ja tuottavuuden menetysten arvioinnissa. Koettu työkyky asteikolla 4 - 10 voidaan muuttaa tuottavuudenmenetys-prosentteiksi 0:stä 26:een. Presenteismin prevalenssi oli 48% sekä elintarviketeollisuusyrityksessä että puunkorjuuyrityksissä. Sairauspoissaoloista johtuva tuottavuuden menetys (5.0%) oli suurempi kuin presenteisistä johtuva tuottavuuden menetys (3.7%) elintarviketeollisuuden tuotantotyöntekijöillä. Tutkimus myös osoitti, että vuotuisen tuottavuuden menetyksen kustannukset ovat huomattavan suuret suhteutettuna yrityksen taloudellisiin tunnuslukuihin ja suurin osa presenteisimpäätivistä muodostuu työntekijöistä, joiden koettu työkyypistlelu oli 7 tai 8. Tutkimus osoitti, että työtehtävä (toimisto- tai tuotantotyö) oli merkittävä tekijä presenteismin määrässä, mutta koettu johtaminen selitti presenteismin jakaumaa ryhmien sisällä vielä tarkemmin.

Työkykykonsepti on hyvä viitekehys presenteismitutkimukselle ja koettuun työkykyn liittyvä mittari on validi presenteismin prevalenssin ja tuottavuuden menetysten määrittämisessä. Kehitettyä mittaria voidaan käyttää myös tuottavuuden menetysten kustannuslaskennassa sekä koetun johtamisen ja presenteismin välisen yhteyden arvioimisessa.
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LIST OF ORIGINAL PUBLICATIONS

This dissertation is based on the following original publications:

I


II


III


IV

Kimmo Vänni, Subas Neupane, Anna Siukola, Heikki Karinen, Hannu Pursio, Jukka Uitti, Clas-Håkan Nygård. The Presenteeism Scale as a measure of productivity loss. (Accepted for publication in Occupational Medicine Published by Oxford University Press).

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# ABBREVIATIONS

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<th>BD</th>
<th>bipolar disorder</th>
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<td>BMI</td>
<td>body mass index</td>
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<tr>
<td>FCA</td>
<td>friction cost approach</td>
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<td>HCA</td>
<td>human capital approach</td>
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<td>HPQ</td>
<td>health and work performance questionnaire</td>
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<td>MDD</td>
<td>major depressive disorder</td>
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<td>MM</td>
<td>multiplier method</td>
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<td>ROC</td>
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1 INTRODUCTION

The role of sickness absence and its costs have been of interest in health research during the last few decades. Several published studies have reported the associations between an employee’s health in terms of sickness absences (e.g. Marmot et al. 1995; Kivimäki et al. 2003; Hanebuth et al. 2006) and work-related physical and psychosocial factors (e.g. Gimeno et al. 2004b; Netterstrøm et al. 2008). However, few previous studies have focused on presenteeism, which is another phenomenon in productivity loss and the costs related to it. This study is based on previous evidence in the literature, which suggested that effective work ability, which means the balance between work demands and an employee’s functional abilities, is a precursor of good productivity (Ilmarinen 2006). In addition, the work ability index (WAI) predicted sickness absences among the studied population (Kujala et al. 2006; Sell 2009; Ohta et al. 2017). The work ability score (WAS) is the first item on the WAI (Gould et al. 2008). The WAS has been used extensively in occupational health studies, and it has been validated against the WAI (Ahlström et al. 2010; El Fassi et al. 2013). Based on the evidence gleaned from applying the work ability concept, the WAI and the WAS in the sickness absence research, this dissertation was conducted to investigate the possibility of using a perceived WAS related measure to assess presenteeism and perceived productivity loss among workers in the food and forestry industries.

In earlier studies, presenteeism was presented in terms of productivity loss. Most presenteeism instruments, such as the Health and Work Performance Questionnaire (HPQ) (Kessler et al. 2003) and the Work Performance Scale (WPS) (Pronk 2003b), are focused on estimating employees’ performance. However, these assessment tools do not measure the factual quantity of output per day (objective productivity). Instead, they estimate the effort or lost hours per day (subjective, perceived productivity). The presenteeism scale developed measures neither factual output nor the relative share of lost functional capacity, which, in theory, affects performance and further output.

Most previous methods used to measure presenteeism applied the employee’s health status (e.g. Lerner et al. 2001; Koopman et al. 2002; Goetzel et al. 2003; Shikiar et al. 2004) as a proxy. However, work ability has not been used to assessing
presenteeism. Another issue is that the previous methods mainly used fixed recall periods from two weeks to a few months and thus were able to report only temporary presenteeism. In addition, because these methods were focused on certain disease conditions, such as migraine, they could not be used effectively to calculate the productivity loss in an entire population (Brooks et al. 2010). From the point of view of occupational health, there is a need for an instrument that estimates productivity loss over a lengthy period, such as, a year. Because WAS is related to employees’ health status, and it has been shown to be a stable indicator (Tuomi et al. 2001), in this study, it was predicted that a WAS-based measure would be valid in assessing productivity loss on a yearly basis.

Most presenteeism research has focused on the prevalence of presenteeism and has applied a self-assessment approach in which a person perceives whether he or she has worked at least twice during a year while feeling ill (Aronsson et al. 2000). This approach was able to determine the relative amount of presenteeism among employees, which was reported to vary between 17% and 65% (Aronsson et al. 2000), excluding the amount of productivity loss. Only a few studies have reported productivity losses at the organisational level (e.g. Mitchell and Bates 2011). Hence, to investigate the amount of presenteeism and productivity loss among a studied population, a WAS-based instrument, the presenteeism scale, was developed.

A practical question concerns how to measure subjective productivity loss (i.e. presenteeism) and why it is important. The ability to measuring productivity loss helps organisations to control their performance, allows for screening an employee’s performance with respect to his or her work demands, and thus identify the early symptoms of decreased work performance.

The present study was a part of several studies conducted in the food industry and forest harvesting companies. The study first examined employees of one of the leading food processing companies in Finland, and then employees of small- and middle-sized enterprises in the forestry industry. Both the food processing industry and the forestry industry are known as sectors where work is physically and/or mentally strenuous and in which presenteeism may occur.

This dissertation was aimed to develop a new approach and a new instrument for assessing the prevalence of presenteeism and subjective productivity loss among employees in the food industry employees and validate the findings among employees in the forest industry. The study is based on the premise that an employee who indicates presenteeism also incurs productivity loss. Thus, presenteeism and perceived subjective productivity loss are synonymous. In this dissertation, every
employee with decreased perceived work ability (i.e. WAS 8 or less) is assumed to be a presenteeism case, and the amount of productivity loss is based on this assumption.
2 REVIEW OF THE LITERATURE

2.1 Presenteeism

2.1.1 Concept of presenteeism

In the early definition of presenteeism, employees were in the workplace but did not work to their full capacity (Cooper and Cartwright 1994; Burton and Conti 1999; Goetzel and Ozminkowski 1999; Kendall et al. 2003). In the early literature, the terms presenteeism and productivity loss are synonymous and used interchangeably (Druss et al. 2001; Koopman et al. 2002; Lowe 2002; Goetzel et al. 2003; Lang 2004; Ozminkowski et al. 2004; Schultz et al. 2007). Two main definitions of presenteeism have been identified: to remain in a workplace longer than necessary, indicating a high-level of commitment; to remain on the job but be less productive than usual because of an illness or injury (Lowe 2002). The former definition was introduced by Cooper and Cartwright (1994), according to which presenteeism may occur when employees stay at the workplace and are not able to leave before a team manager leaves. In that case, the reason is to show commitment, and it is not related to employee health. The latter definition is more common in the literature, and it has been used in several studies (e.g. Lowe 2002; Johns 2010). Presenteeism in employees has multiple effects, such as work delays, poor customer satisfaction, poor quality and unpaid extra work (Lynch 2003a).

The concept of presenteeism has evolved during the last two decades. According to Johns (2010, p. 521), the concept of presenteeism was ambiguous, so he presented the following nine definitions of presenteeism: “(a) attending work, as opposed to being absent, (b) exhibiting excellent attendance, (c) working elevated hours even when unfit, (d) being reluctant to work part time rather than full time, (e) being unhealthy but exhibiting no sickness absenteeism, (f) going to work despite feeling unhealthy, (g) going to work despite feeling unhealthy or experiencing other events that normally compel absence, (h) reduced productivity at work due to health problems, (i) reduced productivity at work due to health problems or other events
that distract one from full productivity.” The common denominator in these definitions is the physical presence at work but the incapability of normal performance (Johns 2010). Presenteeism has also been investigated in terms of sickness presenteeism (Hansen and Andersen 2008), sickness presence (Vingård et al. 2004), and on-the-job productivity loss (Lang 2004; Schultz and Edington 2007). Although there are many definitions of presenteeism, according to Lofland et al. (2004), there is no “gold standard” or consensus of what constitutes presenteeism. Hence, the literature on the concept of presenteeism is diverse.

There is a distinction between the prevalence and the magnitude of presenteeism. The prevalence of presenteeism is assessed by asking employees if they have worked while they were ill. If an employee has gone to work at least twice, it could be counted as presenteeism (Aronsson et al. 2000; Aronsson and Gustafsson 2005; Bergström et al. 2009; Janssens et al. 2013). However, some exceptions have been reported. In Nyberg et al. (2008), presenteeism was defined as attendance at work at least four times in a year. In Robertson et al. (2012), the corresponding attendance requirement was one time, but they used a three-month timeframe. The magnitude of presenteeism was assessed using instruments to evaluate the magnitude of the outcome, such as performance or productivity loss (Ospina et al. 2015).

2.1.2 Prevalence of presenteeism

The phenomenon of presenteeism seems to be common among the working population. It is comparatively high in work for which it is difficult to find a substitute, such as physicians, consultants (McKevitt et al. 1997), teachers, entrepreneurs, banking officials and care workers (Aronsson et al. 2000). The prevalence of presenteeism varies depending on the type of occupation. Aronsson et al. (2000) studied six occupational sectors and 42 occupational groups, reporting that the prevalence varied from 17% to 65%. Johansen et al. (2014) reported that 56% of their Norwegian and Swedish respondents experienced sickness presenteeism, and Vroome (2006) reported that 63% of Dutch workers went to work even when they felt ill. According to Vik (2005), 45% of the respondents in a forestry study worked when they were ill, and of these about 70% reported that this condition had prevailed for at least five days.
2.1.3 Assessment methods of presenteeism

According to Thompson et al. (2015), all 212 presenteeism studies that were published between 1996 and 2012 assessed presenteeism and used at least one presenteeism instrument. On hundred and thirty-three (62.7%) studies were conducted in the USA, and 40 (18.8%) studies were conducted in Europe (Thompson et al. 2015).

According to Burton and Conti (1999), presenteeism is challenging to measure. It is difficult to quantify output especially when it consists of intangibles. Burton and Conti (1999, p. 36) noted that “matching productivity loss to individual risk factors is even harder, since it requires detailed employee health records”. According to Cohen et al. (1997, p. 24) “to measure presenteeism requires accurate recall by the affected employee, although studies have yet to show whether it's a reliable or valid method”. Brouwer et al. (2002, p. 176) found that “productivity losses without absence can be substantial for certain patient groups, such as migraine patients but are not yet a normal part of an economic evaluation”. For example, Lipton et al. (2001) found that workdays that were lost because of migraine (absenteeism) were consistent across studies at two to four days per year, and an additional four to nine days per year were lost due to reduced effectiveness at work (presenteeism).

Several different instruments have been introduced to measure presenteeism. The presenteeism instruments developed in the 1980s and 1990s are simple, and they measured only the employees’ perceived absenteeism and presenteeism, whereas the instruments developed in 2000s measure a wide range of factors, including job characteristics, work output and job satisfaction (Jones et al. 2016). The Integrated Benefits Institute (2003) reported that assessing presenteeism was problematic about 15 years ago because of the lack of reliable data and evidence. Recent studies of presenteeism have produced strong evidence, and the instruments are now able to produce valid results, even if Brooks et al. (2010) reported that all the current instruments have drawbacks, such as a lack of a transparent scoring or too specific range of application e.g. migraines.

According to Prasad et al. (2004) and Brooks et al. (2010), few objective measurement methods are available, but they are computer-based tracking methods or job specific, which are useable only for certain occupations and the results are challenging to transfer to other occupation. However, self-reporting measures have been found to be appropriate and reliable in assessing presenteeism (Druss et al. 2001; Kessler et al. 2003). In general, all the published assessment methods have
shown construct and convergent validity (Ospina et al. 2015), but none has been shown to predict productivity (Thompson et al. 2015). Therefore, Thompson et al. (2015) suggested that research should focus on studies that seek ways to estimate real-life productivity.

Ospina et al. (2015) reported that although many presenteeism studies were methodologically strong, they were not able to meet the criteria of “a gold standard (hours of productivity loss)” or to predict productivity loss while at work. Table 1 presents a summary of the presenteeism assessment instruments described e.g. in previous review studies (Mattke et al. 2007; Ospina et al. 2015; Jones et al. 2016).

The validity of the instruments used to measure productivity loss has been difficult to establish because of the challenging nature of the data, which are not as factual as the data on absenteeism are (Mattke et al. 2007). According to Loeppke et al. (2003), a daily employee diary, instead of a retrospective assessment of impairment, would improve the sensitivity of studies in this area. In contrast, Severens et al. (2000) found that retrospective questionnaires could be a reliable source of data if a recall period were no more than two months.
Table 1. Summary of the presenteeism assessment instruments

<table>
<thead>
<tr>
<th>Name of the instrument</th>
<th>Aim to assess</th>
<th>Recall timeframe</th>
<th>Areas covered</th>
<th>Developer</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Osterhaus technique (OT)</td>
<td>Decreased productivity due to migraine.</td>
<td>1 month</td>
<td>Migraine headache specific. Reports absenteeism and presenteeism.</td>
<td>Osterhaus et al. 1992.</td>
</tr>
<tr>
<td>SF – 36 / SF –series</td>
<td>Individual’s functional status indicator.</td>
<td>1 month</td>
<td>9 different areas related to individual’s total health status.</td>
<td>Ware and Sherbourne 1992.</td>
</tr>
<tr>
<td>Health and labour questionnaire (HLQ)</td>
<td>Relationship between illness, treatment and work performance.</td>
<td>2 weeks</td>
<td>General health. Reports absence, presenteeism and reduced productivity.</td>
<td>van Roijen et al. 1996.</td>
</tr>
<tr>
<td>Endicott Work Productivity Scale (EWPS)</td>
<td>Work productivity and efficacy of therapeutic interventions.</td>
<td>1 week period or can be customised</td>
<td>General health. Reports absenteeism and presenteeism.</td>
<td>Endicott and Nee 1997.</td>
</tr>
<tr>
<td>Questionnaire</td>
<td>Description</td>
<td>Time</td>
<td>Angina Specific?</td>
<td>Authors</td>
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<td>Angina-Related Limitations at Work Questionnaire (ALWQ)</td>
<td>Work limitations of patients with angina pectoris.</td>
<td>4 weeks</td>
<td>Reports absenteeism and presenteeism.</td>
<td>Lerner et al. 1998.</td>
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<td>Quantity and Quality method (QQ)</td>
<td>Quantity and quality of work.</td>
<td>1 day</td>
<td>General health. Reports presenteeism and monetary value.</td>
<td>Brouwer et al. 1999.</td>
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<tr>
<td>Questionnaire/Diary</td>
<td>Type of Questionnaire</td>
<td>Timeframe</td>
<td>Measured Outputs</td>
<td>References</td>
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<tr>
<td>Health-Related Productivity Questionnaire Diary (HRPQ-D)</td>
<td>Unproductive time at work.</td>
<td>1 day over 1 week</td>
<td>General health. Reports absenteeism and presenteeism.</td>
<td>Lipton et al. 2000; Kumar et al. 2003.</td>
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<tr>
<td>Work Limitations Questionnaire (WLQ)</td>
<td>Chronic or acute health problems and those impacts on productivity.</td>
<td>2 weeks, 4 weeks</td>
<td>General, physical and mental health and output demands. Reports presenteeism.</td>
<td>Lerner et al. 2001.</td>
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<td>Unnamed Hepatitis Instrument (UHI)</td>
<td>Effect of the disease on work functioning and productivity.</td>
<td>4 weeks</td>
<td>Hepatitis specific. Reports absenteeism and presenteeism.</td>
<td>McHutchison et al. 2001.</td>
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<tr>
<td>Instrument</td>
<td>Intervention Frequency</td>
<td>Time Period</td>
<td>General Health Measures</td>
<td>References</td>
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<tr>
<td>Work Productivity Short Inventory (WPSI)</td>
<td>Changes in productivity.</td>
<td>2-week, 4-week, 3-month, 12-month</td>
<td>General health. Reports absenteeism, presenteeism and monetary value.</td>
<td>Goetzel et al. 2003.</td>
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<tr>
<td>Tool Name</td>
<td>Description</td>
<td>Timeline</td>
<td>Outcome Measures</td>
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<tr>
<td>iMTA Productivity Cost Questionnaire (iPCQ)</td>
<td>Demographics, absenteeism, presenteeism and unpaid work.</td>
<td>4 weeks</td>
<td>General health. Reports absenteeism, presenteeism and monetary value.</td>
<td>Bouwmans et al. 2015.</td>
</tr>
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</table>
Many instruments are specific to patient groups, such as those who suffer from migraine (Loeppke et al. 2003). However, but the WLQ and HPQ were the most useful in assessing presenteeism among a general population (Schultz and Edington 2007).

There are variations in response scales, but the HPQ and HWQ are consistent with the scales in WAS. In the HPQ, a 10-point scale is used to measure the overall quality and amount of work. The HWQ uses a 10-point scale to measure job performance during the immediately previous four weeks (Mattke et al. 2007). The most straightforward instrument is the quality and quantity (QQ) method, which was introduced by Brouwer et al. (1999). The QQ is a self-evaluation method in which an employee estimates the quality and quantity of his or her work on a scale from 0 to 10.

Although numerous presenteeism instruments are available, according to Beaton et al. (2010), the convergence between them is poor. The existing assessment methods have been criticised because they employ self-reporting measures instead of objective measures (Brooks et al. 2010). However, it might be difficult or even impossible to construct an objective measure for assessing presenteeism (Gustafsson Sendén et al. 2016) or employees’ performance and their work outcomes (Braakman-Jansen et al. 2012). Nevertheless, so far, the self-reporting measures have been found to be appropriate and reliable in assessing presenteeism (Druss et al. 2001; Kessler et al. 2003).

2.2 Factors associated with presenteeism

2.2.1 Health-related factors

Zengerle (2004) reported that the biggest productivity drains are relative benign ailments, like headaches and arthritis. Hemp (2004) reported that research on presenteeism has focused on chronic or episodic ailments. The most common health conditions studied were gastrointestinal, musculoskeletal, neurological, respiratory, mental and dermatological (Goetzel and Ozminkowski 1999; Lowe 2002; Thompson et al. 2015). The previous studies have also reported the associations between presenteeism and obesity (Gates et al. 2008; Janssens et al. 2012), diabetes (Stewart et al. 2007; Breton et al. 2013), cardiovascular diseases (Gordois et al. 2016), migraine (Osterhaus et al. 1992; van Rijjen et al. 1995; Lipton et al. 2001) and asthma (Mitchell
and Bates 2011; Sadatsafavi et al. 2014). Previously, the interest of presenteeism research focused on groups of high-risk (Pelletier 1999; Mitchell and Bates 2011) employees and those with chronic illnesses (Lipton et al. 2001; Goetzel et al. 2004; Collins et al. 2005). Recently, the focus of presenteeism research has changed to employees’ work abilities with respect to work demands (Lohela Karlsson et al. 2013) and mental health (Druss et al. 2001; Goetzel et al. 2001; Sanderson et al. 2007; Martinez and Ferreira 2011; Suzuki et al. 2015; Pohling et al. 2016; Lerner et al. 2017).

According to Loeppke et al. (2003) the instrument developers should consider the possibility of developing separate tools for both healthy and chronically ill groups of employees.

2.2.2 Non-health-related factors

Psychosocial workplace factors and presenteeism

Presenteeism has been associated with non-health-related factors such as psychosocial issues (Robertson et al. 2012) and organisational practices (Böckerman and Laukkanen 2009; Gilbreath and Karimi 2012). Some studies reported that presenteeism may be culturally dependent (Dew et al. 2005). For example, some organisational cultures favour long working hours (Worrall and Cooper 1999). In addition, Doki et al. (2015) reported more than 2.5-fold higher odds of presenteeism among those who worked for a private company than in the public sector (odds ratio [OR] 2.57, 95% CI 1.10-5.99). Gilbreath and Karimi (2012) reported the association between negative supervisor behaviours, whereas Bierla et al. (2011) and Ramsey (2006) found that managers’ high commitment to the team and working during illness motivated employees to work when they were ill. Other studies found that poor leadership was associated with absenteeism, worker stress and poor productivity (Nyberg et al. 2008; Ribelin 2003; Sandmark and Renstig 2010).

Aronsson and Gustafsson (2005) reported that presenteeism was associated with time pressure, insufficient resources and personal financial problems. Böckerman and Laukkanen (2010) reported that presenteeism was sensitive to working-time arrangements, and Baker-McClearn et al. (2010) found that presenteeism was related to work pressures, such as deadlines and peak periods. Klein (2013) found that psychosocial stress at work was associated with presenteeism, and Elstad and Vabo (2008) reported that job stress influenced the level of presenteeism. Presenteeism
because of non-health related factors could be explained by the hard competition inside companies and the fear of losing employment if sick leave were taken (e.g. Virtanen 1994; Probst 2002; Vahtera et al. 2004; Caverley et al. 2007). It was reported that employees with fixed term contracts were more prone to presenteeism (Virtanen et al. 2003; Caverley et al. 2007; Bierla et al. 2011; Huver et al. 2012). A study by Johansson and Lundberg (2004) found that people who experienced pressure at work were more likely to work despite their illness. Another study also found that attendance management procedures were associated with the level of presenteeism (Munir et al. 2008). The voluntary or involuntary pressure to work while ill also could be related to colleagues’ support (Baker-McClearn et al. 2010; Grinyer and Singleton 2000). Brun and Biron (2006) reported that involuntary factors represented about 54% of presenteeism cases. Voluntary factors were related to individual motivation and loyalty to colleagues and clients (Dew et al. 2005; Baker-McClearn et al. 2011; Caverley et al. 2007) and to the organisation (Hansen and Andersen 2008).

Previous findings also showed that the organisation’s policies regarding absence (Chatterji and Tilley 2002; Baker-McClearn et al. 2010) and sickness benefit and incentives (Baker-McClearn et al. 2010) were related to presenteeism. In addition, efficiency demands (Böckerman and Laukkanen 2010) and personal factors, such as preferring to be with colleagues (Vézina et al. 2011), circumstances at home that were not conducive to resting (Hansen and Andersen 2008), and the fear of losing income (Ashby and Mahdon 2010) were found to affect presenteeism. Other causes of presenteeism included the minimising of symptoms (Kivimäki et al. 2005) and the ability to tolerate discomfort (Garrow 2016).

**Socio-demographic factors and presenteeism**

The role of age and gender in presenteeism is still unclear although it seems that presenteeism varies among age groups. Wada et al. (2013) reported that migraines or chronic headaches were the leading cause of presenteeism among men aged 18–39 years, whereas mental disorders were the leading cause of presenteeism among men aged 50 years and older. Among women under 50 years, a leading cause was mental disorders, whereas insomnia was the main reason in women over 50 years. Stewart et al. (1992) reported that the prevalence of migraine was high for both genders aged from 35 to 45 years. Yang et al. (2016) reported that the health status of an employee decreased with age, and presenteeism increased in the ageing working population. Hansen and Andersen (2008) reported that presenteeism and older age were positively correlated. Bierla et al. (2013) also found that the probability of
presenteeism increased with age. They considered that the reason for the increased presenteeism among older employees might be the fear of being substituted and losing a job because of absences. According to Bierla et al. (2013), there was little evidence for the relation between age and presenteeism, which should be explored in further research.

Demerouti et al. (2009) reported that the risk of presenteeism was higher among men than women. However, Gustafsson Sendén et al. (2016) reported that sickness presenteeism was more frequent in female than in male physicians. They found that work-family conflict explained the higher prevalence of presenteeism among females. In a systematic review by Schultz and Edington (2007), 30 studies were found to use gender and age as controlled confounders, but only one of those studies reported a difference between genders. Tunceli et al. (2006) reported that overweight and obese women had more work limitations compared to normal weight women, but the results for men were not statistically significant. It might be possible that age and gender are used in adjusting the results but not necessarily as independent variables. Aronsson and Gustafsson (2005) found no statistically significant differences in presenteeism by gender. Bierla et al. (2013) reported that women seemed to have less presenteeism but longer absences. Overall, the relation between gender and presenteeism is not conclusive in the literature (Bierla et al. 2013), and further evidence is needed.

2.3 Sickness absence and presenteeism

Several studies have focused on the economic effects of absenteeism. Recently, interest has been paid to the mechanism of presenteeism because absenteeism has been well documented (Aronsson et al. 2000; Lowe 2002; Goetzel et al. 2003; Loeppeke 2003; Pelletier and Koopman 2003; Pronk 2003). It was reported that the bases of presenteeism and absenteeism are not only similar (Hansen and Andersen 2009) but also related (Brouwer et al. 2002; Bergström et al. 2009; Johns 2010). A worker’s individual assets and organisational issues may be factors affecting absenteeism or presenteeism (Munir et al. 2008; Steensma 2011). It was reported that high levels of presenteeism may be a predictor of sickness absence in the future (Aronsson et al. 2000; MacGregor et al. 2008), and presenteeism may occur both before and after sickness absence (Brouwer et al. 2002; Kumar et al. 2003) (Figure 1). According to Brouwer et al. (2002), 25 % of employees experienced production losses (presenteeism) before an absence and 20% experienced production losses
(presenteeism) after an absence. The related costs were about 14% of the total productivity costs. According to Kivimäki et al. (2000), a large number of sickness absences were attributable to changes in work characteristics especially in relation to employees’ opportunities to participate in decision-making. Joo and Garman (1998) reported that many work-related and personal factors influence absenteeism, such as environment, work characteristics and employee characteristics. For example, Hansen and Andersen (2008) reported that work-related factors were more important than employees’ attitudes in decisions to attend work during an illness. It was found that temporary employees had a lower absence rate (Vahtera et al. 2004), but a higher presenteeism rate and a lower quality of output (Probst 2002). Brouwer et al. (2002) reported that employees with a low income experienced longer absence on average compared with employees with higher incomes.

![Figure 1. A schematic view of the association between presenteeism and absenteeism. Modified from Brouwer et al. (2005)](image)

In summary, the early research on presenteeism focused on the association between employees’ health and presenteeism. Moreover, many non-health related factors are recognised in the literature, such as working-time arrangements (Böckerman and Laukkanen 2009), personal and work-related demands (Aronsson and Gustafsson 2005; Demerouti et al. 2009), heavy workloads, precarious employment status (Biron
et al. 2006), efficiency demands (Böckerman and Laukkanen 2010) and psychosocial workplace factors (Robertson et al. 2012).

2.4 Economic consequences of presenteeism

According to the early literature, extracting the true costs of presenteeism at national and international levels is challenging (Brouwer et al. 2002; Ceniceros 2015) because of contextual and methodological differences (Cooper and Dewe 2008). In addition, some studies were focused on the macroeconomic effects of presenteeism (Hemp 2004; Davis et al. 2005; Kessler et al. 2006; Mattke et al. 2007; Medibank 2011; Mitchell and Bates 2011; EU-OSHA 2014), and others were focused on assessing the costs of presenteeism to organisations (Goetzel et al. 2004; Ozminkowski et al. 2004; Burton et al. 2006). Although some cost data were presented at the national level (Medibank 2011), the data on company-level estimations are still limited.

Burton et al. (2002) reported that annual presenteeism costs at the company level due to migraine were USD 21.5 million. Daley et al. (2009) found that the costs of insomnia to the economy amounted to USD 5 billion costs. Goetzel et al. (2004) studied 10 common conditions and found that presenteeism accounted for about 61% of total health costs. Hellgren et al. (2010) studied allergic rhinitis and common cold and reported that the annual cost of presenteeism was EUR 1 billion. In their study, the proportion of absenteeism exceeded that of presenteeism. Hilton et al.’s (2008) study on distress showed that the annual costs were USD 11.1 billion. Kessler et al.’s (2008) study on bipolar disorder (BD) and major depressive disorder (MDD) found that the annual costs of presenteeism to the US labour force were USD 7.6 billion (PD) and USD 24.5 billion (MDD), respectively. Ricci and Chee (2005) studied the economic consequences of lost productive time due to obesity. Their findings showed that the value of the lost productive time of obese workers, but not overweight workers, was USD 11.7 billion higher compared with normal weight workers. The share of presenteeism in that amount was USD 7.9 billion (67.8%). Stewart et al. (2003) studied a US work force and found that common conditions, such as headache, back pain, arthritis pain and musculoskeletal pain, led to annual presenteeism costs of USD 46.9 billion. Medibank (2011) reported that the cost of presenteeism to the Australian economy was about AUD 34 billion; the most common conditions that caused productivity loss were depression (21%), allergy (17%), hypertension (13%) and diabetes (12%).
In general, the cost evaluations were based on reduced performance because of illnesses (e.g. Burton et al. 2002; Collins et al. 2005; Linde et al. 2012; Kigozi et al. 2017). Overall, reliable estimates are needed of the effects of the total costs of illnesses and diseases, including the cost of work loss and reduced productivity due to poor health and health care (Berger et al. 2001).

2.5 Productivity

Productivity has been defined variously (Williams et al. 1996; Lynch 2003a). Indeed, Tangen (2015) identified 14 different definitions of productivity. However, in general, it has been defined according to the employee’s capacity and performance, such as knowledge and skills, as well as the organisation’s capacity, such as technology, machines, equipment, investments and management (Uusi-Rauva 1997). According to Gilbert (1968) productivity is related to the speed of work, work methods and the level of utilizing people, materials and equipment. In the classic definition of productivity, a ratio is assumed between output and the input (Chew 1988) but ignores the quality of the outcomes. Moreover, productivity and performance, which are different issues, have been considered simultaneously with efficiency, effectiveness and profitability (Tangen 2015). Efficiency relates to productivity such that it defines how well an employee can allocate his or her skills, effort and time to work. From the point of view of economics, performance is an even broader term than productivity because it includes economic and operational aspects (Tangen 2015). However, from the human point of view, performance can be defined as the ability to accomplish a task in accordance with the expectations of the organisation. According to Lynch (2003a, p.11) “worker performance” may be more apt term than health related productivity at an employee level.

In the presenteeism literature, there are few studies on productivity loss because the quantification of total output is complex (Burton and Conti 1999). Pauly et al. (2008) reported that workers might have difficulty determining their effects on productivity; therefore, the term productivity is sometimes defined as the ability to work. According to Mattke et al. (2007, p. 214), “for most jobs there is no true account of productivity with which to assess an employee’s performance”. One way to measure productivity is to measure the quantity of work done, such as the number of tasks performed during a specific period. The other method is to measure whether the targets (deadline or production rate) were met or not (Wong 2015). However, it is challenging to assess the association between an employee’s performance and his
or her output (Greenberg et al. 2001) and to quantify overall output (Schultz and Edington 2007). These concerns about measurement of productivity, presenteeism and productivity loss and the related costs are common and thus in companies scepticism about reliable figures has remained at a high level (Lynch 2003a; Riedel 2003; Brooks et al. 2010).

There is a distinction between objective and subjective measures of productivity or company performance. Objective measures are factual, whereas subjective measures based on an employee’s self-reported attitudinal state and perceived estimation (Castelle 2017). The objective productivity and performance measures are prevalent in economics and industrial engineering, whereas the subjective measures are prevalent in health sciences. Some studies have tried to validate an association between objective and subjective productivity or performance measures, but so far an association has remained unclear (Wall et al. 2004; Forth and McNabb 2008).

2.5.1 Employee health and productivity

According to Shamansky (2002), the reasons for productivity loss are high stress, common cold, allergies and musculoskeletal disorders. Berger et al. (2001) found that health status was a factor that determined the productivity of employees. Measuring health related productivity as an output is challenging because it is influenced by both the employee, the organisation and the external factors such as economic trend (Lynch 2003a). Examples are machines, tools, processes and social factors, such as collaboration with colleagues and sub-contractors (Leijten et al. 2013; Leijten et al. 2014). The assessment of productivity loss could be impossible because of the lack of a gold standard used to measure it (Braakman-Jansen et al. 2012).

Previous studies in the literature also found that associations between health, productivity and outcomes were not clear (Greenberg et al. 2001). Their concern was related to the validity and reliability of self-reported instruments and causal conclusions about the role of health status as a determinant of productivity and company outcomes. Another concern was related to the focus of instruments and surveys, which were, according to Lofland et al. (2004), often disease-and occupation-specific. However, the recent literature on presenteeism shows that instruments are valid and reliable at some levels and some surveys have focused on healthy participants (Ospina et al. 2015; Thompson et al. 2015). Thompson et al. (2015) reported that presenteeism was a variable in 212 studies, and of these, 66% (n = 140) focused on clinical samples and 34% (n = 72) focused on healthy workers.
2.5.2 Productivity loss

Brouwer et al. (2002) found that the amount of productivity lost because of presenteeism was about 14% of the total productivity costs. According to Lowe (2002), some studies found that the productivity lost because of presenteeism was 7.5 times higher than the productivity lost because of absenteeism. The productivity lost by presenteeism exceeded the productivity lost by absenteeism because of chronic diseases (Collins et al. 2005) and poor mental health (Hemp 2004, Hilton et al. 2008). Lerner et al. (2004) reported that the productivity loss because presenteeism was found in 2% of healthy employees.

Several previous studies focused on the annual productivity loss costs per employee but often in relation to specific health conditions (Kigozi et al. 2017). Burton et al. (2005) studied various health conditions and reported that the annual presenteeism costs were from USD 1,392 to 2,592 per employee per year. Cisternas et al. (2003) studied the costs of asthma in employees and reported that the annual costs were USD 4,912 of which presenteeism accounted for 28%. Collins et al. (2005) reported that the total cost of chronic conditions was about 10% of the total labour costs for the company, and 6.8% of these costs was incurred by presenteeism. Finkelstein et al. (2010) reported a wide range of costs because of lost productivity (i.e. presenteeism and absenteeism) due to obesity. These costs varied from USD 322 to USD 6,087 for men and from USD 797 to USD 6,694 for women.

2.5.3 Methods for quantifying the costs of lost productivity

According to Brouwer et al. (2002), three different methods are used to quantify the costs of lost productivity: the friction cost approach (FCA), the human capital approach (HCA) (Koopmanschap and Ineveld 1992; Koopmanschap et al. 1995; Koopmanschap and Rutten 1996; Lensberg et al. 2013) and the US panel approach, which is a qualitative method (Gold et al. 1996). The HCA is widely used in presenteeism cost analyses (Kigozi et al. 2017). Lensberg et al. (2013) reported that no empirical studies of productivity loss had used the FCA. However, Thavorncharoensap et al. (2010) used the FCA in their study. A seldom-used approach is the multiplier method (MM) (Nicholson et al. 2006; Pauly et al. 2008; Lensberg et al. 2013).
The friction cost approach

The FCA presumes the short-term and medium-term effects of illness on production output or loss (Koopmanschap et al. 1995; Lofland et al. 2004). Lensberg et al. (2013) reported that the FCA takes into account the employee replacement cost rather than the wage. According to Brouwer at al. (2002), the friction period is an adaptation period, which is needed to replace an absent worker by a competent worker, which prevents further production loss (Drummond 1992a; Koopmanschap and Rutten 1996; Hutubessy et al. 1999). Friction costs include the lost productivity output, decreased productivity and extra costs incurred by substitute employees (Koopmanschap et al. 1995). The FCA is applied to evaluate the actual value of production loss. It takes into account the part of the work that may be completed by colleagues or postponed until an employee’s productivity returns to normal (Lensberg et al. 2013).

Although the FCA is well known, its application has some limitations. Most studies use national data because most private sector companies do not collect reliable data. In addition, each firm has an internal labour pool that could buffer the effects of absenteeism and thereby hide indirect costs (Berger et al. 2001). The FCA seems to work better in European countries than in countries overseas (Koopmanschap and Rutten 1996). According to Lofland et al. (2004), the FCA is suitable for use in studies that involve the employer’s viewpoint, whereas the HCA is suitable for studies from the perspectives of the employee and society. Lensberg et al. (2013) considered that the FCA might be difficult to use in presenteeism studies because an employee is not replaced. They commented that in presenteeism cases, the FCA may be used in a way that is similar to the MM, but more specific information is required about the effects of an unproductive employee on his or her co-workers.

The human capital approach

The HCA is also used to estimate indirect costs (Berger et al. 2001; Lofland et al. 2004). Indirect costs are defined in terms of foregone earnings (Osterhaus et al. 1992). The amount of reduced productivity is estimated as the self-reported amount of the productivity reduction (Osterhaus et al. 1992; Legg et al. 1997). The HCA is straightforward, and it assumes that wages are a proxy measure of employee output (Birnbaum 2005; Lensberg et al. 2013).
Severens et al. (1998) found that compensation mechanisms may be used to reduce production losses. According to their findings, compensation mechanisms may reduce production losses up to 25%. Compensation means that an employee can postpone his or her work and finish it upon returning to the workplace (Drummond 1992b).

According to Berger et al. (2001), the HCA is ambiguous. Some studies have included only paid labour whereas others have included all activities. Previous studies have used dissimilar wage rates to calculate the value of lost labour time. The wide range in such factors may account for the variations in the results. The HCA is used to measure the societal costs of illness (Berger et al. 2001). Some studies have found that the HCA does not yield reliable results concerning the economic consequences of productivity loss (Drummond 1992a; Koopmanschap et al. 1992; Koopmanschap and Rutten 1996).

The US panel approach

The US panel approach is mentioned in the literature, but it is seldom used in presenteeism studies. In this approach, health state values are applied, which implicitly incorporates the effects of diseases on work ability and financial loss. In the US panel approach productivity costs related to quality of life effects are evaluated as well as income changes due to health status (Gold et al. 1996). Based on the criticism of its inaccurate measurement of the effect of health status on productivity (Krol 2012), the approach is not recommended for use in economic evaluations (Krol and Brouwer 2014).

The multiplier method

The multiplier method (MM) is based on the assumption that an employee’s decreased performance is related to the organisation’s activities, which have a value that is greater value than the employee’s wage. An example is that an employee’s performance effects the total productivity of the team (Nicholson et al. 2006; Pauly et al. 2008). In the MM, the real productivity loss is simulated and the multiple effects on co-workers and productivity are taken into account (Lensberg et al. 2013). Nicholson et al. (2006) identified two examples where the total loss is greater than an employee’s wage, and presenteeism affects both the output of the team and the costs of postponed production.
2.6 Work ability concept

Work ability has been studied widely. It was reported that perceived work ability and presenteeism (Lohela Karlsson et al. 2015) as well as management, work ability and productivity (Ilmarinen 2001; Tuomi et al. 2001) were related. It was demonstrated that work-related physical and psychosocial factors and individual characteristics affected work ability (Ilmarinen et al. 1997). The concepts of work ability and perceived work ability have been widely used in the research on sickness absence (Nygård at al. 2005; Kujala et al. 2006). However, these concepts rarely appear in the presenteeism literature with a few exceptions (Lohela Karlsson et al. 2015). The work ability concept is based on how well employees can cope with their work with respect to work demands (Ilmarinen 2006). The concept of work ability resembles a four-floor house (see Figure 2) where the ground floor is the employee’s mental, physical, psychological and social functional capacity. The second floor consists of the employee’s skills, such as expertise and knowledge; the third floor consists of the employee’s values, such as attitudes and motivation. The top floor consists of work and work-related factors, such as leadership (Ilmarinen 2006). In principle, any employee-related or work-related factor could be addressed by at least one element of the work ability concept.
Work ability index and work ability score

The WAI is used to quantify how well a worker is able to perform his or her job. It takes into account the employee’s health and mental and physical capabilities as well as psychosocial and physical work-related factors. The index is used to measure the physical and mental demands of an employee with respect to his or her work, diagnosed diseases, limitations due to disease, sickness absence, work ability prognosis and psychological resources. These seven dimensions of work ability are rated on a scale from 7 to 49, which is sub-classified as follows: poor (7-27), moderate (28-36), good (37-43), and excellent (44-49) (Tuomi et al. 1998).

It was demonstrated that high mental work demands (Tuomi et al. 1991; Tuomi et al. 2001; Sjögren-Rönkä et al. 2002; Tuomi et al. 2004), high physical work load (Tuomi et al. 1991; Ilmarinen et al. 1997; Tuomi et al. 1997; Tuomi et al. 2004;
Rostamabadi et al. 2017), poor management (Tuomi et al. 1991; Tuomi et al. 2001) and a poor physical work environment (Tuomi et al. 1991; Tuomi et al. 2001) were associated with low work ability.

A part of the WAI, the WAS was found in many early studies to be valid and reliable (Tuomi et al. 2001; Ahlström et al. 2010; El Fassi et al. 2013; Jääskeläinen et al. 2016; Mokarami et al. 2017). Perceived work ability scores (general, physical, mental) are normally measured by asking the respondents to assess their perceived WAS “compared with that at its best” on a scale ranging from (0 = unable to work to 10 = work ability at its best). The average WAS among employees in the Finnish process sector and in forestry were reported to be 8.4 and 8.1, respectively (Gould et al. 2008). The average WAS among Finnish entrepreneurs was reported to be 7.6 (Md 8.0) (Lundell et al. 2014).

Previous studies demonstrated that health-related factors affecting presenteeism were associated with lowered WAI and WAS. It has been reported that overweight (Fischer et al. 2006; Tuomi et al. 2001), poor musculoskeletal capacity (Eskelinen et al. 1991; Nygård et al. 1991; Sjögren-Rönkä et al. 2002), chronic health conditions (Koolhaas et al. 2014), cardiovascular diseases (Jedryka-Góral et al. 2005), depressive and anxiety disorders (Knekt et al. 2008), rheumatoid arthritis (Hoving et al. 2009) and smoking (Tuomi et al. 1991) were found to be associated with poor WAI. In addition, WAS and an organisation’s business performance were also associated (Lundell et al. 2014).
3 THEORETICAL FRAMEWORK OF THE STUDY

It is common that employees go to work although they feel ill. There are various reasons that employees decide to work instead of taking sick leave. The reasons are related to both the organisation and the employee. Aronsson and Gustafsson (2005) found that absenteeism and presenteeism were mutual issues, but there is no unified theory of an employee’s reasons for choosing absenteeism or presenteeism (Halbesleben et al. 2014). Some conceptual models of the preference for presenteeism have been introduced. Working when ill could worsen an employee’s health, or it could be therapeutic (Halbesleben et al. 2014). Johns (2010) presented a model that distinguished attendance at work and taking sick leave when feeling ill. The distinction depended on the severity of the medical condition and work and organisational factors as well as the employee’s personal factors. Halbesleben et al. (2014) also reported that the decision to attend work when ill was associated with the nature of the relationship between the employee and the supervisor.

This study is based on the assumption that the work ability concept (Ilmarinen et al. 1997) and WAS (Tuomi et al. 2001), which are associated with sickness absences, would also be associated with presenteeism. Although there are various definitions of presenteeism (Johns 2010), this study is based on a model (Figure 3) in which presenteeism is equivalent to productivity loss (Lang 2004; Schultz and Edington 2007) and the employee’s salary is a proxy for the costs of productivity loss.

The design principles of existing presenteeism instruments are focused on certain conditions and a fixed recall period. These instruments consider that most presenteeism is related to episodic health events, and employees recover their normal performance after such events. However, the present study considers that an employee’s work ability can decrease in the long-term or permanently, and the perceived status of health and work ability as related presenteeism (productivity loss) can be extended to an entire year.
Figure 3. Theoretical model regarding the factors associated with presenteeism and productivity loss

As shown in Figure 3, in the theoretical framework of this study, presenteeism, related factors, the work ability concept and WAS are associated. A WAS-based measure for assessing presenteeism (productivity loss) can be developed, tested and validated. In the studies conducted for this dissertation, decreased WAS is associated with presenteeism (Study I) and presenteeism affects costs (Study II). Perceived leadership relates to presenteeism (Study III). Finally, the WAS-based measure is valid in assessing the prevalence of presenteeism and productivity loss (Study IV).

3.1 Impetus for the present study

The impetus for the present study was that although the work ability concept (Ilmarinen et al. 1997) and WAS (Tuomi et al. 2001) have been widely used in occupational health, they have not been quantified for assessing presenteeism and productivity loss. Another impetus was that the presenteeism research lacks a theoretical framework for assessing productivity losses. The work ability concept and the work ability house model (Ilmarinen 2006) offer an appropriate framework.

The findings of the literature review indicated that WAS might be effective in developing a new instrument to assess presenteeism. WAS has been used in the
sickness absence research. Early studies found that it was related to an employee’s performance (e.g. Alavinia et al. 2009). Furthermore, the relationship between sickness absences and presenteeism was previously reported (Aronsson et al. 2000; Brouwer et al. 2002). The health-related and psychosocial workplace factors in presenteeism were the same, which also defined sickness absences (Hansen and Andersen 2009). The literature review also revealed that because the existing presenteeism instruments had an overabundance of items, converting its results to productivity loss percentages and to monetary figures was complicated. In addition, most existing methods focus on health conditions, and they use a fixed recall period.
4 PURPOSE OF THE STUDY

The main aim of the present study was to develop and validate a presenteeism scale based on work ability scores and to study its association with organisational factors (leadership) and the consequences of productivity loss for the organisation. The fulfilment of the objectives of this study were guided by the following research questions:

Research questions

1. How can the work ability score be used and quantified in developing a new method for assessing the prevalence of presenteeism and productivity loss? (Study I)
2. How can the work ability-based measure (i.e. the presenteeism scale) be used in reporting the monetary value of productivity loss to the company and society? (Study II)
3. How is the work ability-based measure (i.e. the presenteeism scale) associated with perceived leadership? (Study III)
4. What is the validity of the work ability-based measure (i.e. the presenteeism scale)? (Study IV)
5 MATERIALS AND METHODS

5.1 Study context

The data were collected from office and factory employees in a large food processing company in Finland as well as from forestry harvest workers and entrepreneurs in Finland.

The food processing company employed about 2,600 workers, mostly in factories (about 80%). About 60% of the workers were women. The company consisted of four factories and an administrative unit in Finland. One factory processed raw meat, and another factory processed canned foods and produced food, such as potato salad, porridge, desserts and jams. The company included a dispatch department and slaughterhouses as well as administration, sales and marketing, finance, purchasing, export and communications departments. The project was conducted from 2003 to 2010. The study project was focused on physical and psychosocial working conditions, work ability, health, workload and sickness absences. The data in this study were collected in three surveys (2003, 2005 and 2007) and from sickness absence registers between 2003 and 2008. These data were a part of a larger project funded by the Finnish Work Environment Fund. The study was approved by the Ethics Committee of the Pirkanmaa Hospital District.

The data used in this dissertation included information collected from small and middle-sized (SME) forest harvesting companies, some of which offered transportation services. The data were collected in a survey conducted in 2016. The study focused on physical and psychosocial working conditions, work ability, presenteeism, productivity loss, workload and risks. This study was part of a large survey funded by the Finnish Work Environment Fund and the Metsämiesten Säätiö Foundation. The study was approved by the Ethics Committee of the University of Tampere, Tampere, Finland.
5.2 Study design

In the first study (I), a cross-sectional survey was conducted in 2003. Data on sickness absence days, employment type, gender and age of the employee were obtained from the registers of human resources departments. The perceived WAS and the perceived health status were examined in addition to the register data. Employees with a WAS less than 4.0 and employees with sickness absences of more than 50% of their annual working days were excluded. The mean age of the respondents was 40.5 years. Most participants were women (69%, n = 589) and factory workers (68%, n = 581).

The second study (II) was based on the data collected in three cross-sectional surveys as well as register data. Data on age, gender, employment type and number of sickness absences were obtained for each year between 2003 and 2008 from the register of the company’s human resources department. One survey proposition, perceived WAS, was examined in conjunction with the register data. Employees with a WAS less than 4.0 were excluded. About 61% of the participants in the surveys were women, and more than 70% were factory workers.

The sample used in Study III was the same as the sample used in Study I. Data on number of sickness absence days, employment type, gender and age per employee were obtained from the register of human resources department. Two survey propositions, perceived WAS and perceived leadership were examined in conjunction with the register data. Employees with a WAS less than 4.0 and employees with sickness absences of more than 50% of their annual working days were excluded.

The fourth study (IV) was conducted in 2016 among forestry employees. Study (IV) was based on two cross-sectional questionnaire surveys. Five survey propositions were examined in conjunction with presenteeism and four propositions were examined in conjunction with productivity loss. All the participants were men, 55% (N = 151) of whom were entrepreneurs. The mean age of the respondents was 46 years, and their average amount of experience in forestry work was approximately 22 years.
5.3 Participants

The participants in this study consisted of office and factory workers at a food company as well as forestry harvesting entrepreneurs and operators. Specifically, Studies I and III addressed office and factory workers from the food company. The original study yielded 1,120 replies (response rate = 56%); 873 (78%) of which included their consent to having their survey data collated with the company’s sickness absence records. After the exclusion of the incomplete responses, 847 employees were eligible to participate in the studies. In Study II, the sickness absence register data for the period from 2003 to 2008 were collated with the cross-sectional questionnaire surveys carried out in the company in 2003, 2005 and 2007. The data were collected in four factories and an administrative unit, and the participants included both office and factory workers. The number of participants in the surveys were as follows: 2003 (N = 851), 2005 (N = 1,195) and 2007 (N = 1,363). The response rates were as follows: 56% (2003), 61% (2005) and 70% (2007). The register data were collected from the following numbers of participants: 2003 (N = 2,676), 2004 (N = 2,604), 2005 (N = 2,702), 2006 (N = 2,730), 2007 (N = 2,718) and 2008 (N = 2,754). The participants in Study IV were forest harvesting entrepreneurs (N = 151) and operators (N = 188). The response rates were as follows: entrepreneurs (16%) and operators (22%) or a total of 339 (19%).

5.4 Methods

5.4.1 Development of the Presenteeism Scale (Study I)

The presenteeism scale instrument was based on perceived WAS, perceived health status and the results in Ozminkowski et al.’s (2004) study. It was hypothesised that the average health status of the sample group in Ozminkowski et al.’s (2004) study was comparable to the average health status of the food industry employees. The average productivity loss values of 4.9% (WLQ) and 6.9% (WPSI) in Ozminkowski et al.’s study (2004) were compared with the average perceived WAS level (8.4) of the food industry employees. Because WLQ and WPSI were health-status related, the average productivity loss percentages of 4.9% and 6.9% were converted to work ability-related percentages by multiplying them by the contingency coefficient (.85).
of perceived health status and perceived work ability among the food industry employees. The result yielded the average perceived productivity loss percentages of 4.2% and 5.9%. Next, the ratios between the work ability fixed productivity loss percentages of 4.2% and 5.9% and the perceived WAS of 8.4 of the food industry employees (4.2/8.4 and 5.9/8.4) were calculated and matched linearly to the perceived work ability of level 8. The productivity loss percentages of 4.2% (WLQ) and 5.9% (WPSI) corresponded to the perceived WAS of 8.4, the corresponding productivity loss percentages for the perceived WAS of 8 were 4.4% (WLQ) and 6.1% (WPSI). Then the productivity loss figures related to the WAS of 8 were extended to correspond to perceived WASs from 0 to 10. The procedure resulted in two perceived work ability-related productivity loss scales, one of which was related to WLQ, and the other to WPSI. Finally, the means of the two scales were calculated and the Productivity Loss Scale was constructed (Table 2). The WAS of 8 theoretically corresponded to a reduction in productivity of approximately 5%. Each downward step of the perceived work ability scale reduced productivity by about 5%. The excellent perceived WASs of 9 and 10 were considered to not causing productivity loss, and WASs less than 4 were ignored (Figure 4).

Table 2. Presenteeism scale according to perceived work ability score (WAS)

<table>
<thead>
<tr>
<th>Measure of presenteeism</th>
<th>Perceived WAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>WLQ (WAS related)</td>
<td>34.8 30.5 26.1 21.8 17.4 13.1 8.7 4.4 0.0 0.0</td>
</tr>
<tr>
<td>WPSI (WAS related)</td>
<td>49.1 43.0 36.8 30.7 24.5 18.4 12.3 6.1 0.0 0.0</td>
</tr>
<tr>
<td>Avg. productivity loss % (WAS)</td>
<td>42.0 36.7 31.5 26.2 21.0 15.7 10.5 5.2 0.0 0.0</td>
</tr>
<tr>
<td>Discount factors (WAS related)</td>
<td>0.42 0.37 0.32 0.26 0.21 0.16 0.11 0.05 0.00 0.00</td>
</tr>
</tbody>
</table>

WAS = work ability score, WLQ = work limited questionnaire, WPSI = Work Productivity Short Inventory. The starting values of WLQ and WPSI were derived from Ozminkowski et al.’s (2004) study.
5.4.2 Questionnaire

This study used two different sets of questionnaire surveys. In the studies that were conducted in a food company (i.e. I, II and III) cross-sectional questionnaire surveys on employee health, work ability as well as physical and psychosocial working conditions were carried out in 2003, 2005 and in 2007. The employees’ names and social security numbers were elicited to enable combining individual survey and register data. In Study IV, a cross-sectional questionnaire survey was distributed to forestry employees in 2016. The questions were designed to elicit data on perceived work ability, productivity loss, presenteeism, workload, performance requirements and economic risks.

Presenteeism

In Study IV, presenteeism was determined by the answers to the following question “During the last 12 months, how many times did you go to work despite feeling so ill that you should have taken sick leave?” The response options were scaled on a four-point Likert scale as follows: 1 = “never”, 2 = “once”, 3 = “2 to 5 times”, 4 =
more than 5 times”. This question has been used widely in the presenteeism research (e.g. Aronsson et al. 2000).

**Perceived health status**

In Study I the perceived health status was determined by the answers to the following item: “Define your current health status”. The responses were indicated on a scale from 0–10, where 10 signified the best health status.

**Perceived work ability score**

In Studies I–IV, perceived work ability was determined by the answers to the following item: “Define your current work ability compared to your lifetime best”. The responses were indicated on a scale from 0–10, where 10 signified the best work ability. The question was drawn from the Work Ability Index (i.e. the first item of the WAI) (Tuomi et al. 1998), which was validated against WAI and can be used as an alternative method (Tuomi et al. 2001). This variable was categorised by using the Presenteeism Scale to assess productivity loss and the prevalence of presenteeism.

**Perceived productivity loss**

In Study IV, the perceived productivity loss was determined by the answers to the following question: “If you have worked while ill, estimate how much slower you worked compared to working when healthy?” The response options were indicated on a six-point Likert scale from 1 = “No slower at all” to 6 = “Very much slower”. Regarding the quantitative analysis, a six-point Likert scale was quantified to match the productivity loss percentages from 0 to 26, which were based on the Presenteeism Scale. A five-point Likert scale with the productivity loss percentages from 0 to 100 was used in an earlier study (Mitchell and Bates 2011).

**Productivity loss based on presenteeism scale**

In Studies I–IV, productivity losses were measured by the Presenteeism Scale that was constructed as a measure in Study I. The perceived WAS of 8 on a scale from 0 to 10 corresponded to the productivity loss rate of 5%. Each downward step of the WAS increased productivity loss by 5%. Perceived WASs of 9 and 10 corresponded to a zero-loss rate, and the perceived work ability less than 4 was irrelevant. Hence, the loss rate started at 5% (level 8) and finished at 26% (level 4). The percentages on
the scale were used as discount factors in assessing the rate of days lost because of presenteeism.

**Perceived leadership**

In Study III, the perceived leadership (motivating and participating leadership) was measured by using the adjusted sum variables developed by Ruohotie (1993). The single responses were indicated on a five-point Likert scale from 1 = “totally disagree” to 5 = “totally agree”. The perceived leadership variable was presented as the mean of six propositions ranging from 1.00 to 5.00. The Cronbach’s alpha for a leadership measure was 0.88. Furthermore, the mean leadership scores from 1 to 5 were classified into three categories: poor leadership (mean score = 1.00–2.90), average leadership (mean score = 3.00–3.49) and good leadership (mean score = 3.50–5.00).

The following six items pertained to incentive and participative leadership:

1. My supervisor pays attention to my suggestions and wishes.
2. If necessary, my supervisor is able to give advice and guidance.
3. My supervisor gives me feedback about my work performance.
4. My supervisor encourages her/his subordinates to participate and commit to the function.
5. My supervisor is interested in and takes responsibility for the advancement of her/his subordinates.
6. My supervisor trusts her/his subordinates and allows them to work independently.

**Workload**

In Study IV, physical and mental workloads were determined by the responses to the following item: “Evaluate how much mental and physical workloads have changed during the last two years”. The responses were indicated on a five-point Likert scale from 1 = “Decreased greatly” to 5 = “Increased greatly”.

**Economic risks**

In Study IV, perceived economic risks were determined by the responses to the following item: “Evaluate how much economic risks may cause insecurity in future”.

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The responses were indicated on a five-point Likert scale from 1 = “Not at all” to 5 = “Very much”.

**Performance requirements**

In Study IV, the performance requirements were determined by the responses to the following item: “Evaluate how much increase in performance requirements may cause insecurity in the future”. The responses were indicated on a five-point Likert scale from 1 = “Not at all” to 5 = “Very much”.

5.4.3  **Sickness absence register**

Sickness absence was measured as the number of days of absence from work. First, sickness absence days were used in reporting the annual number lost days at the company level. In Studies I and II, the sickness absence days were reported separately, and they were counted to correspond to a productivity loss of 100%. Second, in Studies I–III, the sickness absence days were used to assess the net number of working days by subtracting the numbers of sickness absence days from the number of annual working days. The net working days were used to assess the amount of productivity loss at work. The calculations took into account the number of each employee’s sickness absence days. Bank holidays, vacations and weekends were taken into account in assessing the number of sickness absence and annual working days.

5.5   **Statistical analysis**

5.5.1  **Sickness absence, work ability and productivity loss (I)**

In Study I, the differences between the respondents and the non-respondents were determined by the Kruskal-Wallis test. The focus of Study I was to determine the number of sickness absence and presenteeism days and to compare the results between men and women working in the office or the factory. Cross-tables were used to describe presenteeism and sickness absence days per person per year. The
mean values, standard deviations, medians and ranges were calculated. To determine the probability of productivity loss among the studied population, presenteeism was dichotomised in the upper quartile (0–11 days versus at least 12 days), and an age-adjusted binary logistic regression with 95% confidence intervals was used.

5.5.2 Presenteeism, sickness absence and costs (II)

In Study II, the descriptive statistics were emphasised because of the aim of the study was to determine the costs of presenteeism and sickness absences. The number of sickness absence days and presenteeism days, percentages and costs were calculated separately and then summed. The annual sickness absence costs for the company and the public economy were assessed. The percentages of sickness absence, presenteeism and their sum were calculated with respect to the organisation’s annual turnover, personnel costs and business profit. Pearson’s correlation test was used to ascertain any possible association between sickness absence, presenteeism and the company’s statistics. Finally, the number of presenteeism days and percentages with respect to perceived work ability were calculated.

5.5.3 Presenteeism and leadership (III)

In Study III, the correlations among leadership, presenteeism and type of work were calculated using Pearson’s correlation test. The descriptive statistics for age, perceived work ability and presenteeism percentage according to gender and occupational groups were calculated. A chi-square test and ANOVA were used to describe the differences between WAS and presenteeism. The association between perceived leadership and presenteeism was assessed separately for women and men working in offices and factories and the groups in order to compare the groups. A GLM with a negative binomial assumption was used in order to determine the associations between presenteeism and perceived leadership. Rate ratios (RR) and their 95% CIs were calculated as the measure of association.
5.5.4 Validation of the Presenteeism Scale (IV)

In Study IV, the validity of the Presenteeism Scale was assessed against productivity loss. First, the frequencies and percentages of the background characteristics of the study participants were stratified by the dichotomous presenteeism variable (0 to 1 times = no presenteeism vs. 2 to 5 times or more than 5 times = presenteeism). The descriptive statistics (mean and standard deviation) were used to assess and compare the perceived and work ability-related productivity losses. The Pearson’s correlations test was used to explore the associations between presenteeism, productivity losses, perceived workloads and economic performance. The effects of the predictive ability of presenteeism on productivity loss were tested using a multivariable logistic regression model. Odds ratios (OR) and 95% CI were calculated as the measure of associations. The performance of the Presenteeism Scale was ascertained using the ROC against productivity losses.
6 RESULTS

6.1 The Presenteeism scale as a measure of presenteeism (I and IV)

The Presenteeism Scale indicated that the prevalence of presenteeism among the population in a food industry company was 48%. The highest prevalence was among female factory workers (53%), and it was the lowest among female office workers (37%). The corresponding results were (50%) and (44%) for male factory workers and male office workers, respectively. According to the Presenteeism Scale, 60% of lost working days were sickness absence days and 40% or lost working days were related to presenteeism.

The Presenteeism Scale was tested in the forestry harvesting group to assess the prevalence of presenteeism and productivity loss. The results showed a higher prevalence of presenteeism (63%) compared to employees’ perceptions (48%). Based on the Presenteeism Scale, the OR of productivity loss was 3.05 (95% CI 1.16–8.04) among those who reported presenteeism. The OR of productivity loss based on the employees’ self-estimations was 77.39 (95% CI 25.36–236.12) among those with presenteeism. The validity of the Presenteeism Scale was tested by the plotting ROC curves (Study IV). The value of the area under the curve (AUC) for perceived productivity was 0.83 (95% CI 0.78-0.87). The value of the Presenteeism Scale-based productivity loss was 0.64 (95% CI 0.58-0.70).

6.2 Perceived work ability scores and prevalence of presenteeism (I- IV)

The mean of the perceived WAS in the studied population was 8.4 (SD 1.3) (Studies I and III). The corresponding results were as follows: 2005 (8.3 SD 1.3) and 2007 (8.5 SD 1.4) (Study II). Table 3 presents the distribution of the perceived WAS in detail.
Table 3. Perceived work ability score (WAS) among food industry workers

<table>
<thead>
<tr>
<th>WAS</th>
<th>2003 n</th>
<th>2003 %</th>
<th>2005 n</th>
<th>2005 %</th>
<th>2007 n</th>
<th>2007 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>0.1</td>
<td>1</td>
<td>0.1</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>0.2</td>
<td>2</td>
<td>0.2</td>
<td>3</td>
<td>0.2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>0.5</td>
<td>10</td>
<td>0.8</td>
<td>12</td>
<td>0.9</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>0.6</td>
<td>12</td>
<td>1.0</td>
<td>16</td>
<td>1.2</td>
</tr>
<tr>
<td>5</td>
<td>20</td>
<td>2.4</td>
<td>29</td>
<td>2.4</td>
<td>26</td>
<td>1.9</td>
</tr>
<tr>
<td>6</td>
<td>27</td>
<td>3.2</td>
<td>31</td>
<td>2.6</td>
<td>37</td>
<td>2.7</td>
</tr>
<tr>
<td>7</td>
<td>86</td>
<td>10.1</td>
<td>135</td>
<td>11.3</td>
<td>119</td>
<td>8.7</td>
</tr>
<tr>
<td>8</td>
<td>268</td>
<td>31.5</td>
<td>386</td>
<td>32.4</td>
<td>404</td>
<td>29.6</td>
</tr>
<tr>
<td>9</td>
<td>284</td>
<td>33.4</td>
<td>401</td>
<td>33.6</td>
<td>452</td>
<td>33.2</td>
</tr>
<tr>
<td>10</td>
<td>154</td>
<td>18.1</td>
<td>186</td>
<td>15.6</td>
<td>294</td>
<td>21.6</td>
</tr>
<tr>
<td>Total</td>
<td>851</td>
<td>100</td>
<td>1193</td>
<td>100</td>
<td>1363</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 4 shows the prevalence of presenteeism among the food industry workers between 2003 and 2007. Employees with perceived WASs of 7 and 8 accounted for 85% of the prevalence of presenteeism and about 70% of presenteeism days annually.

Table 4. The distribution of presenteeism scale in the datasets used in Studies I–III

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>16</td>
<td>1.2</td>
<td>14</td>
<td>1.1</td>
<td>24</td>
<td>1.8</td>
<td>31</td>
<td>2.4</td>
<td>30</td>
<td>2.6</td>
</tr>
<tr>
<td>5</td>
<td>63</td>
<td>4.9</td>
<td>73</td>
<td>5.9</td>
<td>52</td>
<td>3.9</td>
<td>61</td>
<td>4.7</td>
<td>47</td>
<td>4.2</td>
</tr>
<tr>
<td>6</td>
<td>85</td>
<td>6.7</td>
<td>90</td>
<td>7.3</td>
<td>69</td>
<td>5.1</td>
<td>74</td>
<td>5.7</td>
<td>66</td>
<td>5.8</td>
</tr>
<tr>
<td>7</td>
<td>269</td>
<td>21.2</td>
<td>257</td>
<td>20.8</td>
<td>283</td>
<td>21.0</td>
<td>281</td>
<td>21.6</td>
<td>218</td>
<td>19.4</td>
</tr>
<tr>
<td>8</td>
<td>839</td>
<td>66.0</td>
<td>801</td>
<td>64.8</td>
<td>919</td>
<td>68.2</td>
<td>852</td>
<td>65.6</td>
<td>763</td>
<td>67.9</td>
</tr>
</tbody>
</table>

Employees with presenteeism (n)

<table>
<thead>
<tr>
<th></th>
<th>2003 n</th>
<th>2004 n</th>
<th>2005 n</th>
<th>2006 n</th>
<th>2007 n</th>
</tr>
</thead>
<tbody>
<tr>
<td>1271</td>
<td>1347</td>
<td>1299</td>
<td>1124</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Employees (n)

<table>
<thead>
<tr>
<th></th>
<th>2003 n</th>
<th>2004 n</th>
<th>2005 n</th>
<th>2006 n</th>
<th>2007 n</th>
</tr>
</thead>
<tbody>
<tr>
<td>2676</td>
<td>2705</td>
<td>2730</td>
<td>2718</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Prevalence (%)

<table>
<thead>
<tr>
<th></th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>48</td>
<td>47</td>
<td>50</td>
<td>48</td>
<td>41</td>
<td></td>
</tr>
</tbody>
</table>

60
Table 5 presents the prevalence of presenteeism among food industry workers who were classified by age, gender and type of work. The prevalence was generally high among factory workers regarding both gender and age group. The biggest difference in prevalence was shown between men aged +50 in 2005; 72% (n = 84) of factory workers (n = 117) indicated presenteeism, whereas 44% (n = 22) of office workers (n = 49) indicated presenteeism.

### Table 5. Prevalence of presenteeism (%) among food industry workers during the study years stratified by age group, gender and occupational class

<table>
<thead>
<tr>
<th>Age</th>
<th>Gender</th>
<th>Occupation</th>
<th>2003</th>
<th>2005</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 30</td>
<td>Women</td>
<td>Factory</td>
<td>42%</td>
<td>43%</td>
<td>28%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Office</td>
<td>0%</td>
<td>27%</td>
<td>36%</td>
</tr>
<tr>
<td></td>
<td>Men</td>
<td>Factory</td>
<td>36%</td>
<td>35%</td>
<td>33%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Office</td>
<td>6%</td>
<td>50%</td>
<td>33%</td>
</tr>
<tr>
<td>30-39</td>
<td>Women</td>
<td>Factory</td>
<td>55%</td>
<td>52%</td>
<td>38%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Office</td>
<td>35%</td>
<td>35%</td>
<td>30%</td>
</tr>
<tr>
<td></td>
<td>Men</td>
<td>Factory</td>
<td>53%</td>
<td>56%</td>
<td>43%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Office</td>
<td>29%</td>
<td>32%</td>
<td>39%</td>
</tr>
<tr>
<td>40-50</td>
<td>Women</td>
<td>Factory</td>
<td>52%</td>
<td>54%</td>
<td>50%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Office</td>
<td>40%</td>
<td>44%</td>
<td>33%</td>
</tr>
<tr>
<td></td>
<td>Men</td>
<td>Factory</td>
<td>56%</td>
<td>57%</td>
<td>56%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Office</td>
<td>38%</td>
<td>35%</td>
<td>38%</td>
</tr>
<tr>
<td>&gt; 50</td>
<td>Women</td>
<td>Factory</td>
<td>59%</td>
<td>67%</td>
<td>64%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Office</td>
<td>67%</td>
<td>51%</td>
<td>56%</td>
</tr>
<tr>
<td></td>
<td>Men</td>
<td>Factory</td>
<td>67%</td>
<td>72%</td>
<td>65%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Office</td>
<td>57%</td>
<td>44%</td>
<td>45%</td>
</tr>
</tbody>
</table>

The average WAS was 7.7 (SD 1.5), and the perceived prevalence of presenteeism among the forestry workers (n = 328) was 48% (n = 159). The highest prevalence was among the forest workers aged 30-39 years (58%). However, the lowest prevalence was among workers under 30 years (42%) and workers over 50 years (44%). Based on the general WAS and assessed on the Presenteeism Scale, the
prevalence of presenteeism was 78%. The corresponding result based on the mental WAS was 55%.

6.3 Productivity loss days and percentages (I, II and IV)

The total number of lost working days in the study group (n = 847) was 17,786 (Study I). Of those, 10,642 (60%) were sickness absence days, and 7144 (40%) were presenteeism days. These results corresponded to the annual loss by 5.0% due to sickness absence and 3.7% due to presenteeism. In the forestry harvesting group, 67% (n = 221) of the respondents (n = 328) reported that they had a productivity loss of at least 5% (Study IV). Of these respondents, 70% (n = 153) reported that they had worked when feeling ill at least twice a year. Correspondingly, about 33% (n = 107) of respondents (n = 328) reported no productivity loss. The results of Study IV also showed that the productivity loss based on the general WAS = 10% (SD 9.6%), on the physical WAS = 8.1% (SD 9.4%) and on the WAS = 7.3% (SD 7.8%).

Sickness absence was found to be 63% (8,067 days) among the female factory workers and 51% (2,575 days) among the male factory workers compared to the total number of lost days. The relative share of the lost days were opposite those of the office workers, where presenteeism contributed to a higher loss than sickness absence did. The number of presenteeism days among the female office workers was 866, which corresponded to 55% of the total loss days. The number of presenteeism days among the male office workers was 692 (61%) (Study I).

The total number of sickness absence days varied from 42,580 (2007) to 50,778 (2003). The highest percentage of sickness absence was 8.3% in 2003, and the lowest was 6.9% in 2007. The total number of sickness absence days that affected a company varied from 16,191 (2003) to 18,824 (2008). The total number of presenteeism days varied from 23,106 (2004) to 28,234 (2007). The relative share of presenteeism days in the total loss ranged from 31% (2003) to 40% (2007) (Study II).
6.4 The costs of productivity loss (II)

The sickness absence costs per employee to the public economy annually ranged from EUR 1,963 (2007) to EUR 2,318 (2008), an average of EUR 2,157. The corresponding cost to the employer ranged from EUR 714 (2007) to EUR 806 (2008), an average of EUR 773. The costs of sickness absence to the public economy varied between 2003 and 2008 by an average of EUR 5.8 million. The cost to the employer was EUR 2.1 million.

The cost of presenteeism per employee annually ranged from EUR 986 (2003) to EUR 1,302 (2007), an average of EUR 1,093 between 2003 and 2007. The total annual costs of presenteeism to the employer ranged from EUR 2.6 million (2003) to EUR 3.5 million (2007). The total costs of productivity loss to the employer were calculated as the sum of presenteeism and sickness absence costs; they ranged from EUR 4.6 million (2003) to EUR 5.6 million (2007). The corresponding costs per employee were EUR 1,736 (2003) and EUR 2,061 (2007).

The share of sickness absence costs paid by the company was about 0.7% of the annual turnover and about 2.7% of the annual personnel costs. The share of presenteeism costs was about 1% of the annual turnover and about 3.7% of personnel costs except in 2007 (4.4%). The widest variation was found in the association between business profit and loss costs. The relative share of sickness absence ranged from 8.3% to 15.6%, and presenteeism varied from 14.3% to 21.2% of the annual profit. The total annual costs of loss due to sickness absence and presenteeism was about 1.7% of the turnover and about 6.5% of the personnel costs. In the worst case, the total loss costs amounted to 36.4% (2006) of the annual business profit, whereas in the best case the corresponding result was 22.6% (2007).

6.5 The factors affecting presenteeism and productivity loss (I, III and IV)

The probability of presenteeism was high in the factory workers compared to the office workers: 3.90 for women (95% CI 2.06, 7.39) and 4.21 for men (95% CI 2.08, 8.53). The difference between genders was slight, and age slightly increased the probability of presenteeism (OR 1.03, 95% CI 1.02, 1.05).

Sixty percent of the office workers perceived good leadership, whereas the corresponding results were 33% in female factory workers and 40% in male factory
workers. The lowest percentage of presenteeism (mean 1.9, SD 2.8) was found among the female office workers, who perceived good leadership, whereas the highest percentage of presenteeism (mean 6.4, SD 7.6) was found among the male factory workers, who perceived poor leadership. The male factory workers who perceived good leadership had a reasonable presenteeism percentage (mean 3.3, SD 4.9). The risk of presenteeism (RR) was 48% higher among those who perceived average leadership, and 64% higher among those who perceived poor leadership.

No statistically significant difference was found in the prevalence of presenteeism by age group, but a higher prevalence was found among those aged 31–40 years (56.9%). The prevalence was the lowest among those ≤30 years (42.5%). Mental workload had a significant association with presenteeism and productivity loss. Increased performance requirements had a strong association with presenteeism and perceptions of mental and physical workloads. Economic risk was associated with presenteeism, perceived productivity loss and mental workload (Study IV).

The highest prevalence of presenteeism was found among current smokers (56.3%) and among those with a body mass index (BMI) ≥30 kg/m² (54.1%) although no significant difference was found within the group (Study IV).
7 DISCUSSION

7.1 Summary of findings

Only a few studies in the presenteeism research have used WAI or WAS (de Vries et al. 2013; Lohela Karlsson et al. 2015) although they have been widely used in the sickness absence research (Nygård et al. 2005; Kujala et al. 2006). In the present study, the WAS was quantified in terms of productivity loss percentages and the Presenteeism Scale was developed to assess presenteeism and perceived productivity loss based on the WAS. The results demonstrated the feasibility of using the Presenteeism Scale in two different industrial sectors and that it could be generalised to a domain other than the food industry, where the method was originally developed. Based on the results, presenteeism and perceived productivity loss among an industrial population were explained in detail.

Regarding the assessment of presenteeism, the study showed that WAS and the Presenteeism Scale could be used in economic evaluations and association studies in future presenteeism research. However, further research is needed to improve accuracy of the Presenteeism Scale.

As assessed by the Presenteeism Scale, the prevalence of presenteeism among both the food industry workers and the forestry workers was 48%, based on their responses to the question concerning the number of times they went to work despite feeling so ill that they should have taken sick leave. Among the food industry workers, the presenteeism was 3.7% (2003) of the annual number of working days, accounting for an average of EUR 2.9 million in costs between 2003 and 2007. Employees with perceived WASs of 7 and 8 accounted for 85% of the prevalence of presenteeism and about 70% of the number of presenteeism days and annual costs in the food industry company. Factory work and perceived poor leadership were relevant factors in high presenteeism, whereas gender and age had minor effects on presenteeism.
7.2 The presenteeism scale for assessing presenteeism

The focus of this study was to assess presenteeism in the entire population. Therefore, a method was needed to measure presenteeism and productivity loss without including health conditions. Based on the long history of the use of the concept of work ability in health research, a WAS-based instrument, the Presenteeism Scale, was developed and tested as a measure of presenteeism and productivity loss. The use of work ability in presenteeism research was innovative. Only a few previous studies used that approach (de Vries et al. 2013; Lohela Karlsson 2015).

The presenteeism scale developed in this dissertation is a simple tool compared to other presenteeism instruments. It required only one self-evaluation item of work ability: “Define your current work ability compared to your lifetime best on a scale from 0 to 10”. The single item question is a part of the WAI, which is a valid and reliable tool (Tuomi et al. 1998). A potential limitation of the Presenteeism Scale instrument is that it does not directly evaluate the prevalence of presenteeism or the factual magnitude of productivity loss. It could be considered that assessing an employee’s perceived work ability and calculating a theoretical productivity loss would yield reliable results compared to a method in which an employee is asked to self-evaluate his or her productivity loss. In the traditional approach to assessing presenteeism, employees would be asked to evaluate their health limitations and the effects of the latter on their performance at work (Mattke et al. 2007). In fact, because the Presenteeism Scale is based on the WAS, it takes into account an employee’s health status and functional capacity, the work, values and skills (Ilmarinen 2006). The perceived WAS has been used in previous sickness absence research (Nygård et al. 2005; Kujala et al. 2006). Moreover, the same factors, such as an employee’s health status, are used to define both sickness absence and presenteeism (Hansen and Andersen 2008).

It is important to bear in mind that in this study, the costs of the perceived productivity loss were theoretical. An objective measure of productivity loss at the company or employee level was not applied. However, an objective assessment would have required a different study design and would have been challenging (Braakman-Jansen et al. 2012).

In Study I, the results of the Presenteeism Scale were comparable with the results of previous studies (Wahlqvist et al. 2006; Lipton et al. 2001; Goetzel et al. 2004; Mitchell and Bates 2011), which suggesting that the method is valid and worth further development. The results of a previous study (Ozminkowski et al. 2004) were
successfully used to construct the Presenteeism Scale, and they were applied in the four sub-studies (Study I, Study II, Study III and Study IV). In Study IV, the Presenteeism Scale was validated in a sample of forestry workers. Although the Presenteeism Scale was not as accurate as the workers’ self-perceptions of their productivity losses, it was a valid method for assessing and predicting productivity loss among those who reported presenteeism.

Although the Presenteeism Scale was able to report only theoretical productivity loss, it may be a useful instrument in health screening, cost accounting and production planning. The method offers a tool for evaluating theoretical productivity losses at the company level and determining the overall health and productivity of employees. Regarding cost accounting, it is valuable to know how many human resources have been invested in products and how many resources have been used to compensate presenteeism. For example, a team could use more time resources than allocated if it included employees that indicated presenteeism.

Although the Presenteeism Scale is based on perceived work ability (WAS), we showed that our method was valid for assessing the prevalence of presenteeism and productivity loss (Study IV). The Presenteeism Scale was able to quantify perceived work ability in relative loss percentages from 0 to 26, which is more realistic compared with previous approaches that assessed loss percentages on a scale from 0 to 100 (Brouwer et al. 1999). In Studies I–III, the implementation of scale from 0 to 100 would have yielded a tremendous productivity loss rate of 16%. In contrast, the Presenteeism Scale from 0 to 26 resulted in 3.7%, which was in alignment with Mitchell and Bates’s (2011) finding that the average annual productivity loss among 1.3 million employees was 3.9%.

7.3 Validation of the presenteeism scale

The results of the multivariable model showed that the Presenteeism Scale predicted presenteeism-based productivity loss even when the employees’ self-perceptions of their productivity losses showed greater accuracy. However, the descriptive statistics and cross-tabulations showed that the productivity loss based on Presenteeism Scale was consistent with the employees’ self-reported perceived productivity loss.

The results of the Presenteeism Scale were similar to previous findings regarding the prevalence of presenteeism (Vik 2005) and productivity loss (Mitchell and Bates 2011). Because this similarity may be coincidental, we suggest interpreting the results
with caution because different scales were used, and the convergence between instruments was poor (Beaton et al. 2010).

The strength of the Presenteeism Scale developed the present research is that it was validated using multiple methods. The Pearson’s correlations test and a logistic regression were used to ascertain the associations among presenteeism, productivity losses and related factors. The predictive ability of presenteeism was tested by computing the ROC to describe the productivity loss predicted by presenteeism based on the Presenteeism Scale. In addition, the validation was done among forestry workers, thus showing that the Presenteeism Scale could be generalised to a domain other than the food industry where the method was originally developed.

Some limitations should be considered regarding the validation of the Presenteeism Scale. The first limitation is that the number of participants eligible for validating the Presenteeism Scale was only 107. However, that number was reasonable and comparable with other presenteeism instrument studies (Thompson et al. 2010). The second limitation is that all the respondents in the validation study were men although the Presenteeism Scale was developed in the food industry where female employees are predominant. However, the Presenteeism Scale was also feasible among only men. It seems that it would have been even more feasible if the respondents had been both men and women. The third limitation is that a verbal scale, which was subsequently quantified, was used to assess productivity loss instead of asking the respondents to indicate directly their perceived percentages productivity loss. This approach is common (Mitchell and Bates 2011), and the self-quantification of productivity loss percentage would be challenging.

Despite these limitations, the results showed that the Presenteeism Scale is a valid method for assessing productivity loss among those reporting presenteeism, and it is as effective as any other method (Ospina et al 2015). However, further research is needed to improve the accuracy of this scale.

7.4 Presenteeism and productivity loss

Presenteeism among the food industry workers and forestry workers in Finland is as common as it is in other countries (Aronsson et al. 2000). The results of this study showed that the distribution of the productivity loss variable was skewed, which means that many employees had no productivity loss. However, there were wide differences between the office workers and the factory workers in the food industry company. Previous studies reported that the amount of presenteeism was higher
than the amount of sickness absence (Brady et al. 1997; Lipton et al. 2001). The results of the present study confirmed these previous findings among office workers, whereas sickness absence predominant among the factory workers. The reasons for the greater amount of sickness absence among factory workers might be that the work is strenuous and physically demanding (Savinainen et al. 2011). Moreover, according to the company’s strict hygiene rules, food industry workers should not work when they are ill especially when they could spread contagious viruses (Richards 2001; Boxman et al. 2011).

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The results of Study I showed that the prevalence of presenteeism was 48% in the food industry company; in Study IV the corresponding 48% was found in the forestry workers. This percentage is comparable with earlier studies that reported a prevalence of about 50% (Aronsson et al. 2000; Aronsson and Gustafsson 2005; Vik 2005; Johansen et al. 2014). It is worth discussing the association between the prevalence of presenteeism and the amount of productivity loss. A common measure of prevalence (e.g. Aronsson et al. 2000) is the number of employees who have worked at least twice a year even when they felt so ill that they should have sick leave. However, this measure does not consider how long an employee’s ill health has prevailed or how many times (more than twice) an employee had worked while ill. It does not measure either productivity loss or the number of times an employee has worked during a year when they felt ill but the ailment did not necessitate a sick leave.

The consequences of working when feeling ill and the amount real objective productivity loss are difficult to assess (Braakman-Jansen et al. 2012). In general, measuring objective productivity is challenging and little research has been done to associate objective measures with the subjective presenteeism instruments (Brooks et al. 2010). However, according to Riedel (2003, p.24) self-reported productivity loss is becoming common in many companies and Lynch (2003b, p.53) predicts that self-report measures will become the standard method. In developing the Presenteeism Scale, we assumed that that if employee’s perceived WAS of 8 indicated presenteeism and a productivity loss of 5%, which amounts to a loss of 11 working days a year and 24 minutes loss per workday if the full capacity is needed. However, it does not mean that an employee will have that loss directly because in the Finnish food industry, the capacity has been about 80% (Välimäki 2006), and a loss of 5% would equate with about 19 minutes per a workday. Although the prevalence of presenteeism and the amount of productivity loss were different measures, the results of Study IV showed that employees who exhibited presenteeism also
contributed to productivity loss, which supports the use of a measure of prevalence as an indicator of productivity loss.

An employee's number of entries at work when feeling ill might be a good indicator of psychosocial and organisational factors in the workplace and in the work itself. Both negative (Gilbreath and Karimi 2012) and positive behaviours of supervisors (Ramsey 2006; Bierla et al. 2011) have been shown to affect presenteeism, so they should be taken into account. In addition, working while ill may be a cultural issue (Dew et al. 2005), or it may be related to the difficulty in finding substitutes (McKevitt et al. 1997; Aronsson et al. 2000).

In this study, the average productivity loss was comparable to those found in other studies (Lipton et al. 2001; Ozminkowski et al. 2004; Mitchell and Bates 2011). However, there is a lack of studies that discuss the acceptable level of productivity loss even if presenteeism is a part of the every organisation’s daily life. Finding an organisation without health-related or non-health-related presenteeism might be challenging.

7.5 The costs of productivity loss

It is difficult to calculate the costs of presenteeism (Ceniceros 2015). According to Pauly et al. (2008) company directors have been sceptic about calculations of presenteeism costs. Many previous studies focused on the costs at the macroeconomic level (Davis et al. 2005; Kessler et al. 2006; Mattke et al. 2007; Mitchell and Bates 2011), but only a few studies have reported monetary figures at the company level (Ozminkowski et al. 2004; Goetzel et al. 2004; Burton et al. 2006). Some studies focused on presenteeism costs (Osterhaus et al. 1992; Lipton et al. 2001; Brouwer et al. 2002; Wang et al. 2004; Mattke et al. 2007; Mitchell and Bates 2011), but none discussed their impact on an organisation’s turnover or revenue. Study II was designed to assess presenteeism costs at the company level, but it was difficult to show the long-term effects on the company’s business because they consisted of various factors, which would have required adjustment.

Study II showed that the average annual presenteeism cost per employee in the food industry company was EUR 1,093, which was aligned with Australian figure the EUR 1,159 found in Australian studies (Medibank Private 2008; Medibank 2011) and the EUR 790 reported by the Ministry of Social Affairs and Health in Finland (Rissanen and Kaseva 2014). Cost studies regarding the average employee are lacking because most previous studies have focused on health conditions (Cisternas et al. 2012).
Most of the presenteeism research has been conducted in the USA, Canada and Australia. Therefore, comparing the findings with those of European studies entails further research (Cooper and Dewe 2008). In addition, most of the cost data are presented at the national level (Medibank 2011), and estimations at the company level are still limited. Employers would like to know the effects of presenteeism on their businesses; however, an adequate equation for measuring the magnitude of productivity losses is lacking (Ceniceros 2015) although methods for evaluating productivity loss are available (Lensberg et al. 2013). The discussion regarding the assessment of the costs of lost productivity seems to be at a standstill, but it does not prevent the assessment of productivity loss costs especially when an organisation evaluates costs for its own purposes and does not need to compare them with the costs of other companies.

Another issue worth discussing is the allocation of costs. Study II showed that the average annual sickness absence cost per employee to the employer and the public economy were EUR 773 and EUR 2,157, respectively. In such cases, the sickness absence costs might paid by the national social insurance institution as compensation to an employer. Every European Union member state provides benefits that compensate income loss during sickness absence from work, but there are different criteria, such as in the duration of sick pay (Spasova et al. 2016). However, a double payment arrangement, in which both the employer and the national social insurance institution pay benefits, is common in Europe (Spasova et al. 2016). Because of the differences between countries in the duration of sick pay and the amount of allowance, they should be taken into account in comparing the costs of loss due to sickness absences. The results of Study II are not necessarily comparable with other countries that have different relative allocations between the employer and the national social insurance institution.

Allocating the productivity loss costs of presenteeism is simple because all costs are allocated to the employer. However, the challenge is to compare the productivity loss costs of organisations in different countries because they use different instruments to assess presenteeism, and they have different salary levels and living standards. It is noteworthy that the convergence between presenteeism instruments is poor (Beaton et al. 2010). The best way to utilise information about the cost of presenteeism is to evaluate the source of costs within a company and to follow their trend. For example, in Study II, the main source of potential productivity loss costs at the company level was the employees with WASs of 7 and 8, who accounted for
about 70% of the presenteeism days. That finding is in direct contrast to the findings in the traditional presenteeism research, which emphasises the loss and costs of chronic conditions (Mitchell and Bates 2011). We concede that chronic conditions and mood disorders are the costliest in terms of presenteeism, but the number of employees who have those conditions is usually minimal; thus, the costs at the company level are irrelevant.

In summary, further research and discussion are required regarding the health-related loss of productivity loss and its costs (Lensberg et al. 2013). In addition, standardised measures for productivity loss and methods are required to monetise losses so that costs can be compared across studies (Mitchell and Bates 2011).

7.6 Factors associated with presenteeism

Previous studies showed that factors other than health affect presenteeism, such as psychosocial (Robertson et al. 2012) and organisational practices (Nyberg et al. 2008; Böckerman and Laukkanen 2009; Gilbreath and Karimi 2012). The results of the present study confirmed that the type of work (Study I) was a relevant factor in presenteeism, and the perceived leadership explained the probabilities of presenteeism more precisely than gender and type of work did (Study III). Among the female participants, perceived average leadership did not reduce the percentage of presenteeism or the risk of presenteeism, which indicates that the level of leadership is a factor in decreasing productivity loss. A remarkable finding was that poor leadership practices affected presenteeism in men more than in women although the reason is unclear.

In Studies I and IV, age was a covariate. In Study I, the probability of presenteeism was increased with increasing age, but in Study IV the association with age was not consistent. There was no statistically significant difference in the prevalence of presenteeism by age group, but employees over 61 years had reduced odds of having perceived productivity loss compared to employees 30 years and younger. The productivity of older employees was comparable with the findings of a study by Börsch-Supan and Weiss (2016), which found that productivity did not decline at least up to 60 years. However, the number of participants in our Study IV was small, and the results should be interpreted with caution. The low amount of productivity loss among older employees could be explained by the characteristics of the forestry work, in which work experience is a crucial factor in high productivity (Gellerstedt 2002). In Study IV, other covariates, such as BMI, smoking status,
perceived mental and physical workloads, economic risks and profit requirements were studied. High BMI and smoking were related to WAS-based productivity loss, which could be explained by the decreased health status of obese people (Gates et al. 2008; Janssens et al. 2012) and smokers (Bunn et al. 2006).

Compared with physical workload, mental workload also was an important variable in productivity losses and presenteeism. This result could be explained by the low equity ratio (Pere et al. 2015) and the high debt-to-cash flow ratio in the forestry industry (Penttinen et al. 2008).

The study of the food and forestry industries showed that variables should be selected according to the characteristics of the industry and the study population. In the forestry sample, a gender variable was not used because there were only few women in that industry. Moreover, work in the forestry is independent and comparable to self-employment, which led us to use factors related to economic risk and profit requirements.

7.7 Theoretical and methodological consideration

7.7.1 Theoretical understanding

Most presenteeism studies have focused on employees’ health, medical conditions (Schultz et al. 2007; Cooper and Dewe 2008), health risks (Burton et al. 2006), personal and work-related demands (Aronsson and Gustafsson 2005) and psychosocial workplace factors (Biron et al. 2006; Robertson et al. 2012). The results of most previous studies concerned the prevalence, association or amount of presenteeism with respect to a certain factor, such as employee health. However, based on the literature review conducted for this dissertation, a theoretical framework is lacking, which afforded a holistic basis for assessing presenteeism and its related factors. Based on the findings of the studies conducted for this dissertation, the work ability concept (Ilmarinen 2006) might provide a relevant framework because any factor of presenteeism or reasons for abnormal performance can be fit to a certain element of the work ability concept. Figure 5 presents the theoretical understanding of the study. Any impairment of health or work-related factors may decrease performance and the perceived work ability, thus contributing to the perceived WAS. According to this theory, WAS is related to the prevalence of presenteeism because an employee with a WAS of 8 or less was considered a case of
presenteeism. However, the WAS cannot be transferred directly to productivity loss (dashed line), so the Presenteeism Scale is needed. Although this scale is used to assess the prevalence of presenteeism, its primary aim is to assess the productivity loss related to presenteeism.

![Figure 5. Research design between work ability, presenteeism and productivity loss. Solid lines present direct and dashed lines indirect associations.](image)

### 7.7.2 Measures and methods

In the present study, the perceived WAS was used as a primary measure in assessing the prevalence of presenteeism and subjective productivity loss. In the analysis, the WAS was dichotomised because its distribution was highly skewed. In Study IV, three different WAS measures (general, physical and mental) were used. The results showed that the WAS should be selected depending on the nature of the work and the tasks. For example, the mental WAS is a better measure in stressful work, whereas the physical WAS is better in measuring physically strenuous work. Sickness absence days were used to define the number of effective working days, thus ensuring that the share of presenteeism was calculated correctly.

A quantitative methodology was applied in this dissertation. Descriptive statistics and cross-tabulations were applied present the differences between occupation and gender. Logistic regressions are commonly used in presenteeism research (e.g. Janssens et al. 2013; Suzuki et al. 2014; Doki et al. 2015). They were used in the
present research because they revealed differences in presenteeism between and within the sub-groups. Using a quantitative methodology and diverse statistical tools, the results of this research showed that the developed Presenteeism Scale was useful, and it yielded valid results.

7.7.3 Strengths and limitations of the study

The main strength of this study is that it was conducted in two different industrial sectors, and the data were collected in multiple cross-sectional surveys. In the study on the food industry company, questionnaire data were collected in 2003, 2005 and 2007, and the register data were collected from 2003 to 2008. In the study on the forest industry, the data were collected in 2016. The number of participants was adequate to assess productivity losses at the company level. Because presenteeism and sickness absence were investigated in both office and the factory workers, it was possible to compare the results and to observe emerging issues. For example, there were wide differences between the office and factory workers in their rates of sickness absence and presenteeism. One reason for this difference was the factor of perceived leadership. Another strength was that the register data on sickness absence was used to assess the number of effective working days and link these findings with the results of multiple questionnaire surveys conducted between 2003 and 2008. The Presenteeism Scale allowed for assessing individual productivity loss. In addition, the distributions of productivity losses among and within the occupational groups at the company level were explored. Previous presenteeism studies were focused on the prevalence of presenteeism (e.g. Aronsson et al. 2000; Johansen et al. 2014). However, the present study was focused on the number of days of productivity loss and their percentages (Studies I and II). Regarding the costs of presenteeism, previous studies used national data (Medibank 2011), whereas this study reported the monetary value of loss at the company level (Study II).

In the present study, self-perceived WASs and related factors were assessed. Although the self-assessment method has been criticised (Brooks et al. 2010), in previous research it was found to be appropriate and reliable in assessing presenteeism (Druss et al. 2001; Kessler et al. 2003). In addition, as Gustafsson Sendén et al. (2016) reported, there are no objective tests for assessing presenteeism. According to Braakman-Jansen et al. (2012), studies in which self-reported work productivity has been matched with objective productivity measures have not yet been published. The methodological validity of the present research is supported by
Johns’ (2010) study, in which the convergent validity between presenteeism assessment methods was poor. Thus, the method used in this study is as effective as any other method is (Mattke et al. 2007).

The Presenteeism Scale was able to produce reasonable results, which were comparable to those of other studies (Brady et al. 1997; Lerner et al. 2001; Lipton et al. 2001; Medibank Private 2008; Medibank 2011; Rissanen and Kaseva 2015). In addition, the questionnaires and the register data used in this study were used previously in academic dissertations (Neupane 2012; Siukola 2013) and in several other studies (Nygård et al. 2005; Virtanen et al. 2008; Neupane et al. 2014). Although Studies I–III were conducted in a single company, the data were collected from four separate factories (business units) and an administration unit, which served to mitigate the limitation of a single-company study (Virtanen et al. 2008). In Study IV, the participants were drawn from several companies, and they comprised both entrepreneurs and workers.

This study has the following limitations. Regarding the productivity loss of an employee, it was assumed that there was a linear relation between an employee’s perceived WAS and productivity. Real productivity loss was not measured. No previous studies on the relation between perceived WAS and perceived productivity loss were available with the exception of Tuomi et al. (2001), who reported that high work ability was related statistically significantly to high productivity.

It is debatable that the impetus for the present study rested on the previous study by Ozminkowski et al. (2004), which examined productivity loss using two different presenteeism instruments. In the present study, these previous results were used as the experimental baseline and as a latent variable in developing the Presenteeism Scale. Indeed, it is in keeping with scientific inquiry that new knowledge is derived from previous knowledge. Although whether Ozminkowski et al.’s (2004) results were the best possible basis for the present study could be debated, the results of Studies I–IV were comparable with those of previous studies. In the present study, it was hypothesised that perceived health status is a global factor that does not vary according to an employee’s nationality. It was also hypothesised that productivity losses based on health status could be transferred to productivity losses based on work ability.

Another limitation was that a single question on perceived WAS was asked, and the responses were extrapolated to cover the entire year. The physical WAS is stable, but in Study IV, the participants were also asked to evaluate their mental WAS, which might be more sensitive to variations during a short time frame. It is also possible that some employees overestimated their perceived WAS, whereas others may have
underestimated it. However, previous studies reported that WAI and WAS were valid and reliable (Tuomi et al. 2001; de Zwart et al. 2002; Radkiewich and Widerszal-Bazyl 2005). Moreover, extrapolation is frequently used in presenteeism research (Mitchell and Bates 2011). Questionnaire surveys might have some reliability and bias issues, which should be taken into account in interpreting the results of this study, although the number of respondents was adequate and a non-respondent analysis was performed in Study I.

In Studies I–IV, a cross-sectional design was implemented to assess the association between certain factors and presenteeism. Although a longitudinal design was not used, it would be useful in a follow-up study on the amount of presenteeism and the amount of productivity loss. In the literature, cross-sectional studies account for 76.5% of the presenteeism studies conducted between 1996 and 2012 (Thompson et al. 2015). Only 30 cohort studies, 42 randomised controlled clinical trials and 8 pre-post studies were carried out during that period (Thompson et al. 2015).

A final limitation of this study may be that the effects of chronic disease, stress and depression on presenteeism and productivity loss were not explored although this information was included in the register data. However, the number of employees with such ailments was not sufficient to warrant a separate analysis. Moreover, the main objective of our study was to explore presenteeism and productivity loss among the entire population.

7.7.4 Generalisability

This study was conducted in two industrial sectors in the same country. Studies I–III were focused on the food industry sector, which consisted of one big company that operated four separate factories. The validation study (Study IV) was focused on the forestry industry sector, which consists of many small- and middle-sized companies. Therefore, the study’s settings should be taken into account in generalising the results especially at the international level. The monetary values of presenteeism related to productivity loss should be generalised cautiously. Furthermore, in international comparisons, the figures should be adjusted according to national salary levels. The comparison of productivity loss costs between companies even nationally should consider the specific characteristics (e.g. team performance vs. individual performance) of companies (Berger et al. 2001). Regarding the costs of sickness absences (Study II), the national legislation in Finland
stipulates that the Social Insurance Institution of Finland (KELA) must pay a sickness allowance as compensation to an employer. Not every country has similar legislation. Therefore, in this study, the costs of sickness absences to the company and the public economy were calculated separately. Regarding the Presenteeism Scale, more research among several different industry sectors is needed to validate its use, validity and reliability.

7.8 Recommendations for further research

The Presenteeism Scale and the use of the WAS are novel approaches in the presenteeism research. However, because many presenteeism instruments are available, it would be useful to compare the use of the Presenteeism Scale developed in this dissertation with other methods to re-validate the loss scale. There is reliable information available regarding WASs among the Finnish population in general (Gould et al. 2008) as well as the rates of sickness absence in Europe (Gimeno et al. 2004a; Spasova et al. 2016). However, no information is available on the rates or costs of presenteeism and productivity loss at national and international levels. We recommend that data on both national and international presenteeism be collected, which could be used as reference information.

Although the concept of work ability has been applied in many studies on sickness absence (Nygård et al. 2005; Kujala et al. 2006), it is a novel approach in the presenteeism research. Hansen and Andersen (2008) reported that the reasons for presenteeism are similar to the reasons for sickness absence. Therefore, in future studies on this topic, we recommend using the “house of work ability” (Ilmarinen 2006) as a framework because it considers some elements of presenteeism.

Previous studies focused on the association between sickness absences and presenteeism (Aronsson et al. 2000; Brouwer et al. 2002; Kumar et al. 2003). However, to determine the degree to which productivity may decrease before an employee takes sick leave and how quickly productivity would recover to a normal level would require an objective measure of productivity, which would be challenging (Braakman-Jansen et al. 2012; Gustafsson et al. 2016). Nevertheless, there is a need for presenteeism research that focuses on measuring productivity and especially the association between objective and perceived productivity.

Presenteeism has often a negative label and employees with presenteeism are stigmatized as a cost factor and a productivity problem. However, presenteeism is an important outcome variable which can be used in a positive way for finding
health-related and non-health-related gaps and, thus enabling improving employees’ health and increase of productivity, quality and business performance overall.

We also recommend that future research use a longitudinal design in which health-related and non-health-related factors were determined to show they affected presenteeism and productivity losses. Although previous studies focused on the association between age and presenteeism (Bierla et al. 2013; Yang et al. 2016), there is little evidence for the relation between age and presenteeism, which warrants further investigation.
8. CONCLUSIONS

1. This study provides new evidence that work ability scores (from 4 to 10) can be used and quantified (from 0% to 26%) to develop a method (i.e. the presenteeism scale) for assessing the prevalence of presenteeism and perceived productivity loss.

2. The results showed that the presenteeism scale combined with effective working hours and salary information could be used to assess the costs of productivity loss to companies and to society.

3. The work ability-based measure (i.e. the presenteeism scale) showed an association between perceived leadership and presenteeism. The risk of presenteeism was greater among participants who reported poor perceived leadership.

4. The presenteeism scale is a valid instrument for assessing presenteeism and perceived productivity loss.

Assessing presenteeism and productivity loss as well as calculating the costs of presenteeism are challenging. The results of the study imply that presenteeism is common in industry, and there are variations between and within gender and occupational groups. Based on the results of this study, the potential costs of productivity loss to both companies and society are vast. Therefore, organisations should assess presenteeism in their workplaces and devise a course of action if an employee’s productivity loss exceeds the desired level, which is critical for both the employee’s health and the organisation’s performance.
ACKNOWLEDGEMENTS

The present study was carried out at the Faculty of Social Sciences (Health Sciences) at the University of Tampere. I sincerely convey my gratitude to all those advisors and contributors who made this Dissertation possible. This journey started about 15 years ago and during that time period there have been many helping hands and advisors e.g. from Finland, Germany and US who have guided me on the right track. I thank University of Tampere and people at Kauppi Campus for supporting my research work. It was always a great pleasure to enter into campus and to feel friendly but also professional atmosphere.

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During these years there have been many professionals with whom I have had inspiring discussions which have helped me to find new points of view regarding presenteeism, occupational health and related costs. Therefore, I want to thank Professor (emeritus) Guy Ahonen and PhD Markku Aaltonen who instructed me in the beginning of this study. I warmly thank also President Sean Sullivan and Vice President Deborah Love from the Institute for Health and Productivity Management (IHPM) and Managing Director Wolf Kirsten from Kirsten Consulting for their help when I was taking the first steps of presenteeism research.
There are only few professionals who are competent reviewers and opponents regarding work ability and presenteeism and the related issues. Luckily, we were able to reach them and got their positive consents. Therefore I would like to express my sincere gratitude to Docent Paula Liukkonen and Professor Petri Böckerman, the official reviewers of the dissertation manuscript. Thank you for those supportive and constructive comments to improve the quality of manuscript. Their comments also gave me a new impetus to focus on the association between subjective and objective measures of productivity and the causal effects between the used variables in future. I am also grateful to Professor Kimmo Räsänen for agreeing to act as the opponent at the public defence.

My sincere thanks to Occupational Medicine journal, especially to Ms Angela Burnett, and International Journal of Occupational Safety and Ergonomics for their supportive attitude and advices to publish presenteeism articles.

My profoundest thanks to the Saarioinen Group and all the employees who participated in this study. I am also grateful to the Finnish small and middle-sized forestry enterprises and their employees. Their participation and co-operation made this Dissertation possible. Thanks to the Finnish Work Environment Fund and Metsämieslen Säätiö Foundation for the financial support to conduct this research.

I would like to sincerely thank to all the members of the occupational health research group. It was always a great pleasure to participate in the research group seminars and share ideas and discuss various topics. Warm thanks also to my relatives, friends, colleagues and workmates who were interested in my research during these years.

My profoundest thanks to my beloved wife Annina Korpela who always supported me and reminded that it is important to exercise, rest, and to eat healthy food instead of drinking coffee. Thanks also to our sons Topias and Matias. Despite their young age they sometimes asked challenging questions such as “Who discovered a toothbrush and where?” or “Can we travel same day from home to abroad by using teletransportation?” Those questions showed that thirst for knowledge of children is inherent and we human beings should not lose that feature while growing up. Annina, Topias and Matias, you are the best thing in my life. I love you.

Kimmo Vänni

September 2018, Tampere, Finland
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Krol M (2012): Productivity costs in economic evaluations, Erasmus University, Rotterdam.


ORIGINAL PUBLICATIONS

I

II

III

IV
Kimmo Vänni, Subas Neupane, Anna Siukola, Heikki Karinen, Hannu Pursio, Jukka Uitti, Clas-Håkan Nygård. The Presenteeism Scale as a measure of productivity loss. (Accepted for publication in Occupational Medicine Published by Oxford University Press).
Relationship between Perceived Work Ability and Productivity Loss

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Abstract

This paper presents an approach to assessing presenteeism (on-the-job productivity loss) that is related to perceived work ability. The aim of this explorative research was to find out if perceived work ability could be a robust indicator, interchangeable with presenteeism, in Finnish food industry organizations. The developed approach was based on existing presenteeism research as well as on register and survey data. The approach demonstrates that one step downward on the 10-point perceived work ability scale theoretically reduces employees’ on-the-job productivity by ~ 5 percentage points. At the company level, on-the-job productivity loss was 3.7% (mdn 0%), while sickness absence was 5.0% (mdn 2.2%). The probability of productivity loss among factory workers was fourfold compared to women in office work. The developed approach makes it possible to assess perceived productivity loss at the level of an individual and an organization. The perceived work ability may, in fact, be a robust indicator for assessing perceived productivity loss.
1. Introduction

All decision-makers are keen on improving their organization’s performance, productivity and outcome. Sickness absence is a costly problem and a great concern also at the national level. However sickness absence is not the only health related issue that increases organization’s costs; presenteeism, too, is relevant as a potential performance loss factor. [1-3] Presenteeism has many synonyms, e.g. sickness presence [1], sickness presenteeism, [2] on-the-job productivity loss [4] and at-work productivity loss. [5] In fact, presenteeism means being at the workplace but not fully working due to health problems. [6-8] In this research, productivity loss and presenteeism are synonyms.


Existing presenteeism measurement methods are appropriate for a rather short recall period of 1 to 4 weeks and those methods are suitable for evaluating the productivity loss in different health conditions. However, our philosophical basis was totally different compared to the existing methods. We did not use the fixed recall period at all or we may say that the length of the recall period was as long as an employee’s work career so far. In addition, our philosophy was that also people who did not have any medical conditions could feel that their ability to perform had decreased compared to lifetime best.

We were also keen to research and to develop a way of reporting the average on-the-job productivity loss caused by to poor or decreased perceived work ability. Previous studies did not address our intention, expect for Ozminkowski et al. [5] who compared the usability of two valid and reliable instruments, the Work Limited Questionnaire [24] (WLQ) and the Work Productivity Short Inventory [28] (WPSI), and reported productivity loss percentages. They reported that the average productivity loss due to presenteeism was 4.9% and 6.9% for WLQ and WPSI, respectively. We selected Ozminkowski et al. [5] research as our reference study because their study group consisted of ordinary healthy people without any specific symptoms, diseases or illnesses. There is no consensus or gold standard which measurement method is appropriate for evaluating on-the-job productivity loss. In addition, there is no gold standard for productivity loss percentages regarding so-called healthy employees, or even regarding employees with health conditions. It is hard to say what the average productivity loss percentage might be regarding healthy employees or regarding employees with health conditions. Much research on productivity loss has reported productivity loss related to medical conditions [11,16,29,30] like depression, migraine and arthritis, however, the productivity loss percentages due to poor health seem to vary case by case. [30]

One cornerstone of our research was the work ability concept [31] which tells how well people can cope with their work with respect to the work demands. Work ability is like a four-floor building where the ground floor is based on an employee’s mental, physical,
psychological and social functional capacity. The second floor consists of the employee’s skills, the third floor of the employee’s values, and the top floor is work itself and work-related factors.

Earlier research reported that perceived work ability was associated with sickness absence and perceived health status [32-34] as well as poor productivity [35] but we were keen on finding out if the perceived work ability could be a robust indicator and if it could be interchangeable with presenteeism. Perceived work ability is one’s own sense about capability to perform. Decreased work ability does not mean directly that a person is a poor worker or the bottleneck of company performance but it can theoretically reveal how much company might lose if the full capacity is necessary.

Regarding our intention to report the connection between perceived work ability and on-the-job productivity loss, we used the study result by Ozminkowski et al. [5] owever, we had to introduce some restrictions because our primary data did not include questions on presenteeism. We found that the relative shares between health statuses in Ozminkowski et al.[5] study group and ours study group were quite comparable, even if there were some differences, too. For example, ~14% of of Ozminkowski et al.’s respondents reported fair or poor health. The corresponding share in our research was 16% (Table 1). Because there is a strong relationship between employee health status and work ability, we hypothesized that productivity loss percentages in Ozminkowski et al.’s study were comparable with perceived work ability. Thus, we combined Ozminkowski et al.’s results and our research data, and we obtained productivity loss discount factors, which consist of employees’ perceived work ability and which directly report theoretical productivity loss percentages.

Table 1. Comparison between some factors of Ozminkowski et al.[5] study and our study.

<table>
<thead>
<tr>
<th>Health status [%]</th>
<th>Ozminkowski et al. study</th>
<th>Our study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>14.11</td>
<td>7.0</td>
</tr>
<tr>
<td>Very good</td>
<td>33.86</td>
<td>25.0</td>
</tr>
<tr>
<td>Good</td>
<td>37.57</td>
<td>52.0</td>
</tr>
<tr>
<td>Fair</td>
<td>13.76</td>
<td>14.4</td>
</tr>
<tr>
<td>Poor</td>
<td>0.71</td>
<td>1.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other factors</th>
<th>Ozminkowski et al. study</th>
<th>Our study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual working days [d]</td>
<td>238</td>
<td>228</td>
</tr>
<tr>
<td>Age (mean) [yrs]</td>
<td>37.4</td>
<td>40.5</td>
</tr>
<tr>
<td>Number of respondents [n]</td>
<td>567</td>
<td>847</td>
</tr>
</tbody>
</table>

Our intention was not evaluate the difference between presenteeism and sickness absence. However, we took into account and reported sickness absence figures because we used
sickness absence data as an independent variable for calculating perceived productivity loss days due to presenteeism.

This approach was explorative. We hypothesized that it was possible to construct a presenteeism measurement method based on the perceived work ability, even if such an attempt had never been made before.

2. Materials and method

The study was carried out at one of the largest food processing companies in Finland, which consists of an administration center and four factories. At the time of the study, the company employed 1995 persons.

2.1 Register data

Objective data on age, gender, employment type (office or factory work) and sickness absences of all individuals employed from January 1 to December 31, 2003 were obtained from the register of the human resources department. Age and sickness absence factors were treated as continuous variables. An employee without any absence from work had 228 working days annually, excluding vacations and other day-offs.

2.2 Survey data

Data on perceived work ability and perceived health status were based on the questions selected from a large survey, also including questions on leadership, community spirit and workload. The survey was carried out in 2003 among all employees of the company. It yielded 1120 replies (response rate: 56%). Of these, 873 (78%) consented to the survey data being combined with their sickness absence records. After excluding incomplete responses, the number of respondents eligible for this study was 847. [36] The research was approved by the ethical committee of Pirkanmaa Hospital District.

Because number of eligible respondents was relative low, compared to total number of company employees, we compared objective data on age, gender, work experience, employment type and sickness absence of respondents and non-respondents. According to descriptive statistics (Table 2) and Kruskal-Wallis test, the difference between the respondents and non-respondents was not significant. Therefore, we can state that the sample represented well the whole company.
Table 2. Demographic between respondents and non-respondents

<table>
<thead>
<tr>
<th></th>
<th>Respondents</th>
<th>Non-respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N</strong></td>
<td>847</td>
<td>1101</td>
</tr>
<tr>
<td><strong>Sickness absence percentage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (Sd / Md)</td>
<td>5.0 (2.2 / 7.3)</td>
<td>6.0 (3.0 / 7.9)</td>
</tr>
<tr>
<td><strong>Working years</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (Sd / Md)</td>
<td>11.8 (8.6 / 9.5)</td>
<td>10.9 (8.6 / 8.8)</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (Sd / Md)</td>
<td>40.5 (40.0 / 11.1)</td>
<td>39.3 (38.0 / 11.4)</td>
</tr>
<tr>
<td><strong>Employment type</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office work [n, %]</td>
<td>273 (32 %)</td>
<td>143 (13 %)</td>
</tr>
<tr>
<td>Factory work [n, %]</td>
<td>581 (68 %)</td>
<td>958 (87 %)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female [n, %]</td>
<td>589 (69 %)</td>
<td>639 (58 %)</td>
</tr>
<tr>
<td>Male [n, %]</td>
<td>265 (31 %)</td>
<td>462 (42 %)</td>
</tr>
</tbody>
</table>

Sd= standard deviation, Md= median

2.3 Construction of measures to assess presenteeism

The survey included the question “Define your current work ability compared with your lifetime best“. The response scale was from 0 to 10. The question is a part of the Work Ability Index [37], but methodological studies have shown that the question is also valid for defining an employee’s perceived work ability.[35,38] The employees also self-reported their perceived health status on a 0-10 scale. Perceived work ability, perceived health status and Ozminkowski et al.’s [5] study results were the starting point in constructing measures for assessing presenteeism. The average perceived work ability level of our study group was 8.4 (SD 1.3) and perceived health status was 7.7 (SD 1.5), while the contingency coefficient between perceived work ability and perceived health status was 0.85.

The variable of our study, the perceived work ability- related Presenteeism Scale, was constructed as follows. We hypothesized that the average health status of of Ozminkowski et al.’s [5] study group and ours were comparable; therefore we could use Ozminkowski et al.’s research results. We combined and compared the average productivity loss values 4.9% (WLQ) and 6.9% (WPSI) from Ozminkowski et al.’s study our average perceived work ability level of 8.4. Because WLQ and WPSI were health status related, we fixed the average productivity loss percentages 4.9% and 6.9% into work ability- related percentages by multiplying them by the contingency coefficient 0.85 between perceived health status and perceived work ability from our study. The result yielded the average perceived productivity loss percentages of 4.2% and 5.9%. Next, we calculated the ratios between the work ability fixed productivity loss percentages 4.2% and 5.9% and the perceived work ability level 8.4 of our study group (4.2/8.4 and 5.9/8.4) and matched those linearly to relate the perceived work ability level 8. While the productivity loss percentages 4.2% (WLQ) and 5.9% (WPSI)
corresponded perceived work ability level 8.4, the corresponding productivity loss percentages for perceived work ability level 8 were 4.4% (WLQ) and 6.1% (WPSI). It is good to notice that when perceived work ability number decreases, perceived productivity loss percentage increases. For example, the mathematical proportion $\frac{4.2\%}{8.4} = \frac{X}{8.0}$ yields $X = 4.0\%$. However, in this case we have to invert the scale so that decreasing perceived work ability yields $X = 4.4\%$. The next phase was that excellent perceived work ability levels 9 and 10 were considered as not causing productivity losses [35], and therefore level 9 was considered to respond to zero perceived productivity loss. For example, the linearity of our scale means that a one-level discount downward a perceived work ability level yields ~4.4% (WLQ) and 6.1% (WPSI) productivity loss.

\[
\begin{align*}
\text{productivity loss (WLQ)} & \quad \frac{0.0\%}{9.0} \xrightarrow{\text{loss}} \frac{4.4\%}{8.0} \xrightarrow{\text{loss}} \frac{8.7\%}{7.0} \xrightarrow{\text{etc.}} \\
\text{productivity loss (WPSI)} & \quad \frac{0.0\%}{9.0} \xrightarrow{\text{loss}} \frac{6.1\%}{8.0} \xrightarrow{\text{loss}} \frac{12.3\%}{7.0} \xrightarrow{\text{etc.}} 
\end{align*}
\]

After that, we extended the productivity loss figures to correspond the perceived work ability levels. The procedure resulted in two perceived work ability related productivity loss scale options, one related with WLQ, the other with WPSI. Finally, we calculated the means of the two scales (Table 3) and constructed the Productivity Loss Scale.

We calculated that perceived work ability 8 corresponds to ~5% reduction in productivity, and each downward step of the perceived work ability scale reduces productivity by ~5 percentage points. We cut and ignored the productivity loss scale from downward of perceived work ability level 4 because perceived work ability levels from 3 to 0 were irrelevant in employees who might have on-the-job productivity loss. In this case, the relative share of employees who had level under 4 was 0.7%. Employees with a very low perceived work ability level also had very low health status level and, therefore, a high number of sickness absence days.
Table 3. Presenteeism Scale according to perceived work ability level

<table>
<thead>
<tr>
<th>Perceived Work ability level</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>*WLQ (WA related presenteeism %)</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>21.8</td>
<td>17.4</td>
<td>13.1</td>
<td>8.7</td>
<td>4.4</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>*WPSI (WA related presenteeism %)</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>30.7</td>
<td>24.5</td>
<td>18.4</td>
<td>12.3</td>
<td>6.1</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Mean [%]</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>26.2</td>
<td>21.0</td>
<td>15.7</td>
<td>10.5</td>
<td>5.2</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Presenteeism Scale (discount factor)</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>0.26</td>
<td>0.21</td>
<td>0.16</td>
<td>0.11</td>
<td>0.05</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

WA=work ability, WLQ= Work Limited Questionnaire, WPSI= Work Productivity Short Inventory, n/a= irrelevant value.

* The starting values of WLQ and WPSI are derived from Ozminkowski et al.5

When we took into account bank holidays, vacations and weekends, we calculated that an employee with no absence from work had 228 working days annually, i.e. potential on-the-job productivity loss days. The annual sickness absence days [Dabs] of every employee were calculated from the register data by multiplying every employee’s absence rate percentage [A%] by the 228 annual working days [Dgross].

\[ \text{Dabs} = \text{A\%} \times \text{Dgross} \]

We calculated the on-the-job productivity loss [Lpres] i.e. presenteeism days, by using the perceived work ability-related discount factors [Fwa] and annual net working days [Dnet] obtained by subtracting the annual absence days [Dabs] from the annual working days [Dgross]. Every employee’s annual presenteeism days were determined individually by multiplying their net working days [Dnet] by their perceived work ability discount factor [Fwa].

\[ \text{Lpres} = \text{Dnet} \times \text{Fwa}, \text{ where } \text{Dnet} = (\text{Dgross} - \text{Dabs}) \]

The total loss days due to presenteeism at the company level is:

\[ \sum_{i=1}^{n} L_{pres} \], where \( n \) = number of employees.
2.4 Analysis design

The independent variables were sickness absence percentage from register data as well as perceived work ability level and perceived health status level from survey data. The dependent variable, presenteeism, was defined according to independent variables. We hypothesized that the selected independent variables were the only possible variables related to presenteeism in this research.

2.5 Statistical analysis

Cross-tables of presenteeism and absence days per person per working year described the differences in total loss days between women and men working in an office or a factory. Presenteeism was dichotomized in the upper quartile (0-11 days versus at least 12 days). High presenteeism was explained with age-adjusted interaction of gender and occupational status by binary logistic regression; they were described with odds ratios (OR) and their 95% confidence intervals (CI). Analyses were done by SPSS release 14.0.1, and Microsoft Excel.

3. Results

The aim of this research was to explore if perceived work ability could be a robust indicator, interchangeable with presenteeism. In addition, the aim was to develop a new approach to using perceived work ability as an indicator for assessing data on presenteeism.

The total number of lost working days in the study group of 847 employees was 17786, of which 60% (10642 days) were sickness absence and 40% (7144 days) presenteeism (Table 4). These figures corresponded 5.0 % annual loss due to sickness absence and 3.7 % loss due to presenteeism.

Table 4. Annual presenteeism and absence among the participant groups

<table>
<thead>
<tr>
<th></th>
<th>Number of annual working days</th>
<th>Number of presentee days</th>
<th>Presenteeism %</th>
<th>Number of absence days</th>
<th>Absence %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (Sd)</td>
<td>Median (Range)</td>
<td>Mean (Sd)</td>
<td>Median (Range)</td>
<td></td>
</tr>
<tr>
<td>Office workers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(n=172)</td>
<td>39 216</td>
<td>866</td>
<td>2.3 (3.3)</td>
<td>0.0 (15.9)</td>
<td>698</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.8 (3.7)</td>
</tr>
</tbody>
</table>
Table 5 presents descriptive statistics of the participants. There were more women than men both among factory workers and office workers. The mean age ranged from 38 years in male factory workers to 45 years in male office workers.

Table 5 also shows presenteeism, sickness absence and the total number of lost days per person per working year. The figures were higher for factory workers than for office workers. Sickness absence contributed 63% (female factory workers) and 51% (male factory workers) to the total number of lost days; in office workers, the corresponding percentages were lower, 39-43%. Regarding the whole company the median of presenteeism days was 0 (interquartile range, IQR: 11.4) per person, while the median of sickness absence days was 5 (IQR: 15) per person. In all, for 52% of the factory workers the perceived work ability level was under 9, i.e. potential perceived productivity loss, whereas in office workers the figure was 40%.
Table 5. Mean and median values of presenteeism and sickness absence at the employee level

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Age</th>
<th>Presenteeism</th>
<th>Absence</th>
<th>Total loss</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>WA below 9</td>
<td>Days/person/year</td>
<td>Days/person/year</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>(Sd)</td>
<td>N</td>
<td>%</td>
<td>Mean</td>
</tr>
<tr>
<td>Office workers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>172</td>
<td>43.2</td>
<td>64</td>
<td>37</td>
<td>5.2</td>
</tr>
<tr>
<td></td>
<td>(10.0)</td>
<td></td>
<td>(7.6)</td>
<td>(11.3)</td>
<td>(8.5)</td>
</tr>
<tr>
<td>Men</td>
<td>94</td>
<td>45.0</td>
<td>42</td>
<td>44</td>
<td>7.5</td>
</tr>
<tr>
<td></td>
<td>(10.4)</td>
<td></td>
<td>(10.7)</td>
<td>(11.4)</td>
<td>(13.5)</td>
</tr>
<tr>
<td>Factory workers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>414</td>
<td>39.5</td>
<td>218</td>
<td>53</td>
<td>9.5</td>
</tr>
<tr>
<td></td>
<td>(11.3)</td>
<td></td>
<td>(12.7)</td>
<td>(11.3)</td>
<td>(18.8)</td>
</tr>
<tr>
<td>Men</td>
<td>167</td>
<td>37.5</td>
<td>84</td>
<td>50</td>
<td>10.0</td>
</tr>
<tr>
<td></td>
<td>(11.0)</td>
<td></td>
<td>(14.1)</td>
<td>(11.4)</td>
<td>(13.4)</td>
</tr>
<tr>
<td>Total</td>
<td>847</td>
<td>40.5</td>
<td>408</td>
<td>48</td>
<td>8.5</td>
</tr>
<tr>
<td></td>
<td>(11.1)</td>
<td></td>
<td>(12.1)</td>
<td>(11.4)</td>
<td>(16.4)</td>
</tr>
</tbody>
</table>

Sd=standard deviation, Md=median, IQR=interquartile range, WA=perceived work ability

Table 6 presents high presenteeism. The probability of age-adjusted presenteeism among male office workers was about twofold compared to women in office work, but the difference was not statistically significant (OR 1.84, 95% CI [0.79-4.29]). Among factory workers, presenteeism was significantly higher than among female office workers (OR 3.90, 95% CI [2.06-7.39] for women, and (OR 4.21, 95% CI [2.08-8.53] for men. Long-term presenteeism seems to be quite similar in both genders, but age increased presenteeism (OR 1.03, 95% CI [1.02-1.05]).
Table 6. Employees having at least 12 presenteeism days during a working year by gender and occupation. Odds ratios (OR) and 95% confidence intervals (CI).

<table>
<thead>
<tr>
<th></th>
<th>Respondents</th>
<th>WA below 9</th>
<th>Univariate</th>
<th>Multivariate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>N</td>
<td>%</td>
<td>OR [95% CI]</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.03 [1.01-1.04]</td>
</tr>
<tr>
<td>Women office workers</td>
<td>172</td>
<td>64</td>
<td>37</td>
<td>1.00</td>
</tr>
<tr>
<td>Men office workers</td>
<td>94</td>
<td>42</td>
<td>44</td>
<td>1.95 [0.84-4.54]</td>
</tr>
<tr>
<td>Men factory workers</td>
<td>167</td>
<td>84</td>
<td>50</td>
<td>3.46 [1.73-6.92]</td>
</tr>
</tbody>
</table>

WA= perceived work ability

4. Discussion

Generally, the magnitude of the reported presenteeism figures were realistic compared to those of other studies, [11,16,29,30] suggesting that our perceived work ability-related measurement method might be reliable and worth further developing. We realized that there were much former researches that reported productivity loss of even 2 - 40%, depending on existing health and the study group.[11,29,30] Lerner et al.[29] reported the lowest productivity loss of 2%, measured with WLQ method, in their depression study, where the figure was related to productivity loss of a healthy control group. That figure corresponds rather well with our research material; we found that the group of so-called healthy employees had a 2.9% productivity loss. The highest productivity loss of 40% was found in Wahlqvist et al.’s Gastro-Oesophageal Reflux Disease study.[11]

It is important to bear in mind that the perceived productivity loss figures of this explorative research were theoretical; they show how much the organization might lose in annual productivity compared to the best-case scenario, where every employee performs without any productivity loss. However, we are going to validate the perceived productivity loss scale in near future to test the method and to secure its validity and reliability.

Even if the measurement method yields sensible figures, we must consider potential limitations. Although perceived work ability is a reliable way to obtain robust data, it should be borne in mind that employees’ self-reported perceived work ability are subjective and
over- or underestimation is possible. Some employees can overestimate their perceived health status and perceived work ability, whereas others can underestimate them. However, self-reports are widely used for assessing individual perceived work ability and productivity loss, and they are considered reliable. In addition, there is no any previous research on the relationship between perceived work ability, work ability concept and on-the-job productivity loss. However, researching and developing a measurement method for that kind of relationship is relevant, especially in Europe, where the concept of work ability is widely used and has a long history.

The link between the reported presenteeism (productivity loss) days and the reality may also be questioned at an individual level. In fact, productivity is defined as the ratio of output and input, and it depends on many variables, not only labor input.[39] In this study, we were able to calculate a theoretical amount of perceived productivity loss days during a year, but we were not able to measure quantitative productivity, input and output, of the company or an employee. In all, we were not able to illustrate how much at-work productivity may decrease in the real world. However, we can state that a high presenteeism rate decreases productivity especially in times of an economic boom; that is why high capacity is necessary. Therefore, the developed perceived work ability-related Productivity Loss Scale can be used for estimating how much the perceived productivity loss might be if the full capacity is necessary.

Speaking technically, we succeeded in using the study result by Ozminkowski et al.’s[5] study in constructing the perceived work ability-related Productivity Loss Scale and in applying the obtained variable in testing the developed perceived productivity loss measurement method. However, our questionnaire did not include directly presenteeism or productivity loss questions. That restriction might be a weakness or a strength. We were not able to obtain presenteeism data directly but we know that employees are not willing to answer questions regarding their perceived productivity or presenteeism. Therefore, the question on perceived work ability might be better than a question on perceived productivity level or presenteeism. One more limitation was that we hypothesized that the average health status of the participants at Ozminkowski et al.’s[5] study and of our study group were comparable. We knew there was a difference in the health status but we assumed that the difference was not significant among employees in industrialized countries. However, the relative shares of our data regarding perceived work ability matched well Ozminkowski et al.’s[5] data on perceived health status. In addition, perceived productivity loss percentage regarding healthy employees from our study match rather well with the figure for the control group in Lerner et al.’s study.[29]

Regarding the productivity loss scale, we assumed that there was a linear relation between employees’ perceived productivity loss and their perceived work ability. We were not able to measure the real productivity loss and we do not know any previous research on the relation between perceived work ability and perceived productivity loss; even if, Tuomi et al.[35] reported that high work ability level related statistically significantly to high productivity in one’s work. It is possible that the relation between perceived work ability and perceived productivity loss is linear, nonlinear, curve or a combination of them but we need other research to find that out. However, the developed Productivity Loss Scale seems to be more relevant than a scale where perceived work ability numbers from 0 to 10 were transformed
directly into presenteeism from 100% to 0%. For example, in this research the direct scale would give a tremendous mean value of company’s productivity loss, ~16%, whereas the developed scale resulted in 3.7%. In all, the Productivity Loss Scale seems to enable realistic estimation and prediction of presenteeism, and it may be considered a methodological solution in future research and in organizations aiming to carry out questionnaire surveys among their personnel without direct questions on presenteeism or perceived productivity loss.

Even if the presenteeism is a hot topic, it is not every employee’s problem. The result of the pilot study showed that distributions of the presenteeism and the sickness absence variables were skewed, i.e. many employees had no perceived productivity loss and/or no sickness absence at all. However, the result showed wide differences between office and factory workers.

The findings of earlier research on a higher share of presenteeism than sickness absence [16,40] were confirmed regarding office workers, while in factory workers sickness absence was still dominant. The reason for the higher share of sickness absence than presenteeism among factory workers is that working in the food processing industry is strenuous and physically demanding [41,42] especially on the shopfloor, where manual and repetitive work, in spite of a high automation, is still necessary and the working environment is challenging. [43] Production workers may have as much as a ninefold relative risk for musculoskeletal symptoms compared to administrative workers. [44] Even if office work may seem to be less strenuous than factory work, musculoskeletal symptoms are also predominant because of the one-sided strain pattern of work. [45,46]

There has been an ongoing discussion about the job performance of older employees in the industry. Work ability, measured with the Work Ability Index, decreases over time, especially in physical work. [47] However, there is no research on a possible connection between perceived work ability-related productivity loss and ageing. We did not research the age question in this study but we recommend that it should be researched.

When an organization wants to gain an economic advantage and cut total productivity loss, it should monitor both presenteeism and sickness absence. Both are important when the focus is on maintaining the employees’ health and on managing those with impaired perceived work ability. Such monitoring, however, is a sensitive topic, and should be approached transparently, i.e. in consensus between the employees and the employer and, obviously, according to the legislation and ethical principles.

This study has three values. First, it is the first attempt to connect employee’s perceived work ability and presenteeism. Second, the developed approach is not fixed to any recall period, which means that it can be used rather quicker and more easily at any time compared to other methods. Third, labor laws require Finnish employers to monitor and promote employees’ working performance. The perceived work ability-related presenteeism indicator is a way for occupational health care to manage and follow up how well employees with decreased perceived work ability level can stay at work instead of taking sick leave.
References:


An effort to assess the relation between productivity loss costs and presenteeism at work

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Abstract

**Purpose:** This study assess potential presenteeism costs and the association of these with a company’s business figures. **Material and methods:** We conducted the questionnaire surveys in alternate years between 2003 and 2007 and linked them to sickness absence register data. Perceived work ability levels were assessed and converted into presenteeism days using the Presenteeism Scale tool. Sickness absence and presenteeism days were converted into monetary figures using median monthly salary information. **Results:** The share of presenteeism costs was constant at about 1% of annual turnover and about 3.7% of personnel costs. The lowest annual presenteeism cost per employee was EUR 986 and the highest EUR 1302. The lowest number of presenteeism days per employee was 8.7 days and the highest number was 10.4 days in a year. Estimated losses to a company due to sickness absences and presenteeism ranged from EUR 4.6 million to EUR 5.6 million annually. The potential presenteeism costs to the company and to Finnish society were vast. **Conclusions:** Presenteeism is a costly problem but more research is needed to reveal the connections between presenteeism and a company’s turnover, personnel costs and profit.

**Keywords:** Presenteeism, productivity loss, assessment methods, work ability, costs, business profit
1 Introduction

The presenteeism concept, which means being at the workplace but not working at full capacity, is often directly associated with employees’ health. [1–4] Recently researchers have reported that there are indirect reasons for presenteeism other than illnesses [5] such as working-time arrangements, [6] personal and work-related demands, [7] heavy workload and precarious employment status, [8] efficiency demands [9] and psychosocial workplace factors. [10] The presenteeism concept is not unambiguous and Johns [11, p. 521] has noted the following nine different definitions of presenteeism “(a) attending work, as opposed to being absent, (b) exhibiting excellent attendance, (c) working elevated hours even when unfit, (d) being reluctant to work part time rather than full time, (e) being unhealthy but exhibiting no sickness absenteeism, (f) going to work despite feeling unhealthy, (g) going to work despite feeling unhealthy or experiencing other events that normally compel absence, (h) reduced productivity at work due to health problems, (i) reduced productivity at work due to health problems or other events that distract one from full productivity.” What these definitions have in common is to be physically present at work but incapable of normal performance. [11] According to definitions the reason for presenteeism varies from health problems to organizational reasons such as job insecurity or the desire to exhibit excellent attendance. [11] The most common definitions are health-related such as sickness presence, [12] sickness presenteeism, [13] on-the-job productivity loss [14] and at-work productivity loss. [15] Because an employee’s health status is an important factor in presenteeism, we utilized the work ability concept [16] in this study and taken presenteeism to mean being at work but not working at full capacity due to poor health and functional ability. [17] We claim that the work ability concept [16] aptly exemplifies the characteristics of these nine definitions of presenteeism [11] and emphasizes an employee’s health. Even if presenteeism is often equated with productivity loss, we determined that presenteeism is a potential risk factor for productivity loss but not directly equated with it. [17]

The economic impact of health costs has become a focus of interest together with medical efficacy and safety. [11] Some studies have indeed focused on presenteeism costs [5, 18–23] but none of them discuss their impact on an organization’s turnover or revenue. Many presenteeism studies have claimed that presenteeism decreases gross domestic product (GDP) and productivity at the macroeconomic level [18, 24–29] but only few studies have shown objectively how to assess productivity, and how to turn productivity loss into monetary figures at the company level. [15, 30, 31] Few studies [32, 33] state that presenteeism is actually a bigger problem than sickness absence, and that a great part of productivity loss is related to impaired performance on the job. Assessing the costs of presenteeism is more complicated than assessing those of sickness absence, and therefore some studies claim unequivocally that presenteeism costs are at least equal to sickness absence costs. [34]

There are many presenteeism assessment instruments available [18, 35–40], their common purpose being to assess the impact of pharmaceuticals on work productivity. [11] Some instruments can assess the costs of lost productivity, but none of them have been reliably established and validated. [18] Escorpizo et al. [41] reported that there are 16 measures that quantify presenteeism, of which nine could be used in economic costing analyses. Lofland et al. [36] reported that only five instruments out of eleven identified are able to capture both absenteeism and presenteeism metrics suitable for conversion into monetary figures. A typical study usually reports reduced productivity in terms of working hours lost [42] but according to Braakman-Jansen et al. [43] estimated time loss compared
with productivity loss is of a limited value and there is no gold standard by which to measure productivity loss.

Although presenteeism has been widely studied in recent years, and although numerous presenteeism assessment methods have been proposed, the valuation of productivity loss has remained a controversial topic.\cite{44} There are currently two main methods for quantifying the costs of lost productivity, the friction cost method and the human capital method.\cite{45–47} The other possible methods available are the US Panel method \cite{48} and the multiplier method \cite{44}, which are seldom used. The friction cost method tries to measure the actual value of production lost \cite{44} and takes into account the cost during the period before another employee assumes the absentee’s work, whereas the human capital method measures the potential value of a production loss \cite{44,45,49} and takes into account the loss of productivity in terms of life-long lost earnings.\cite{50,51} In fact, both approaches are valid for estimating the costs at the macroeconomic level.\cite{19–21,24,28} Our approach follows the principles of the human capital method, but we used only direct wages as a proxy for employees’ output and excluded the indirect and overhead costs due to sickness absence and presenteeism.

The presenteeism concept in this study is based on the worker’s perceived work abilities \cite{16} comprising (a) an employee’s mental, physical, psychological and social functional capacity, (b) an employee’s skills, (c) an employee’s values, and (d) the work demands. The work ability concept afforded a holistic basis for assessing presenteeism, and supported the claim that there are factors other than health issues which contribute to presenteeism. In this study we evaluated presenteeism due to impaired work ability regarding the whole organization with no intention to focus on employees with medical conditions.

The aim of the study was to assess the potential cost of loss of productivity due to presenteeism related to perceived work ability at the company level. Our research questions concerned the impacts of presenteeism and sickness absence on a company’s annual turnover, personnel costs and profit. We were also interested to assess the relative shares of presenteeism and sickness absence costs accruing to a company and Finnish society (taxpayers). In addition, we were interested in studying where presenteeism costs principally accumulate at a company level. Our intention was to test our approach in this case study, but we would further hope to develop a comprehensive approach for use in other sectors and companies for assessing presenteeism costs related to perceived work ability.

The case company operated in the food processing sector, which is well-known for maintaining strict standards regarding employee health, especially as regards contagious diseases. Moreover, work in food processing factories is known to be physically strenuous. These issues may suggest that in such a company presenteeism costs would be low compared with sickness absence costs, and that presenteeism figures would be lower than in other studies.

2 Materials and methods

This study was based on sickness absence register data for the period 2003 to 2008 collated with the cross-sectional questionnaire surveys carried out in the company in 2003, 2005 and 2007. \cite{17,52} The company consisted of four factories and an administrative unit. Table 1 presents the study population consisting of both men and women doing office and factory work. The surveys were not carried out
in 2004, 2006 and 2008. The questionnaire survey data were collated with the company’s register data using employees’ identity numbers. The research project was approved by the ethics committee of Pirkanmaa Hospital District, Finland.

Table 1. Demography of the study population and non-respondents

<table>
<thead>
<tr>
<th>Participants</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2003</td>
</tr>
<tr>
<td>Total (n)</td>
<td>2676</td>
</tr>
<tr>
<td>Respondents (n)</td>
<td>851</td>
</tr>
<tr>
<td>Respondents (%)</td>
<td>32</td>
</tr>
<tr>
<td>Office workers</td>
<td></td>
</tr>
<tr>
<td>Male (n)</td>
<td>94</td>
</tr>
<tr>
<td>Female (n)</td>
<td>171</td>
</tr>
<tr>
<td>Factory workers</td>
<td></td>
</tr>
<tr>
<td>Male (n)</td>
<td>170</td>
</tr>
<tr>
<td>Female (n)</td>
<td>416</td>
</tr>
<tr>
<td>Non-respondents (n)</td>
<td>1814</td>
</tr>
<tr>
<td>Non-respondents (%)</td>
<td>68</td>
</tr>
<tr>
<td>Office workers</td>
<td></td>
</tr>
<tr>
<td>Male (n)</td>
<td>67</td>
</tr>
<tr>
<td>Female (n)</td>
<td>114</td>
</tr>
<tr>
<td>Factory workers</td>
<td></td>
</tr>
<tr>
<td>Male (n)</td>
<td>666</td>
</tr>
<tr>
<td>Female (n)</td>
<td>967</td>
</tr>
</tbody>
</table>

Notes: No surveys were carried out in 2004, 2006 and 2008; n/a = figure not available

2.1 Register data

Objective data on age, gender, employment type (office or factory worker) and sickness absences of all employees were obtained for each year between 2003 and 2008 from the register of the company’s human resources department. A sickness absence variable was treated as a continuous variable. An employee without no absence from work had 228 working days (effective working hours) during the years 2003 and 2005, and 227 working days during the years 2004, 2006, 2007 and 2008.
2.2 Survey data

Data on perceived work ability was based on a question selected from a large survey also including questions on leadership, community spirit and workload. To assess presenteeism the respondents were asked to assess their perceived work abilities with the question: “define your current work ability compared to your lifetime best” on a scale ranging from (0 = totally unable to work, 10 = work ability at its best) [53]. The target company committed to the extensive and long-term occupational health research project, where survey data was collected every two years starting from 2003. This study includes the survey results from years 2003, 2005 and 2007.

2.3 Measurements of variables

2.3.1 Sickness absence

The sickness absence days of each employee were obtained from the register data. We defined the total number of annual productivity loss days (gross days) for Finnish society by summing up employees’ sickness absence days. However, our intention was to ascertain the costs to the company, and therefore we calculated the number of sickness absence days (net days) for which the company paid. Under the terms of the collective labour agreement in the food sector [54] a company must continue to pay an employee’s salary for the duration of specified days of absence due to sickness. If an employee has had an employment contract for between one month and three years, the company must pay full salary for the following 28 days. The maximum remuneration to be paid by a company is for 56 days, and this applies when an employee has had a continuous contract for at least ten years. In this study we simplified the analytic design by applying a 28-day rule to concern all employees. We calculated that each year more than 80% of the study population (M 81.5, Range 80.5–82.7) had a maximum of 28 sickness days or less.

We took into account the national legislation which stipulates that the Social Insurance Institution of Finland (KELA) should pay a sickness allowance as compensation to an employer if an employee’s sickness absence exceeds ten days, and the employer continues to pay the salary for more than ten days.[55] This means that a company pays an employee’s full salary for the first ten days without receiving any compensation. In addition, if a company pays full salary for between ten and 18 days it is entitled to compensation from KELA. This compensation covers about 70% of costs of the salary paid for between ten and 28 days.[56] For example, if an employee has 28 sickness days in a year, she or he will receive full salary during the whole period and the employer’s expenses are as follows; (a) whole salary expense during the first ten days with no compensation, (b) whole salary for the following 18 days with 70% salary compensation from KELA. If an employee’s sickness absence exceeds 28 days, an employee will be paid an allowance directly by KELA for the days in excess of the 28-day period. Accordingly, if an employee has had 15 days of sickness absence, he or she will receive full salary, and the employer’s expenses will consist of the first ten days’ salary (100%) and the employer’s share regarding the next five days (30%). We applied these rules in this study. After ascertaining the days of sickness absence we calculated the cost of a single day’s absence. We calculated the average annual salary per employee for each year by dividing the annual personnel costs of the company by the number of employees. We then divided the annual salary by 12.5 to obtain the average monthly salary (0.5 represents bonus holiday pay). The average monthly salary was divided by the average monthly working days, 19 which were derived by dividing the annual working
days, 227 or 228, by 12 months. As a result the salary figures were as follows: 2003 (EUR 113.1),

2.3.2 Assessment of Presenteeism

Our interest in assessing work ability related presenteeism was based on the popularity of the work
ability index [16] and the work ability scores from 0 to 10, which are common and widely used in
occupational health research.[57] The work ability scores are quite stable and decrease slowly as an
employee’s age increases.[58,59] The method for assessing presenteeism and calculating the
presenteeism days was based on our earlier study, for which we developed the Productivity Loss
Scale.[17] The percentages on the scale were used as the discount factors (Fwa) for assessing the rate
of presenteeism days. As a result, a perceived work ability level of 8 on a scale from 0 to 10
 corresponded theoretically to a 5% discount (presenteeism rate), and each downward step increased
the presenteeism rate by approximately 5 percentage points. This means that the presenteeism rate
starts from 5% (level 8) and ends up at 26% (level 4). Perceived work abilities 9 and 10 corresponded
to a 0% presenteeism rate.

We ignored perceived work ability less than 4 because the average share of employees whose work
ability was lower than 4 was 1.07% (SD 0.26) in this study material. Those employees also had the
highest number of sickness absence days.[17] Our decision to ignore work ability scores lower than
4 is supported by the study by Gould et al.[60] In sum, our presenteeism assessment method took
into account employees whose perceived work ability scores were from 4 to 8.

The rate of presenteeism (Lpres) was calculated by using the discount factors (Fwa) and annual net
working days (Dnet) which were obtained by subtracting the annual absence days (Dabs) from the
annual working days (Dgross). Every employee’s annual presenteeism days were determined
individually by multiplying his or her net working days (Dnet) by personal work ability related
discount factor (Fwa).[17]

\[ L_{\text{pres}} = D_{\text{net}} \times F_{wa}, \text{ where } D_{\text{net}} = (D_{\text{gross}} - D_{\text{abs}}) \]

The total loss in days due to presenteeism at the company level is:

\[ \sum_{i=1}^{n} L_{\text{pres}_i}, \text{ where } n = \text{number of employees } [17] \]

\[ i=1, \text{ increment of each employee’s loss days to total sum until } i \text{ equals } n \]
\[ L_{\text{pres}_i}, \text{ sum of days lost due to presenteeism} \]
Since our aim was to assess presenteeism at the company level, we needed a model for extrapolating the survey results of respondents to cover non-respondents as well. We constructed a model by evaluating the amount of presenteeism from survey questionnaires in respect to factors such as age, gender and type of employment. We defined the distribution and frequency of respondents in every category year by year, and according to that information we calculated the factors (probabilities) and extrapolated the results to cover the non-respondents. Regarding the years 2004 and 2006, when the surveys were not carried out, we used the distribution and frequency information from 2003, 2005 and 2007. As a result of extrapolation we were able to calculate presenteeism figures to cover the non-respondents as well.

2.4 Statistical analysis

Given the aim of this study, we emphasized descriptive statistics. Sickness absence days, percentages and costs were calculated first. After that we calculated the presenteeism figures and the sum of sickness absences and presenteeism. We calculated the percentages of sickness absence, presenteeism and the sum of those with respect to the organization’s annual turnover, personnel costs and business profit. We used Pearson’s correlation test to ascertain any possible association between sickness absence, presenteeism and the business figures.

We reported the results of sickness absence and presenteeism costs regarding the whole company as sum figures because that information was significant at the organizational level. In addition we reported the distribution of presenteeism as regards perceived work ability.

3 Results

The results of the study are presented in the following Tables. The results are mainly descriptive and show monetary values for presenteeism and sickness absence as well as the relative shares of these in the company’s annual turnover, personnel costs and annual profit. Table 2 presents the descriptive figures for sickness absence, presenteeism and the related costs. The total number of sickness absence days varied from 42,580 to 50,778. The company covered about 33–39% of annual sickness absence days at its own expense. The remaining days were covered by the Finnish taxpayer. The sickness absence days covered by the company ranged from 2.7% to 3.0% of total annual work time. The average sickness absence costs to public economy per employee was EUR 2157 per year and the corresponding cost to the employer was EUR 773.

Regarding the lost working hours, the cost of presenteeism days was smaller than that of the total number of sickness absence days for the Finnish taxpayer. The number of presenteeism days compared with a number of sickness absence days paid for by the employer was much higher. The sickness absence and presenteeism costs per employee were quite stable between 2003 and 2007. The total annual costs of sickness absence and presenteeism for the employer were from EUR 4.6 million to EUR 5.6 million. The annual sickness absence and presenteeism costs of EUR 1736 per employee for the company were lowest in 2004 and highest, at EUR 2061, in 2007.
### Table 2. Sickness absence, presenteeism and related costs between 2003 and 2008

<table>
<thead>
<tr>
<th>Demographic</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of employees (n)</td>
<td>2676</td>
<td>2604</td>
<td>2705</td>
<td>2730</td>
<td>2718</td>
<td>2754</td>
</tr>
<tr>
<td><strong>Sickness absence</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual SA (days)</td>
<td>50,778</td>
<td>48,713</td>
<td>48,482</td>
<td>48,794</td>
<td>42,580</td>
<td>49,714</td>
</tr>
<tr>
<td>Annual SA per employee (days)</td>
<td>19.0</td>
<td>18.7</td>
<td>17.9</td>
<td>17.9</td>
<td>15.7</td>
<td>18.1</td>
</tr>
<tr>
<td>Out of working hours (%)</td>
<td>8.3</td>
<td>8.2</td>
<td>7.9</td>
<td>7.8</td>
<td>6.9</td>
<td>7.9</td>
</tr>
<tr>
<td>SA paid for by employer (A) (days)</td>
<td>17,746</td>
<td>16,191</td>
<td>16,937</td>
<td>17,265</td>
<td>16,469</td>
<td>18,824</td>
</tr>
<tr>
<td>Annual SA per employee (days)</td>
<td>6.6</td>
<td>6.2</td>
<td>6.3</td>
<td>6.3</td>
<td>6.1</td>
<td>6.8</td>
</tr>
<tr>
<td>Out of working hours (%)</td>
<td>2.9</td>
<td>2.7</td>
<td>2.7</td>
<td>2.8</td>
<td>2.7</td>
<td>3.0</td>
</tr>
<tr>
<td><strong>Presenteeism (A)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Presenteeism (days)</td>
<td>23,334</td>
<td>23,106</td>
<td>24,005</td>
<td>24,113</td>
<td>28,234</td>
<td>n/a</td>
</tr>
<tr>
<td>Presenteeism/employee (days)</td>
<td>8.7</td>
<td>8.9</td>
<td>8.9</td>
<td>8.9</td>
<td>10.4</td>
<td>n/a</td>
</tr>
<tr>
<td>Out of working hours (%)</td>
<td>3.8</td>
<td>3.9</td>
<td>3.9</td>
<td>3.9</td>
<td>4.6</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>Sickness absence and presenteeism (A)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA+Presenteeism (days)</td>
<td>41,080</td>
<td>39,297</td>
<td>40,941</td>
<td>41,378</td>
<td>44,703</td>
<td>n/a</td>
</tr>
<tr>
<td>SA+Presenteeism /person (days)</td>
<td>15.4</td>
<td>15.1</td>
<td>15.1</td>
<td>15.2</td>
<td>16.5</td>
<td>n/a</td>
</tr>
<tr>
<td>Out of working hours (%)</td>
<td>6.7</td>
<td>6.6</td>
<td>6.6</td>
<td>6.7</td>
<td>7.2</td>
<td>n/a</td>
</tr>
<tr>
<td><strong>Costs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA costs for public economy ('000) (EUR)</td>
<td>5743</td>
<td>5665</td>
<td>5755</td>
<td>6041</td>
<td>5335</td>
<td>6383</td>
</tr>
<tr>
<td>SA costs /person (EUR)</td>
<td>2146</td>
<td>2176</td>
<td>2127</td>
<td>2213</td>
<td>1963</td>
<td>2318</td>
</tr>
<tr>
<td>SA costs for employer (A) ('000) (EUR)</td>
<td>2007</td>
<td>1883</td>
<td>2010</td>
<td>2137</td>
<td>2064</td>
<td>2417</td>
</tr>
<tr>
<td>SA costs /person (EUR)</td>
<td>782</td>
<td>733</td>
<td>738</td>
<td>746</td>
<td>714</td>
<td>806</td>
</tr>
<tr>
<td>Presenteeism costs ('000) (EUR)</td>
<td>2639</td>
<td>2687</td>
<td>2849</td>
<td>2985</td>
<td>3538</td>
<td>n/a</td>
</tr>
<tr>
<td>Presenteeism costs /person (EUR)</td>
<td>986</td>
<td>1032</td>
<td>1053</td>
<td>1093</td>
<td>1302</td>
<td>n/a</td>
</tr>
<tr>
<td>SA+Presenteeism (A) ('000) (EUR)</td>
<td>4646</td>
<td>4570</td>
<td>4860</td>
<td>5123</td>
<td>5601</td>
<td>n/a</td>
</tr>
<tr>
<td>SA+Presenteeism /person (EUR)</td>
<td>1736</td>
<td>1755</td>
<td>1797</td>
<td>1876</td>
<td>2061</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Notes: A = days or costs covered at employer’s expense; SA = sickness absence; n/a = figure not available; '000 = thousand

Table 3 presents that the correlations between the annual business profit, personnel costs, sickness absence and presenteeism costs were non-significant. Even if the figures show some correlations, these are not necessarily related.
Table 3. Correlations between absence, presenteeism, personnel costs and business profit per employee from year 2003 to 2008

<table>
<thead>
<tr>
<th>correlations</th>
<th>Absence</th>
<th>Presenteeism</th>
<th>Cost/person</th>
<th>Profit/person</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson correlation</td>
<td>1</td>
<td>-0.767</td>
<td>0.102</td>
<td>-0.763</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>0.130</td>
<td>0.848</td>
<td>0.078</td>
<td></td>
</tr>
<tr>
<td>Presenteeism</td>
<td>-0.767</td>
<td>1</td>
<td>0.849</td>
<td>0.788</td>
</tr>
<tr>
<td>Pearson correlation</td>
<td>0.130</td>
<td>0.849</td>
<td>0.069</td>
<td>0.113</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>0.848</td>
<td>0.069</td>
<td>1</td>
<td>0.024</td>
</tr>
<tr>
<td>Cost/person</td>
<td>0.102</td>
<td>0.849</td>
<td>1</td>
<td>0.024</td>
</tr>
<tr>
<td>Profit/person</td>
<td>-0.763</td>
<td>0.788</td>
<td>0.024</td>
<td>1</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td>0.078</td>
<td>0.113</td>
<td>0.963</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 4 presents the sickness absence, presenteeism costs and those sums with respect to the company’s annual turnover, personnel costs and business profit. A relative share of sickness absence costs paid by the company, was about 0.7% (from 0.63% to 0.74%) of annual turnover and about 2.7% of the annual personnel costs. The share of potential presenteeism costs was slightly higher than the share of sickness absence costs, and quite constantly about 1% (from 0.97% to 1.08%) of annual turnover, and about 3.7% of personnel costs, except in 2007, where the corresponding figure was about 4.4%. The widest variation was found regarding an association between business profit and sickness absence and presenteeism costs, where the relative share of sickness absence ranged from 8.3% to 15.6%, whereas presenteeism varied from 14.3% to 21.2%. The sum of sickness absence and potential presenteeism costs was annually about 1.7% of turnover and about 6.5% of personnel costs. In the worst case the sum of sickness absence and presenteeism costs (2006) amounted to 36.43% of annual business profit, whereas in the best case (2007) the corresponding figure was 22.58%.

Table 4. Annual business figures and the relative shares of sickness absence and presenteeism

<table>
<thead>
<tr>
<th>Demographic</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of employees (n)</td>
<td>2676</td>
<td>2604</td>
<td>2705</td>
<td>2730</td>
<td>2718</td>
<td>2754</td>
</tr>
<tr>
<td>Turnover ('000) (EUR)</td>
<td>272,778</td>
<td>277,237</td>
<td>292,260</td>
<td>307,464</td>
<td>326,871</td>
<td>340,045</td>
</tr>
<tr>
<td>Personnel costs ('000) (EUR)</td>
<td>71,864</td>
<td>71,941</td>
<td>76,301</td>
<td>80,261</td>
<td>80,914</td>
<td>84,003</td>
</tr>
<tr>
<td>Business profit ('000) (EUR)</td>
<td>14,523</td>
<td>17,713</td>
<td>15,704</td>
<td>14,062</td>
<td>24,806</td>
<td>15,449</td>
</tr>
<tr>
<td>Business profit/person (EUR)</td>
<td>6941</td>
<td>9279</td>
<td>7864</td>
<td>6908</td>
<td>12,775</td>
<td>6961</td>
</tr>
<tr>
<td>Sickness absence (A)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA costs for an employer ('000) (EUR)</td>
<td>2007</td>
<td>1883</td>
<td>2010</td>
<td>2137</td>
<td>2064</td>
<td>2417</td>
</tr>
<tr>
<td>Costs from turnover (%)</td>
<td>0.74</td>
<td>0.68</td>
<td>0.69</td>
<td>0.70</td>
<td>0.63</td>
<td>0.71</td>
</tr>
<tr>
<td>Costs from personnel costs (%)</td>
<td>2.79</td>
<td>2.62</td>
<td>2.63</td>
<td>2.66</td>
<td>2.55</td>
<td>2.88</td>
</tr>
</tbody>
</table>
Table 5 presents the main source of potential presenteeism days. From the company’s point of view a critical mass for presenteeism was derived from those employees who perceived their work ability to be level 7 or 8. Their combined share was more than 85% of employees and they accounted for some 70% of presenteeism days every year. Even if employees with low perceived work ability levels are at a higher risk for presenteeism, and may cause more presenteeism costs, their impact on potential presenteeism days was relatively small. The employees with a perceived work ability level of 4 accounted for only between 3.5% (2004) and 7.6% (2006) of the total annual presenteeism days.
4 Discussion

This study revealed the magnitude of the sickness absence and potential presenteeism days and the related costs for the company concerned and for Finnish society, which thus impedes the growth of productivity.[61] We found that the relative shares of annual sickness absence and presenteeism costs compared with annual turnover and personnel costs were quite constant, but it was difficult to show the long-term effect of presenteeism on the company’s business performance. The constant association between figures could be explained by the nature of the figures and the method used. The values of variables such as sickness absence, perceived work ability scores, personnel costs and turnover were relatively stable from year to year. Variation occurred only between the variables used and annual business profit. However, business profit is an outcome of many independent variables, such as sales and pricing, hence the impact of presenteeism on business figures is difficult to assess. For example, the company achieved a high profit in 2007 compared to other years because of the new products which were well received on the market. The descriptive data showed that presenteeism costs were about 1% of turnover annually, but the result should be interpreted with caution. We cannot categorically state that presenteeism amounting to 1% of turnover is valid with respect to other companies. However, we were able to show that the relative shares were quite constant over time. The correlation data presented in Table 3 is debatable and likewise difficult to interpret. The sample size (five years) was small and the correlations were statistically non-significant but raised some questions and new ideas. It might be logical to assume that an increase in presenteeism costs may increase personnel costs and cut sickness absence costs, but it is difficult to explain why higher presenteeism costs may correlate positively with business profit. The explanation could be that when the company tried to achieve the best possible profit employees were working while ill and efficiency demands were high.[9] However, we can assume that presenteeism costs and the company’s profit in this study material were not necessarily associated.

Regarding the validity and reliability of this study we reported an average presenteeism percentage of 4.0% for the whole study population, including employees with health conditions. That figure matches well with the study on depression by Lerner et al. [62], where the lowest figure was 2% regarding the healthy control group, and also with our earlier study [17], in which we assessed that the group of healthy employees accounted for a 2.9% productivity loss. Regarding the validity of cost valuation, we re-calculated from Medibank’s reports [24,63] that the average annual presenteeism cost per employee in Australia was EUR 1159. Even if the cost figures are not necessarily entirely comparable between countries, our corresponding estimate of EUR 1093 matched well with the

<table>
<thead>
<tr>
<th></th>
<th>WA</th>
<th>n</th>
<th>%</th>
<th>days</th>
<th>%</th>
<th>n</th>
<th>%</th>
<th>days</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>31</td>
<td>2.4</td>
<td>1831</td>
<td>7.6</td>
<td></td>
<td>30</td>
<td>2.6</td>
<td>1929</td>
<td>6.8</td>
</tr>
<tr>
<td>5</td>
<td>61</td>
<td>4.7</td>
<td>2907</td>
<td>12.1</td>
<td></td>
<td>47</td>
<td>4.2</td>
<td>2544</td>
<td>9.0</td>
</tr>
<tr>
<td>6</td>
<td>74</td>
<td>5.7</td>
<td>2696</td>
<td>11.2</td>
<td></td>
<td>66</td>
<td>5.8</td>
<td>2803</td>
<td>9.9</td>
</tr>
<tr>
<td>7</td>
<td>281</td>
<td>21.6</td>
<td>7006</td>
<td>29.1</td>
<td>218</td>
<td>19.4</td>
<td>6791</td>
<td>24.1</td>
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<tr>
<td>8</td>
<td>852</td>
<td>65.6</td>
<td>9673</td>
<td>40.1</td>
<td>763</td>
<td>67.9</td>
<td>14,166</td>
<td>50.2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1299</td>
<td>24,113</td>
<td>1124</td>
<td>28,233</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: WA = perceived work ability
Australian figure [24, 63]. The results also corroborate those of a report by the Ministry of Social Affairs and Health in Finland, which stated that the average annual sickness absence costs per employee were EUR 790. [34] Our corresponding figure was EUR 773 per employee per year in our case company. In addition, our result regarding the annual sickness absence costs, EUR 2157 per employee, for the public economy was consonant with the Ministry’s estimate of EUR 1590. Our estimate was slightly higher, but the Ministry stated that their estimate was actually conservative. [34]

According to the literature, validating presenteeism [18] and tracking the true costs of presenteeism are challenging. [64] Most of the presenteeism research comes from the USA, Canada and Australia, and comparing the findings of such studies with those of European research entails further research. [4] Most of the cost data is presented at the national level [24] and the company level estimations are still limited. The employers would like to know the effects of presenteeism on their businesses, but so far an adequate equation for measuring the magnitude of productivity losses is lacking. [64] To assess the real extent of loss of productivity due to presenteeism we would need to the capacity utilization level of the organization. [65] Organizations do not normally operate at peak capacity because of insufficient demands or operating policies which take into account potential new orders. [66] The average capacity operating level in the Finnish food industry over the last ten years has been about 80% . [67] An organization’s capacity level cannot be compared directly with an employee’s performance requirements and we can conclude that an employee with diminished work ability could perform well if the capacity level requirement is low. In that case presenteeism costs would not occur.

There are two main methods for assessing the value of productivity loss costs [45–47] but adopting these to assess presenteeism costs is still limited. According to Dagenais et al. [68], the human capital method can be used, in theory, for evaluating the costs of presenteeism. Lensberg et al. [44] reported no empirical studies of productivity loss using the friction cost approach and explicitly assessing the presenteeism costs. The discussion regarding the assessment of the costs of lost productivity seems to be at a standstill. It is advisable to remember that an approach for assessing presenteeism and an approach for assessing the extent of lost productivity are different issues.

The strength of this study is that it considered how much potential presenteeism and sickness absence costs may affect a company’s business. The study offered a good estimate of how many percentages those costs might amount to in annual turnover, personnel costs and business profit. As far as we know, such information has not been presented before. A further strength of this study was that it took into account both sickness absence and potential presenteeism costs regarding all employees. Some studies have reported the costs regarding employees with the medical conditions [11, 14, 69] but our study showed the sickness absence and presenteeism costs with respect to all employees, including both apparently healthy employees and those with known health disorders. The results showed that the company did not pay all the sickness absence costs but that the Finnish taxpayer bore most of the expense. Regarding the potential presenteeism costs, the employer bore all the costs, but so far we have no tool with which to assess how much out of the potential, i.e., theoretically assessed presenteeism costs, were indeed realized. It has been reported that it is challenging to match productivity loss percentages directly with the costs of lost productivity. [11] In contrast to earlier studies [70] we did not find that presenteeism costs dramatically exceeded sickness absence costs at the company level, even if the presenteeism costs were slightly higher. The average presenteeism percentage of 4.0% and the potential costs of lost productivity due to presenteeism seemed
reasonable and our results supported Podsakoff et al. [71] in claiming that the impact of health on productivity has been exaggerated.

The third strength of our study is that it showed the main source for potential presenteeism. The relative share of employees with a perceived work ability level of 4 varied from 1.1% to 2.6% and produced only from 3.5% to 7.6% of the annual presenteeism days. Conversely, the share of the employees with work ability levels 7 and 8 was together more than 85% and produced about 70% of presenteeism days. From the company’s economic perspective it would not be sensible to allocate large resources to employees whose work abilities are 4 or 5 because one step upwards, e.g., from level 4 to a level 5 would not greatly reduce total presenteeism costs.

The fourth strength of this study is that it adapted the work ability concept [16] to the assessment of the potential presenteeism costs. The use of perceived work ability supported a statement that not only health but also work design, job demands [13,72,73] and work attitude [11] were the potential factors for presenteeism. This research argued that the convergent validity between the presenteeism assessment methods was limited and that the results were not comparable with each other. [11,15,74,75] That statement supports our view that our perceived work ability-related approach was as good as the other reported methods used to assess the number of potential presenteeism days and the related costs.

Our study has some major limitations. We used the average monthly salary information, and we generalized that every employee had up to 28 reimbursable sickness absence days annually paid for by the company. There was actually variation in salaries and in the number of reimbursable sickness absence days but the average salaries and up to 28 sickness absence days concerned over 80% of employees. Another limitation concerned the self-reported perceived work ability.[76–78] There was undeniably method variance between the estimates, and some employees may have experienced problems determining what the survey item “define your current work ability compared to your lifetime best” meant in practice, even if the employees were informed in advance about the concept of work ability. The generalizability of the findings may be debatable because our study focused on a single company, and data was collected some years ago. However, our data showed that both the presenteeism and sickness absence figures were quite stable across time and we assume that there would be no dramatic changes in the figures if data were to be collected today. Moreover, data was collected from four separate factories (business units) and an administration unit which served to mitigate the label of a single-company study. Even if this was an explorative study, our intention is to test our approach in other companies and business sectors in future, and to develop a comprehensive method for assessing cost of production losses due to work ability related presenteeism.

Our approach of extrapolating the presenteeism figures to cover non-respondents may be controversial. However, we created a model where we classified respondents into sub-groups according to work ability, age, type of employment and gender and matched them with non-respondents’ factors. The validity of our study should be considered in light of earlier studies claiming variation in the presenteeism figures and the associated costs because of different approaches and cost derivation techniques.[11,14] The productivity loss scale that we used to assess loss percentages was based on our assumption of a linear association between perceived work ability and productivity loss.[17] That assumption may be false, but the other methods seemed also to rely on linear scales.[39,74,79] It is also relevant to note that the convergence between presenteeism instruments is
poor [80] and studies where self-reported work productivity has been matched with objective productivity measures have not yet been published.[43] According to Lensberg et al. [44] it is an undisputed fact that further research and discussion are required to assess the loss of productivity and costs due to presenteeism.

5 Conclusions

Presenteeism seemed to be a costly problem from the company’s perspective. Even if the results in this study showed that the percentages of both presenteeism and sickness absence were quite constant in the company’s turnover and personnel costs over time, we should replicate the study in other companies to validate the results. Contrary to general assumptions the most significant cause of loss of productivity due to presenteeism was the employees whose perceived work ability was 7 and/or 8 because their relative share was the highest. We argue that our philosophy of assessing the current work ability and presenteeism without any fixed recall period might yield a more robust result than extrapolating a short recall period to represent annual presenteeism. However, it has been reported that comparing presenteeism costs between different studies might be difficult because of differences in the recall periods and methods used.[43,76] We claim that our data represented the Finnish food industry sector well [52] and that our method was as good as any other method for assessing presenteeism days and costs at company level.[17] Our study afforded a good insight and a procedure for assessing the number of potential productivity loss days and the related costs due to presenteeism.

Finally, presenteeism as a concept, and assessing presenteeism costs are still multidimensional. A good example of the undefined role of presenteeism is that many researchers argue that presenteeism is a risk factor for future sickness absence [81] but Johns [11,p.536] states that “attending work while having minor disorders may be beneficial to both the employee and the employer compared to having a sick leave”. We recommend assessing the association between presenteeism and sickness absence costs and an organization’s business figures more profoundly in order to comprehend the underlying mechanism.

References


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Associations between perceived leadership and presenteeism in an industrial population

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Background Presenteeism has received increasing attention in occupational health research but the evidence for its association with perceived leadership is scant.

Aims To assess the association of perceived leadership and presenteeism among industrial workers.

Methods Survey responses from employees on perceived leadership were linked to the personnel register of a food industry company. The Presenteeism Scale method was used to determine the presenteeism percentage. Perceived leadership was measured as a composite variable of six individual items on motivating and participating leadership. Generalized linear models were used to determine the association of perceived leadership with presenteeism.

Results There were 847 participants. The majority of office workers of both genders reported better perceived leadership than factory workers. We found that perceived poor leadership was associated with a higher likelihood of presenteeism (rate ratio (RR) 1.64, 95% confidence intervals (CIs) 1.51–1.78). However, there was variation amongst and within occupational groups and genders, with a higher risk of presenteeism among male factory workers (RR 2.28, 95% CI 2.02–2.52) than female office workers.

Conclusions Leadership was found to be significantly associated with presenteeism, with a greater risk of presenteeism in those reporting poor perceived leadership. The association between levels of perceived leadership and presenteeism was stronger in men than women. Organizations should focus on motivating leadership practices to reduce the risk of presenteeism, especially among men.

Key words Leadership; occupational health; presenteeism; productivity loss; workers; work ability.

Introduction Presenteeism has had increasing attention in occupational health research and has been investigated in terms of sickness presenteeism [1], sickness presence [2], which are parallel concepts, and on-the-job productivity loss [3]. Classically, presenteeism has been defined as workers’ presence in the workplace without full working capacity due to poor health [4]. Recently, presenteeism [5] and its relationship to non-health related issues such as organizational practices [6] and work ability [7] have also been extensively investigated.

There is some evidence for a relationship between presenteeism and medical conditions [3], health risks [8], and presenteeism costs [9]. However, evidence of association with supervisor behaviour and organizational practices is scant. There seems to be a complex relationship between supervisor behaviour and presenteeism. Previous studies suggest that the behaviour of managers is determined by job stress [6] and that this may pressure employees to work while they are ill [10,11], thereby constituting a risk of presenteeism.

Leadership is a multidimensional concept and can be evaluated from different perspectives, such as sociological [12], organizational [12], and psychological [13]. Surveys among employees and human resources professionals have stated that poor management and low job motivation are the main predictors of poor productivity [14]. It has been reported that there is a positive association between good leadership and job satisfaction [15], and that poor leadership is costly in terms of absenteeism, worker stress and productivity loss [16]. In addition,
leadership affects employees directly or through social climate [17], and the impacts of leadership on work climate are reportedly stronger than the impact on job satisfaction [18].

There are several leadership styles such as human-related [19] and task-related [20], with no clear evidence on the best leadership style. An adaptive leadership style is known to improve business performance [21], whereas passive management by exception has a negative effect on an organization’s performance [22]. Laissez-faire leadership style, known as hands-off leadership, is said to be unsupportive [23] and to lead to the lowest productivity among employees [24].

Traditionally presenteeism has been assessed in relation to employee health but taking into account a current trend of studying non-health related factors we applied the work ability concept in this study to assess the impact of perceived leadership on presenteeism [25]. The work ability concept covers more than health issues alone and indicates how well a person can cope with his/her work with respect to work demands [25]. It includes an employee’s skills, values, mental, physical, psychological, and social functional capacity as well as the work demands [25]. Work ability has been widely studied in occupational health and it has been reported that perceived work ability and presenteeism [7] as well as management style, work ability, and productivity [26] are interrelated.

We found in our earlier study that the risk of presenteeism among male factory workers was fourfold higher than that among female office workers [7]. In this study, we assumed that there might be some distinct factors, other than type of work and gender, to explain this high variation in presenteeism. We therefore aimed to study if perceived leadership was a relevant factor which might more precisely explain that variation in presenteeism. We excluded the impact of other potential organizational factors, such as work satisfaction on presenteeism because it has been reported that supervisor behaviour is an important determinant [6], even if other factors may also have some impact on presenteeism [16].

Methods

A questionnaire survey was carried out in a leading Finnish food processing company in the first half of 2003. The company consisted of an administration unit and four production units. The questionnaires were distributed to all workers at the workplace, after which the sealed reply envelopes were collected and sent to the researchers. The respondents could reply either anonymously or provide their name and give written consent to their survey data being linked with the personnel register of the company. The study population consisted of men or women doing either office or production line work. The research was approved by the ethics committee of Pirkanmaa Hospital District, Tampere, Finland.

Data on perceived work ability and perceived leadership were based on findings from the questionnaire. The employees were asked to assess their work ability ‘compared with when it was at its best’ on a scale ranging from 0 = totally unable to work, 10 = work ability at its best) [26]. The main determinant variable of interest ‘motivating and participating leadership’ was created as a sum score of the following features of a leader: (a) able to take into account employee suggestions and ideas, (b) able to steer and advise, (c) able to give feedback, (d) able to encourage employees to participate and commit, (e) able to commit to employees’ development, (f) able to trust employees and allow them to work independently [27]. The responses were given on 5-point Likert scale from 1 = ‘totally disagree’ to 5 = ‘totally agree’. The perceived leadership variable was presented as a mean of these six items, ranging from 1.00 to 5.00. The Cronbach’s alpha for the leadership measure was 0.88. Furthermore, leadership mean scores from 1 to 5 were classified into three categories: poor leadership (mean score = 1.00–2.90), average leadership (mean score = 3.00–3.49), and good leadership (mean score = 3.50–5.00).

The data on age, gender, and type of work (factory or office work) of all individuals employed from 1 January 2003 to 31 December 2003 were obtained from the personnel register of the company’s human resources department. All the office and factory employees were subject to the same occupational health practices and sickness absence policy. An employee with no absence from work had 228 working days annually, excluding vacations and public holidays.

The outcome variable, annual presenteeism percentage, was defined according to the Presenteeism Scale for reporting perceived work ability related presenteeism [7]. The details of the Presenteeism Scale have been described elsewhere [7]. Briefly, a perceived work ability score of 8 on a scale from 0 to 10 corresponded theoretically to an approximate presenteeism rate of 5%, and each downward step of the perceived work ability scale increased presenteeism by approximately 5 percentage points. Perceived work ability 9 and 10 corresponded to a zero presenteeism rate and perceived work ability less than 4 was irrelevant. The effective working days of each employee were calculated by subtracting sickness absence days (according to the register data) from the annual working days. Then, we multiplied the effective working days of each employee by an individual presenteeism discount factor [7], and as a result obtained presenteeism days for each employee. Analyses were done among both office and factory workers whose presenteeism rates were 5% or more.

We first studied the correlation between perceived leadership and selected organizational factors. Then we
calculated descriptive statistics (percentages, mean, and standard deviations) for the population studied. The association between perceived leadership and presenteeism was assessed separately for women and men working in offices and factories. We used a linear regression model to evaluate if perceived leadership explained presenteeism better than type of work alone. In addition, a generalized linear model (GLM) with negative binomial assumption was used to determine associations between presenteeism and perceived leadership. Rate ratios (RRs) and 95% confidence intervals (CIs) were used as a measure of an association. All the analyses were performed with the statistical package SPSS version 21.0.

Results

The questionnaire was sent to 1,995 employees. The original study yielded 1,120 replies (response rate 56%) and altogether 873 (78%) of the responding employees gave their consent to their survey data being collated with the company's sickness absence records. After the exclusion of incomplete responses (n = 26), the number of employees eligible for inclusion in this study was 847. The youngest respondent was 19 years old and the oldest 66. The mean age of respondents was 41.2 years (SD 11.1). The number of employees with a perceived work ability level under 4 was only seven (0.8% of eligible respondents).

Table 1 presents the descriptive statistics for presenteeism due to perceived leadership among gender and occupational groups. Sixty percent of office workers perceived good leadership, whereas the corresponding figures were 33% in female and 40% in male factory workers. The lowest presenteeism percentage (Mean 1.9, SD 2.8) was among female office workers, who perceived good leadership, whereas the highest presenteeism percentage (Mean 6.4, SD 7.6) was among male factory workers, who perceived poor leadership. However, male factory workers who perceived good leadership had a presenteeism percentage (Mean 3.3 SD 4.9) equal to that of any other group. The average presenteeism percentage among men was 4.4 (SD 6.5) and among women 4.0 (SD 5.7). Correspondingly, the average presenteeism percentage among factory workers was 4.8 (SD 6.5) and among office workers 2.7 (SD 4.2). Perceived average leadership yielded rather similar presenteeism percentages in every group, except among female factory workers, where the percentage was slightly higher.

An age-adjusted RR for presenteeism in association with leadership and the combination of gender and occupation is presented in Table 2. The RR for age-adjusted presenteeism among people who perceived average leadership was 48% higher than among those who perceived good leadership (RR 1.48, 95% CI 1.36–1.61). Among those perceiving poor leadership the risk of presenteeism was even higher (RR 1.64, 95% CI 1.51–1.78). Table 2 also shows the differences in RRs between genders and occupational groups. Both male and female office workers had lower presenteeism rates than factory workers. The highest probability for presenteeism was in male factory workers (RR 2.28, 95% CI 2.02–2.52).

Table 3 presents the RRs for presenteeism between and within the occupational groups. Perceived good leadership resulted in lower presenteeism rates than that amongst those reporting average or poor leadership within every occupational group. Male factory workers who perceived good or average leadership had a lower presenteeism RR than did female factory workers reporting perceived average or poor leadership. This was also the case for male office workers with perceived poor leadership.

Table 1. Presenteeism percentage and perceived leadership among occupational groups

<table>
<thead>
<tr>
<th>Participants</th>
<th>Perceived leadership</th>
<th>Work ability</th>
<th>Age</th>
<th>Presenteeism %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean (SD)</td>
<td>P value</td>
<td>Mean (SD)</td>
</tr>
<tr>
<td>Female office workers (n = 176)</td>
<td>Poor</td>
<td>32 (18)</td>
<td>8.7 (1.0)</td>
<td>43.2 (9.4)</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>38 (22)</td>
<td>8.5 (1.1)</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>106 (60)</td>
<td>8.9 (0.8)</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Poor</td>
<td>16 (17)</td>
<td>8.1 (1.9)</td>
<td>NS</td>
</tr>
<tr>
<td>Male office workers (n = 93)</td>
<td>Good</td>
<td>20 (22)</td>
<td>8.5 (1.2)</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Poor</td>
<td>57 (61)</td>
<td>8.7 (1.0)</td>
<td>NS</td>
</tr>
<tr>
<td>Female factory workers (n = 410)</td>
<td>Good</td>
<td>152 (37)</td>
<td>8.3 (1.1)</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Poor</td>
<td>122 (30)</td>
<td>8.2 (1.2)</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>136 (33)</td>
<td>8.5 (1.3)</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>46 (28)</td>
<td>7.9 (1.6)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Male factory workers (n = 162)</td>
<td>Poor</td>
<td>52 (32)</td>
<td>8.4 (1.1)</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>64 (40)</td>
<td>8.6 (1.1)</td>
<td>NS</td>
</tr>
</tbody>
</table>

NS, non-significant.
Discussion

Our findings suggest that perceived poor leadership is a potential risk factor for presenteeism and as such replicate those of earlier studies [6,16]. Regarding the study population, we found that perceived poor leadership increased the RR of presenteeism by about 64% compared to perceived good leadership. The risk of presenteeism seemed to be the lowest among female office workers and highest among male factory workers. The risk of presenteeism among factory workers was approximately twice as high as among female office workers and about one third higher than male office workers. Within the occupational groups, the risk for presenteeism was lower in women than in men. Ignoring the occupational group limit, the risk for presenteeism in male office workers was lower than female factory workers but higher than that in female office workers. We found in our earlier study that the probability of presenteeism for male factory workers was as much as four times that of female office workers [7]. However, the results of this study suggest that the average presenteeism percentages and the risk of presenteeism varied in factory and office workers, and perceived leadership explained the probabilities of presenteeism more precisely than gender and type of work alone. Even if the male factory workers had the highest RR of presenteeism as a group [7], those perceiving good leadership had a probability of presenteeism twice as low as those perceiving poor leadership. The results were parallel in every sub-group, but it is remarkable that poor leadership practices seem to impact more on presenteeism in men than women. For example, even male office workers perceiving poor leadership had a higher RR for presenteeism than female factory workers. The level of satisfaction with leadership yielded parallel presenteeism percentages in male office and factory workers.

### Table 2. Rate ratios (RRs) and their 95% confidence intervals (CIs) for presenteeism due to leadership and gender/occupation among workers with *WA<9

<table>
<thead>
<tr>
<th>Occupational group</th>
<th>n = 847</th>
<th>*WA&lt;9 n (%)</th>
<th>RR (95% CI) Crude model</th>
<th>Age adj. model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leadership</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>363</td>
<td>147 (37)</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Average</td>
<td>233</td>
<td>122 (30)</td>
<td>1.46 (1.34–1.59)</td>
<td>1.48 (1.36–1.61)</td>
</tr>
<tr>
<td>Poor</td>
<td>246</td>
<td>133 (33)</td>
<td>1.62 (1.49–1.76)</td>
<td>1.64 (1.51–1.78)</td>
</tr>
<tr>
<td>Gender/occupation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female office workers, good leadership</td>
<td>172</td>
<td>64 (16)</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Male office workers, good leadership</td>
<td>94</td>
<td>42 (10)</td>
<td>1.53 (1.32–1.77)</td>
<td>1.46 (1.26–1.69)</td>
</tr>
<tr>
<td>Female factory workers, good leadership</td>
<td>412</td>
<td>216 (33)</td>
<td>1.93 (1.73–2.15)</td>
<td>2.08 (1.87–2.32)</td>
</tr>
<tr>
<td>Male factory workers, good leadership</td>
<td>167</td>
<td>84 (21)</td>
<td>2.02 (1.79–2.28)</td>
<td>2.28 (2.02–2.52)</td>
</tr>
<tr>
<td>Male factory workers, average leadership</td>
<td>54</td>
<td>27 (7)</td>
<td>1.29 (1.07–1.55)</td>
<td>1.24 (1.03–1.49)</td>
</tr>
<tr>
<td>Male factory workers, poor leadership</td>
<td>47</td>
<td>28 (7)</td>
<td>2.04 (1.72–2.42)</td>
<td>1.93 (1.63–2.29)</td>
</tr>
<tr>
<td>Female factory workers, good leadership</td>
<td>134</td>
<td>56 (14)</td>
<td>1.13 (0.97–1.33)</td>
<td>1.04 (0.88–1.22)</td>
</tr>
<tr>
<td>Female factory workers, average leadership</td>
<td>126</td>
<td>72 (18)</td>
<td>1.42 (1.22–1.66)</td>
<td>1.34 (1.14–1.56)</td>
</tr>
<tr>
<td>Female factory workers, poor leadership</td>
<td>151</td>
<td>87 (22)</td>
<td>1.40 (1.20–1.63)</td>
<td>1.30 (1.12–1.51)</td>
</tr>
<tr>
<td>Male office workers, good leadership</td>
<td>57</td>
<td>24 (6)</td>
<td>0.80 (0.65–0.98)</td>
<td>0.66 (0.53–0.81)</td>
</tr>
<tr>
<td>Male office workers, average leadership</td>
<td>19</td>
<td>8 (2)</td>
<td>1.17 (0.90–1.52)</td>
<td>1.00 (0.77–1.30)</td>
</tr>
<tr>
<td>Male office workers, poor leadership</td>
<td>16</td>
<td>8 (2)</td>
<td>1.72 (1.35–2.19)</td>
<td>1.38 (1.08–1.76)</td>
</tr>
<tr>
<td>Female office workers, good leadership</td>
<td>107</td>
<td>38 (9)</td>
<td>0.57 (0.47–0.69)</td>
<td>0.50 (0.41–0.61)</td>
</tr>
<tr>
<td>Female office workers, average leadership</td>
<td>34</td>
<td>15 (4)</td>
<td>0.96 (0.77–1.21)</td>
<td>0.80 (0.63–1.00)</td>
</tr>
<tr>
<td>Female office workers, poor leadership</td>
<td>30</td>
<td>10 (2)</td>
<td>0.72 (0.55–0.94)</td>
<td>0.62 (0.47–0.81)</td>
</tr>
</tbody>
</table>

Bold entries stand for that values are significant.

*Perceived work ability.

### Table 3. Rate ratios (RRs) and 95% confidence intervals (CIs) for presenteeism due to the combination of type of work, gender, and perceived leadership among all employees

<table>
<thead>
<tr>
<th>Occupational group</th>
<th>n = 840</th>
<th>*WA&lt;9 n (%)</th>
<th>RR (95% CI) Crude model</th>
<th>Age adj. model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male factory workers, good leadership</td>
<td>65</td>
<td>29 (7)</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Male factory workers, average leadership</td>
<td>54</td>
<td>27 (7)</td>
<td>1.29 (1.07–1.55)</td>
<td>1.24 (1.03–1.49)</td>
</tr>
<tr>
<td>Male factory workers, poor leadership</td>
<td>47</td>
<td>28 (7)</td>
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<td>1.93 (1.63–2.29)</td>
</tr>
<tr>
<td>Female factory workers, good leadership</td>
<td>134</td>
<td>56 (14)</td>
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<td>1.04 (0.88–1.22)</td>
</tr>
<tr>
<td>Female factory workers, average leadership</td>
<td>126</td>
<td>72 (18)</td>
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<td>1.34 (1.14–1.56)</td>
</tr>
<tr>
<td>Female factory workers, poor leadership</td>
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<td>Male office workers, average leadership</td>
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</tr>
<tr>
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<td>34</td>
<td>15 (4)</td>
<td>0.96 (0.77–1.21)</td>
<td>0.80 (0.63–1.00)</td>
</tr>
<tr>
<td>Female office workers, poor leadership</td>
<td>30</td>
<td>10 (2)</td>
<td>0.72 (0.55–0.94)</td>
<td>0.62 (0.47–0.81)</td>
</tr>
</tbody>
</table>

Bold entries stand for that values are significant.

*Perceived work ability.
workers but there was variation for female office and factory workers. Perceived good leadership yielded the lowest presenteeism percentages but perceived average leadership yielded similar or even higher presenteeism percentages than perceived poor leadership.

Some limitations should be considered while interpreting these results. The first was that we did not assess employees’ rate of presenteeism directly, but used a variable derived from perceived work ability and health [7]. The second limitation was the use of the Presenteeism Scale, which we have used and tested in earlier studies [7,28], but not yet validated with other methods. However, being based on Johns’ [29] research, which reported that convergent validity between presenteeism assessment methods is poor, our method may have been as good as any other [5]. The third limitation was that the study concerned only one company and the results might be difficult to generalize. Nonetheless, Virtanen et al. [30] demonstrated that four factories in a single company, such as the case in this study, were quite different workplaces as regards working conditions and could thus be considered as separate entities. The fourth limitation was that the survey data was collected some years ago. However, in the same study population, we earlier reported that employees’ perceived work ability and presenteeism were quite stable from year to year [28], and therefore we assume that the results would be similar if data were collected today, especially because there have been no major changes in company policy or in labour law. The fifth limitation was that we studied only the effects of perceived leadership, type of work, and gender on presenteeism, even if there are many other organizational and socio-economic factors available. A further limitation was that 875 (44%) of employees did not answer the survey questionnaire at all and of these 247 (22%) did not consent to their survey data being collated with the sickness absence records, which may have created bias in our results. We reported in our earlier study [7] that the sickness absence figures of respondents and non-respondents were similar, but it is possible that non-responders had a more negative perception of their leadership. In addition, it is possible that those who did not give their consent to survey data being collated with sickness absence records may have relatively high levels of absenteeism or other health related reasons for their refusal.

Despite the limitations, we consider that our study is an innovative attempt to collate perceived leadership and the work ability related assessment of presenteeism. According to descriptive statistics and the Kruskal–Wallis test in our earlier study, the study population represented the industrial population well and the difference between respondents and non-respondents was non-significant [7]. The Cronbach’s alpha for the leadership measure was high, and the $\chi^2$ test showed a highly significant association between a type of work, gender, and perceived leadership.

Our recommendation for further research is to quantify the connection between perceived leadership and productivity at the production unit level and to ascertain if there are some confounding variables such as stressful lifestyle or employee’s poor economy which may affect perceptions. We also recommend conducting multifactorial analyses and more detailed study of the potential determinants of presenteeism.

Regarding practical implications, organizations should assess supervisors’ leadership skills periodically with a view to arranging training for managers and supervisors. However, it is noteworthy that especially among women, perceived average leadership does not reduce the presenteeism percentage or the risk of presenteeism. Thus, organisations should focus on motivating good leadership practices to reduce presenteeism in the workforce.

### Key points

- Leadership is significantly associated with presenteeism.
- Poor leadership practices seem to affect more on presenteeism among men than women.
- Organizations should focus on motivating leadership practices to reduce the risks of presenteeism.

### Conflict of interest

None declared.

### References


The Presenteeism Scale as a measure of productivity loss


**Background:** Work ability score (WAS) is a common instrument in assessing work ability but its use in assessing presenteeism and productivity loss is a new insight.

**Aims:** To validate a WAS based measure, the Presenteeism Scale (PS) and to evaluate its accuracy as a presenteeism instrument among forestry employees.

**Methods:** This validation study was based on questions of perceived WAS assessed by the work ability - personal radar (WA-PR) instrument and on questions of perceived productivity loss and presenteeism assessed by a cross-sectional questionnaire survey. Respondents in the cross-sectional survey numbered 339 and in the WA-PR 257. Respondents participating in both surveys numbered 107. Pearson’s correlation test was used to ascertain the associations between variables. The association of productivity loss with presenteeism was evaluated using a logistic regression model. The predictive ability of presenteeism was tested using the receiver-operating characteristic (ROC) curve.

**Results:** The prevalence of presenteeism among the population studied was 48%. Presenteeism was significantly (p<0.05) higher among those reporting productivity losses. Presenteeism is extremely accurate in predicting perceived productivity loss but less accurate in predicting PS based productivity loss. The odds ratio (OR) of self-estimated productivity loss was 77 times higher (OR 77.39, 95% CI 25.36-236.12) among those with presenteeism. Correspondingly, OR of productivity loss based on the PS was three times higher (OR 3.05, 95% CI 1.16-8.04).

**Conclusions:** The PS may be a valid tool for predicting productivity loss and as good as any other instruments. However, further research is needed to improve its accuracy.

**Key words:** presenteeism, work ability, productivity loss, forestry, validation
Introduction

Presenteeism, being at the workplace but not working at full capacity has been an important research topic in occupational health during the last two decades. Numerous studies report the health-related [1,2] or the non-health related reasons, such as psychosocial workplace factors [3], for presenteeism. Even if the non-health-related factors are recognised, the majority of known definitions of presenteeism emphasise employees’ health [4]. Earlier studies have shown significant associations among self-rated poor health, diseases and impairment as well as poor work arrangements with presenteeism [3]. Lifestyle related factors, such as smoking [5] and body mass index (BMI) [6] have also been shown to be associated with productivity loss. The common reason for working while ill instead of going on sick leave seems to be related to the nature of the work, where relationships with customers are crucial to work outcome [1] or work is scheduled beforehand [7]. The prevalence of presenteeism is comparatively high in work tasks where it is difficult to find someone else to do a job, such as physicians and consultants [8], teachers, shopkeepers, bank officials and nurses [1]. A Swedish study reported that the prevalence of presenteeism regarding six occupational sectors and 42 occupational groups varied 17-65% [1]. Vänni et al. [9] reported that among Finnish food industry workers the prevalence of presenteeism was 48%, whereas Johansen et al. [2] reported that 56% of their Norwegian and Swedish respondents experienced sickness presenteeism. Presenteeism also seems to be common among forestry employees. According to a study by Vik [10], 45% of the respondents had worked while ill.

The work ability score (WAS) [11] has been widely used in sickness absence research [12] but it is a novel approach in presenteeism research [9,13,14]. Earlier studies have reported that an employee’s health status and WAS are strongly correlated [9] and health problems are related to productivity losses at work [15].

There are many presenteeism assessment instruments available [16] but none of them are based on WAS. The Presenteeism Scale (PS) [9] (Figure 1) was developed based on WAS and it rested on the assumption that work ability is related to presenteeism and productivity loss. The PS hypothesises that each downward step on the WAS scale (0-10) starting from 8 and ending to 4 may increase presenteeism and reduce productivity by 5 percentage points. Perceived WAS 9 and 10 are counted as excellent and causing no productivity loss. Perceived WAS lower than 4 was accounted as very poor and excluded which is supported e.g. by the study by Gould et al. [17].
The present study focusses on forestry harvesting work, which is physically non-strenuous but it is reported to be related to high mental workload [18] and psychosocial job stress [19]. Even if health problems among employees have been well reported, studies regarding the associations between perceived work ability, presenteeism and productivity loss are scant [14]. We therefore aimed to study the associations between presenteeism and productivity loss and evaluate if work ability based measure the PS would be a valid instrument in assessing presenteeism and productivity loss in forestry harvesting workers.

**Methods**

This validation study was based on two questionnaire surveys, the work ability - personal radar (WA-PR) instrument [20] through which we elicited perceived general, physical and mental WAS [11], and a targeted cross-sectional questionnaire survey through which we elicited perceived productivity loss, perceived presenteeism, perceived workloads, economic risks and performance requirements. The study was carried out among forest harvesting entrepreneurs and operators in 2016 and the questionnaires were distributed to 960 such entrepreneurs and 872 operators, all together 1,832. The number of respondents in the cross-sectional survey consisted of 151 (16%) entrepreneurs and 188 (22%) workers, all together 339 (19%). The number of respondents to the WA-PR questionnaire was 257, and the number of respondents who replied to both the cross-sectional survey and WA-PR questionnaire was 107. The mean age of respondents was 46 years and the average experience of forestry work was 22 years. The study population consisted of men only because the branch employs only few women. The research project was approved by the Ethics Committee of the University of Tampere, Tampere, Finland.
Work ability (general, physical, mental) was measured by asking respondents to assess their perceived work ability “compared with that at its best” on a scale ranging from 0 (totally unable to work) to 10 (work ability at its best).

Presenteeism was measured by the following question “During the last 12 months, how many times did you go to work despite feeling so ill that you should have taken sick leave?” The response options were on a four-point scale: 1) “never”, 2) “once”, 3) “2 to 5 times”, 4) “more than 5 times”. In the analyses, the variable was dichotomised: 0 to 1 times (no presenteeism), 2 to 5 times or more than 5 times (presenteeism). This question and response options have been used in several earlier studies on presenteeism [1,7].

Perceived productivity loss was measured by the following question “If you have worked while ill, estimate how much more slowly you worked compared to working when healthy?” The response options were on a six-point scale: 1) “No slower at all”, 2) “Maybe a bit slower”, 3) “A little slower”, 4) “To some extent slower”, 5) “Much slower”, 6) “Very much slower”. Regarding the quantitative analysis, a six-point verbal scale was used to match the productivity loss percentages 0, 5, 11, 16, 21 and 26 from the PS [9].

Productivity loss based on perceived WAS was assessed by the PS on a scale from 0% to 26% (See Figure 1).

Physical and mental workload was assessed by the following question “Evaluate how much your mental and physical workload has changed during the last two years?” The response options were on a five-point scale: 1) “Decreased a great deal”, 2) “Decreased a little”, 3) “Unchanged”, 4) “Increased a little”, 5) “Increased a great deal”.

Economic risks were assessed by the following question “Evaluate how much future insecurity economic risks may cause”. The response options were on a five-point scale: 1) “Not at all”, 2) “A little”, 3) “To some extent”, 4) “A great deal”, 5) “A very great deal”.

Performance requirements were assessed by the following question “Evaluate how much increase in performance requirements may cause insecurity in the future”. The response options on a five-point scale were: 1) “Not at all”, 2) “A little”, 3) “To some extent”, 4) “A great deal”, 5) “A very great deal”.

BMI (kg/m²) [6] and smoking [5] were assessed as a part of the multivariable logistic regression model to present those effects on productivity loss as the confounders. BMI was calculated and classified into three categories: <25, 25–29.99, ≥30. Smoking status was assessed with three options: Non-smoker, former smoker, current smoker.

The frequency and percentages of the background characteristics of the study participants were stratified by dichotomous presenteeism outcome. The Pearson’s correlations test was used to ascertain the associations between presenteeism, productivity losses, perceived workloads and economic performance. The predictive ability of presenteeism was tested with a logistic regression. Odds ratios (OR) and 95% confidence intervals (CI) were calculated as the measure of associations. The receiver-operating characteristic (ROC) was computed to describe the perceived productivity loss predicted by presenteeism and also to describe the productivity loss based on the PS predicted by presenteeism. All analyses were done with SPSS version 23.0.
Results

Table 1 presents the prevalence of presenteeism according to background characteristics, perceived productivity loss, WAS and WAS based productivity loss (the PS). Overall, 158 workers (48%) reported that having worked at least twice in a year despite feeling ill. Presenteeism was significantly (p<0.05) different according to both perceived and WAS related productivity loss with higher prevalence among those people who reported productivity losses. Moreover, mean WAS was lower among those reporting presenteeism (7.32 vs. 8.03). There was no statistically significant difference in the prevalence of presenteeism by age group, but a higher prevalence was found among those aged 31-40 and lower in the ≤30 year age group (57% vs. 43%). Similarly, a higher prevalence was found among current smokers (56%) and among those with BMI ≥30 kg/m² (54%) although no significant difference found within the group.

Table 1: Background characteristics and the distribution of perceived productivity loss, work ability and presenteeism scale of the population studied.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total</th>
<th>Once or not at all</th>
<th>Twice or more</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Mean, SD)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤30 (n,%)</td>
<td>40 (12)</td>
<td>23 (58)</td>
<td>17 (42)</td>
<td></td>
</tr>
<tr>
<td>31–40 (n,%)</td>
<td>72 (22)</td>
<td>31 (43)</td>
<td>41 (57)</td>
<td></td>
</tr>
<tr>
<td>41–50 (n,%)</td>
<td>89 (27)</td>
<td>45 (51)</td>
<td>44 (49)</td>
<td></td>
</tr>
<tr>
<td>51–60 (n,%)</td>
<td>94 (29)</td>
<td>53 (56)</td>
<td>41 (44)</td>
<td></td>
</tr>
<tr>
<td>61+ (n,%)</td>
<td>33 (10)</td>
<td>18 (55)</td>
<td>15 (45)</td>
<td></td>
</tr>
<tr>
<td>n (%)</td>
<td>328</td>
<td>170 (52)</td>
<td>158 (48)</td>
<td></td>
</tr>
<tr>
<td>Smoking*</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>No smoking (n,%)</td>
<td>219 (68)</td>
<td>122 (56)</td>
<td>97 (44)</td>
<td></td>
</tr>
<tr>
<td>Past smoker (n,%)</td>
<td>43 (13)</td>
<td>20 (47)</td>
<td>23 (53)</td>
<td></td>
</tr>
<tr>
<td>Current smoker (n,%)</td>
<td>64 (19)</td>
<td>28 (44)</td>
<td>36 (56)</td>
<td></td>
</tr>
<tr>
<td>n (%)</td>
<td>326</td>
<td>170 (52)</td>
<td>156 (48)</td>
<td></td>
</tr>
<tr>
<td>BMI (kg/m²)*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;25 (n,%)</td>
<td>71 (22)</td>
<td>42 (60)</td>
<td>29 (40)</td>
<td></td>
</tr>
<tr>
<td>25–29.99 (n,%)</td>
<td>142 (43)</td>
<td>73 (51)</td>
<td>69 (49)</td>
<td></td>
</tr>
<tr>
<td>≥30 (n,%)</td>
<td>111 (35)</td>
<td>51 (46)</td>
<td>60 (54)</td>
<td></td>
</tr>
<tr>
<td>n (%)</td>
<td>324</td>
<td>166 (51)</td>
<td>158 (49)</td>
<td></td>
</tr>
<tr>
<td>Perceived productivity loss*</td>
<td></td>
<td></td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>No (0) (n,%)</td>
<td>107 (33)</td>
<td>101 (96)</td>
<td>4 (4)</td>
<td></td>
</tr>
<tr>
<td>Yes (≥5) (n,%)</td>
<td>221 (67)</td>
<td>67 (31)</td>
<td>153 (69)</td>
<td></td>
</tr>
<tr>
<td>n (%)</td>
<td>328</td>
<td>168 (52)</td>
<td>157 (48)</td>
<td></td>
</tr>
<tr>
<td>WAS (Mean, SD)**</td>
<td>7.71 (1.54)</td>
<td>8.03 (1.57)</td>
<td>7.32 (1.49)</td>
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<tr>
<td>Productivity loss based on WAS**</td>
<td></td>
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<td>0.041</td>
</tr>
<tr>
<td>No (WAS 9-10) (n,%)</td>
<td>42 (39)</td>
<td>28 (67)</td>
<td>14 (33)</td>
<td></td>
</tr>
<tr>
<td>Yes (WAS ≤8) (n,%)</td>
<td>65 (61)</td>
<td>31 (48)</td>
<td>34 (52)</td>
<td></td>
</tr>
<tr>
<td>n (%)</td>
<td>107</td>
<td>59 (55)</td>
<td>48 (45)</td>
<td></td>
</tr>
</tbody>
</table>

Bold entries stand for that values are significant p-values (p<0.05). NS, non-significant. *Based on the participants who replied to a cross-sectional questionnaire survey. **Based on the participants who replied to both the work ability - personal radar (WA-PR) and a cross-sectional questionnaire surveys.
The mean value of respondents’ self-estimated productivity loss was 7% (SD 7%). The highest mean value of productivity loss based on the PS was 10% (SD 10%) regarding general WAS and the lowest 7% (SD 9%) regarding mental WAS. The physical WAS yielded on average 8% (SD 9%) productivity loss and the combined physical and mental WAS 7% (SD 8%).

Table 2 presents the relationship of physical and mental workloads, performance requirements and economic risks on presenteeism and productivity losses among those respondents who participated in both surveys (n=107). Presenteeism was statistically significantly associated with both PS related and perceived productivity losses. Mental workload showed a significant association with PS related productivity loss and also with presenteeism, whereas physical workload was only associated with PS related productivity loss. Intensification of performance requirements showed a strong association with mental workload and presenteeism. Economic risks showed an association with perceived productivity loss and mental workload.

Table 2: Pearson’s correlations between workload, presenteeism, productivity losses, economic risks and performance requirements among respondents participating in both surveys (n=107).

<table>
<thead>
<tr>
<th></th>
<th>Perceived productivity loss</th>
<th>Productivity loss based on PS</th>
<th>Presenteeism</th>
<th>Physical workload</th>
<th>Mental workload</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived productivity loss</td>
<td>R 1</td>
<td>.170</td>
<td>.544***</td>
<td>.141</td>
<td>.167</td>
</tr>
<tr>
<td>Sig.</td>
<td>NS</td>
<td>NS</td>
<td>&lt; 0.001</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>n</td>
<td>104</td>
<td>104</td>
<td>104</td>
<td>99</td>
<td>100</td>
</tr>
<tr>
<td>Productivity loss based on PS</td>
<td>.170</td>
<td>1</td>
<td>.193*</td>
<td>.308**</td>
<td>.305**</td>
</tr>
<tr>
<td>Sig.</td>
<td>NS</td>
<td>NS</td>
<td>&lt; 0.05</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>n</td>
<td>104</td>
<td>105</td>
<td>105</td>
<td>100</td>
<td>101</td>
</tr>
<tr>
<td>Presenteeism</td>
<td>.544***</td>
<td>.193*</td>
<td>1</td>
<td>.047</td>
<td>.299**</td>
</tr>
<tr>
<td>Sig.</td>
<td>&lt; 0.001</td>
<td>&lt; 0.05</td>
<td>NS</td>
<td>&lt; 0.01</td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>104</td>
<td>105</td>
<td>105</td>
<td>100</td>
<td>101</td>
</tr>
<tr>
<td>Physical workload</td>
<td>.141</td>
<td>.308**</td>
<td>.047</td>
<td>1</td>
<td>.308**</td>
</tr>
<tr>
<td>Sig.</td>
<td>NS</td>
<td>&lt; 0.01</td>
<td>NS</td>
<td>&lt; 0.01</td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>99</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Mental workload</td>
<td>.167</td>
<td>.305**</td>
<td>.299**</td>
<td>.308**</td>
<td>1</td>
</tr>
<tr>
<td>Sig.</td>
<td>NS</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
<td>&lt; 0.01</td>
<td></td>
</tr>
<tr>
<td>n</td>
<td>100</td>
<td>101</td>
<td>101</td>
<td>100</td>
<td>101</td>
</tr>
<tr>
<td>Economic risks</td>
<td>.476***</td>
<td>.263</td>
<td>.236</td>
<td>.148</td>
<td>.459**</td>
</tr>
<tr>
<td>Sig.</td>
<td>&lt; 0.001</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>n</td>
<td>38</td>
<td>38</td>
<td>38</td>
<td>38</td>
<td>38</td>
</tr>
<tr>
<td>Performance requirements</td>
<td>.182</td>
<td>.178</td>
<td>.257*</td>
<td>.211</td>
<td>.555***</td>
</tr>
<tr>
<td>Sig.</td>
<td>NS</td>
<td>NS</td>
<td>&lt; 0.05</td>
<td>NS</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>n</td>
<td>64</td>
<td>65</td>
<td>65</td>
<td>62</td>
<td>63</td>
</tr>
</tbody>
</table>

PS, Presenteeism Scale. Bold entries stand for that values are significant. NS, non-significant. *. P < 0.05. **. P < 0.01. ***. P < 0.001

Table 3 presents a multivariable model for the association of presenteeism with perceived productivity loss and productivity loss based on the PS. The odds ratio of perceived productivity loss was about 77 times higher (OR 77.39, 95% CI 25.36-236.12) among those reporting presenteeism at least twice a
year compared to those reporting presenteeism once or not at all. The odds ratio of productivity loss based on the PS was likewise about three times higher (OR 3.05, 95% CI 1.16–8.04) than for those reporting presenteeism once or not at all. Among the covariates, age over 61 years had a reduced odds of having perceived productivity loss (OR 0.12, 95% CI 0.03–0.52) compared to the youngest age group. BMI over 25 had a significant association with productivity loss based on the PS compared to those with BMI <25 kg/m$^2$ (OR for BMI ≥30 group 4.15, 95% CI 1.11–15.51).

Area under the curve (AUC) was calculated by plotting receiver-operating characteristic (ROC) curves for perceived productivity loss and the PS based productivity loss predicted by presenteeism. The value of the area under the curve for perceived productivity was 0.83 (95% CI 0.78–0.87) and for the PS based productivity loss 0.64 (95% CI 0.58–0.70). This indicates that presenteeism is very accurate in predicting perceived productivity loss but not very accurate in predicting PS based productivity loss (Supplementary Figures 1 and 2).

**Table 3: Multivariable logistic regression models for the association of presenteeism with perceived productivity loss and productivity loss based on the Presenteeism Scale.**

<table>
<thead>
<tr>
<th></th>
<th>OR, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Perceived productivity loss (n=251)</td>
</tr>
<tr>
<td>Presenteeism</td>
<td></td>
</tr>
<tr>
<td>Once or not at all</td>
<td>1.0</td>
</tr>
<tr>
<td>Twice or more</td>
<td>77.39 (25.36–236.12)</td>
</tr>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>≤30</td>
<td>1.0</td>
</tr>
<tr>
<td>31–40</td>
<td>0.92 (0.30–2.87)</td>
</tr>
<tr>
<td>41–50</td>
<td>0.56 (0.19–1.63)</td>
</tr>
<tr>
<td>51–60</td>
<td>0.39 (0.13–1.16)</td>
</tr>
<tr>
<td>61+</td>
<td>0.12 (0.03–0.52)</td>
</tr>
<tr>
<td>Smoking</td>
<td></td>
</tr>
<tr>
<td>No smoking</td>
<td>1.0</td>
</tr>
<tr>
<td>Former smoker</td>
<td>1.50 (0.57–3.96)</td>
</tr>
<tr>
<td>Current smoker</td>
<td>1.67 (0.69–4.02)</td>
</tr>
<tr>
<td>BMI (kg/m$^2$)</td>
<td></td>
</tr>
<tr>
<td>&lt;25</td>
<td>1.0</td>
</tr>
<tr>
<td>25–29.99</td>
<td>0.88 (0.40–1.96)</td>
</tr>
<tr>
<td>≥30</td>
<td>0.46 (0.19–1.10)</td>
</tr>
</tbody>
</table>

PS, Presenteeism Scale. Bold entries stand for that values are significant. *Based on the respondents who participated in both work the ability - personal radar (WA-PR) and questionnaire survey questions.

**Discussion**

We found in the multivariable model that both the perceived productivity loss and PS was associated with presenteeism. The correspondence between presenteeism and perceived productivity loss was better than with PS based productivity loss. We suggest that the PS may be a valid tool for assessing productivity loss among those reporting presenteeism even if it is not as accurate as workers’ own perceptions of their productivity losses.
The prevalence of presenteeism in the population studied was 48%, which was consistent with Vik’s study of forestry workers [10] and our earlier study in the food industry [9]. In this study the prevalence of presenteeism was slightly higher than in manufacturing in general [1], which can be explained by the nature of forestry work, where competent substitutes are difficult to find.

We also found that the PS based productivity loss figures were consistent with workers’ perceived productivity loss. It is noteworthy that the productivity loss value of 7%, which was based on the combination of physical and mental WASs, was same as workers’ perceived productivity loss of 7%. This may be a coincidence and we recommend interpreting that similarity with caution because of the scales used. We studied BMI and smoking status as confounders of productivity loss and found that BMI was related to WAS based productivity loss [6] but not perceived productivity loss. Smoking status was not significantly associated with productivity loss, even if the results show that risk of perceived productivity loss was higher among former and current smokers [5].

The results showed that mental workload was an important variable for productivity losses and presenteeism. Given the special characteristics of forestry work, such as complexity and the need to make as many as 4,000 control inputs per hour [21], it is predictable that mental workload is high. The heavy mental workload can also be explained, in general, by the very low (4–6%) equity ratio [22] and a high debt to cash flow ratio [23] in forestry.

The strength of this study was that it demonstrated the feasibility of using the PS with forestry workers and that it can be generalised to a domain other than the food industry, where the method was originally developed. The PS yielded productivity loss figures which were consistent with the respondents’ perceived productivity loss figures, even if the WAS of the respondents differed a lot from that found in our earlier study group [9]. We assume that the forestry employees underestimated their WAS because their average WAS was 7.1 (SD 1.9), which was comparable to that of workers with chronic musculoskeletal pain [13]. We consider that the PS may have yielded even more accurate productivity loss figures if the WAS of forestry workers had been similar to that among industrial population in general [17].

Some limitations should be considered while interpreting these results. The first limitation was that a number of participants who responded to both the cross-sectional survey and the WA-PR questionnaire was 107, thus becoming eligible for validating the PS. However, the relatively low response rate was reasonable and comparable with earlier studies on forestry [24] and presenteeism [13]. The second limitation was that all the respondents were men and comparison between the results of this study and earlier presenteeism studies including both men and women requires caution. The third limitation was that we did not ask the respondents to quantify their perceived productivity loss percentage but instead used a verbal scale, which was quantified afterwards based on the PS. Such an approach is common [25] but it should be borne in mind that the numerical scale of productivity loss (0–26%) from the PS is theoretical and is not based on the outcomes measured. However, a scale from 0 to 100% would be too rough and would yield too excessive figures [9]. The reported productivity loss from 7 to 10% should be interpreted with caution because the study was based on a survey questionnaire but precise estimation of productivity loss requires a controlled trial and screening of all factors with bearing on productivity. We also emphasise that the concept of productivity loss is broad and employees may have difficulties in categorising precisely when productivity loss is attributable to their health and work ability, and when it is attributable to technology and organisational factors.

Despite the limitations, our study showed that the PS may offer a method for assessing productivity loss due to presenteeism in forestry work, which has previously been challenging [26]. In addition, we were able to strengthen the presenteeism concept and to show an association between perceived
productivity loss and presenteeism. We assume that perceived mental WAS together with the PS would be an adequate approach in assessing productivity loss among forestry workers. We recommend policy-makers and occupational health professionals monitor employees’ mental workload in order to reduce presenteeism and productivity loss.

The new PS may be a valid instrument for estimating productivity loss and as good as any other methods currently in use [16]. However, the real extent of productivity loss remained unclear and high-quality randomised controlled trials are needed to improve the accuracy of the PS, and other presenteeism assessment instruments as a whole.

References


**Supplementary Figures**

*Supplementary Figure 1*: Presenteeism and perceived productivity loss
**Supplementary Figure 2:** Presenteeism and the PS related productivity loss

Figure 2

Area under the curve = 0.595