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## Sustainable employability of teachers with hearing loss

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### ABSTRACT

**Objective:** In many countries the retirement age is rising. Consequently, age-related hearing loss is an increasing occupational health problem. This study examined the association between hearing loss and sustainable employability of teachers.

**Design:** For this cross-sectional study a survey and an online hearing screening test were used. Sustainable employability was measured with the Capability Set for Work Questionnaire (CSWQ), examining seven work values. CSWQ-scores of teachers with poor, insufficient, and good hearing were investigated with ordinal regression analyses. Work values and discrepancies between the importance and achievement of the values were examined by chi-square tests.

**Study sample:** Dutch teachers ( $N = 737$ ) of whom 146 (20%) had insufficient and 86 (12%) poor hearing.

**Results:** Teachers with insufficient ( $OR = 0.64$ ; 95% CI 0.46–0.89) and poor ( $OR = 0.55$ ; 95% CI 0.36–0.83) hearing had lower CSWQ-scores compared with good hearing teachers. Adjustment for covariates, in particular for self-rated health, attenuated the associations. Compared with good hearing teachers, teachers with poor hearing reported more discrepancies in using their knowledge and skills and setting their own goals at work.

**Conclusions:** Hearing loss was negatively associated with sustainable employability of teachers. This emphasises the importance of assessing the hearing status of teachers.

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### KEYWORDS

Capability set; hearing loss; online digits-in-noise hearing screening test; presbycusis; sustainable employability; teachers

### Introduction


Adult-onset hearing loss is one of the most common causes of disability (World Health Organization 2008). In the Global Burden of Diseases, Injuries, and Risk Factors Study 2017, age-related hearing loss ranked number 7 in women and number 4 in men out of 359 leading causes of global years lived with disability (James et al. 2018). Hearing loss is associated with high societal costs, partly due to loss of productivity, sick leave, and disability benefits. The World Health Organisation conservatively estimated the global costs of productivity loss due to unemployment and early retirement among people with hearing loss at \$105 billion annually (World Health Organization 2017).

Worldwide, the prevalence of hearing loss (defined as a better ear hearing threshold of  $\geq 20$  dB HL, averaged over the frequencies 500, 1000, 2000 and 4000 Hz) is 34.9% for men and 28.8% for women aged 15 years and older; in high-income regions the prevalences are 24.8% and 22.3%, respectively (Stevens et al. 2013). The hearing loss prevalence increases with age, with a sharp increase around the age of 50–55 (Stevens et al. 2013; Goderie et al. 2020), predominantly due to age-related hearing loss (presbycusis). Other causes of a more gradually increasing

hearing loss with age include noise, genetic mutations, and exposure to therapeutic drugs with ototoxic side effects (Cunningham and Tucci 2017; GBD 2016 Occupational Risk Factors Collaborators 2020).

The Dutch workforce, like many others, is ageing and people have to extend their working lives (OECD 2004). The average retirement age for Dutch employees increased from 60.8 years in 2000 to 64.4 years in 2016 (CBS. 2017). In 2024, the retirement age in The Netherlands will be 67 years. As a consequence of a higher retirement age, more workers will have to cope with age-related hearing loss in their work. Hearing loss hinders work participation and is related to lower self-reported productivity (Nachtegaal, Festen, and Kramer 2012). Nachtegaal et al. (2009, Nachtegaal, Festen, and Kramer 2012) showed that hearing loss was significantly associated with distress, depression, somatisation, and sick leave, partly explained by a higher need for recovery. Ultimately, hearing loss may lead to unfit for the job and disability pensioning (Helvik, Krokstad, and Tambs 2013). Workers in education may be at particular risk for unfit for work and disability pensioning when they do not hear well. Teaching not only requires verbal communication, but also tasks such as localising unrest in the classroom and detecting pupils

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**Figure 1.** Model of sustainable employability based on the capability approach.

who want to ask questions. Hence, the auditory functioning of teachers demands a combination of speech understanding, sound localisation, and detection. Auditory functioning is particularly effortful in primary and secondary education, where most of the teaching takes place in classrooms filled with 25–30 pupils, under suboptimal acoustic circumstances. Teachers with hearing loss may need to allocate more cognitive capacity to comprehend, remember, and respond to relevant speech and sounds (Pichora-Fuller et al. 2016). Furthermore, the localisation and detection of sounds in the classroom can be hindered by hearing loss (Lorenzi, Gatehouse, and Lever 1999). These factors can cause communication problems, reduced performance, and mistakes in relevant auditory tasks, resulting in fatigue, a higher need for recovery, episodes of sick leave, and work disability. This may put the sustainable employability of teachers with hearing loss at risk.

Recently, van der Klink et al. (2016) developed an innovative model of sustainable employability. Based on the capability approach of Nobel Prize winning economist Sen, the authors defined sustainable employability as follows:

Sustainable employability means that throughout their working lives, workers can realise tangible opportunities in the form of a set of capabilities. They also enjoy the necessary conditions that allow them to make a valuable contribution through their work, now and in the future, while safeguarding their health and welfare. This requires on the one hand a work context that facilitates them, and on the other hand the attitude and motivation to exploit these opportunities.

To achieve valuable work functionings and sustainable employability, it is required that a worker is enabled and able to convert personal and work resources (i.e. the means to achieve) into capabilities (i.e. potentials to achieve) (Figure 1). A work value, such as using knowledge and skills and making a meaningful contribution through your work, is part of a person's capability set, when the person rates the value important (in her/his particular work situation), the work context enables this by providing opportunities to realise the work value, and the worker her-/himself is able to achieve the work value. A larger capability set reflects better sustainable employability, which is associated with better work functioning, better work performance, higher work ability, a higher number of workhours, less sickness absence, and better self-rated health (Abma et al. 2016).

Through interviews and expert opinions, seven work values were identified that reflect what people in the Dutch working population value in their work: (i) using knowledge and skills, (ii) developing knowledge and skills, (iii) being involved in important decisions, (iv) having or building meaningful working relationships with others, (v) setting your own goals, (vi) earning a good income, and (vii) making a meaningful contribution

through your work. These seven work values have been included in the Capability Set Work Questionnaire (CSWQ).

To our knowledge this is the second publication in which the CSWQ was used to investigate sustainable employability in workers with a health condition. Previously, van Gorp et al. (2018) examined sustainable employability among workers with multiple sclerosis (MS), a disease in which the insulating covers of nerve cells in the brain and spinal cord are damaged. This damage disrupts the ability of parts of the nervous system to transmit signals, resulting in a range of signs and symptoms, including motor, visual, sensory, and sometimes cognitive problems. The life expectancy of MS patients is 7.5 years shorter compared with the general population (Marrie et al. 2015). Van Gorp et al. included patients with relapsing-remitting MS (RRMS), the most common form of MS. RRMS starts with clinical relapses with near or complete recovery. Over time, recovery may be incomplete, and disability often accumulates (McGinley, Goldschmidt, and Rae-Grant 2021). MS patients are often able to continue working for many years, depending on the progression of impairments and the demands of their job (Nicholas et al. 2019). Despite lower physical work functioning, lower work ability, and poorer self-reported health, workers with MS were found to have a larger capability set than the general population. They rated most work values as more important, more enabled in the work context, and more achievable by themselves as compared with workers in the general working population. The authors hypothesised that a chronic illness like MS may stimulate to re-evaluate what is important in life. MS patients might be more aware of the significance of having a job, and of the aspects in a job that make work valuable and important.

Hearing loss arises more gradually than MS and many workers might at first not be aware of their increasing hearing loss. Teachers with hearing loss may not re-evaluate their work values, while they do encounter more difficulties in achieving work values. Consequently, we hypothesise that the importance of work values will not differ between teachers with hearing loss and those with good hearing. Furthermore, we assume that both groups will be equally enabled in their work to realise the values, although it is possible that teachers with hearing loss who disclosed their condition, could receive additional support from their work context. Because it is difficult to make appropriate work accommodations for hearing impaired teachers, it is uncertain to what extent this extra support would help them to achieve the work values they consider important. In view of the fact that teaching is specifically demanding for workers with impaired hearing, we hypothesise that, regardless of adjustments to the work or the workplace, teachers with hearing loss might experience problems achieving important work values. This study

aims to investigate sustainable employability of teachers with hearing loss, by assessing work values and the capability set of teachers with and without hearing loss and by comparing discrepancies between rating a value as important and being enabled and able to achieve that particular work value.

## Methods

### Study design and sample

An internet survey on “Hearing loss and sustainable employability” was conducted among teachers in primary, secondary, and professional education. Teachers were recruited between April 2014 and June 2015 via Dutch schools, educational sector organisations, and trade unions. The teachers received information about the study and a link to the survey. Participation was voluntary and answers were processed anonymously. The Medical Ethics Committee of the University Medical Centre Groningen reviewed and approved the study (reference M13.142047).

### Hearing status

The survey included a link to the Dutch National Hearing Test (NHT; <https://hoortest.nl/>). This screening test uses digit triplets that are presented against a background of masking noise, according to an adaptive (one-up, one-down) procedure. A total of 23 triplets are presented. The speech reception threshold corresponds to 50% intelligibility and is calculated by taking the average signal to noise ratio (SNR) of the last 20 presentations. The ability to understand speech in noise is generally presented as the speech reception threshold (SRTn). In general, SRTn values range between approximately  $-10$  (the best normally hearing individual) to  $+4$  dB SNR (Smits, Merkus, and Houtgast 2006). The NHT scores were classified into three categories representing good (SRTn  $< -5.5$  dB), insufficient ( $-5.5 \leq \text{SRTn} \leq -2.8$ ), and poor (SRTn  $> -2.8$  dB) hearing. Compared to the Dutch speech-in-noise sentences test using headphones as the gold standard, the NHT sensitivity was 0.91 and specificity 0.93 (Smits, Kapteyn, and Houtgast 2004). The original telephone version of the NHT was modified for internet use, providing the same stimuli online. Subjects received instructions to perform the hearing screening test in a quiet environment and use headphones instead of speakers, and if using speakers to do so only in a quiet environment. The online NHT showed similar results as the original version (Nachtegaal et al. 2009).

After completing the NHT, the result is received in terms of “good”, “insufficient” or “poor”. Teachers were asked to note this NHT result in the survey questionnaire. The participants were also asked if they used hearing aids (yes/no). Teachers with hearing aids were assigned to the poor hearing group.

### Outcome measures

Sustainable employability was the primary outcome measure and was assessed with the CSWQ (Abma et al. 2016). The questionnaire is presented in detail in online [Supplemental Appendix 1](#). The CSWQ asks for each of the seven work values 1) if the work value is important for the individual worker, 2) if the work context offers enough opportunities to realise the value, and 3) if the worker actually manages to achieve the value. Response items for these three aspects were “strongly disagree” (=1), “disagree” (=2), “neutral” (=3), “agree” (=4), and “strongly agree” (=5). A

work value was part of a teacher’s capability set (score = 1) if: the teacher finds a work value important (score 4–5), the work-place offers enough opportunities (score 4–5), and the teacher actually manages to achieve the value (score 4–5). According to the capability model (Abma et al. 2016), discrepancies arise if the teacher finds a work value important (score 4–5), but has no opportunities in work to realise it (score  $\leq 3$ ) and/or does not succeed in achieving it (score  $\leq 3$ ). The work values with capability set score = 1 were summed to a capability set score ranging between 0 (small) and 7 (large). As no predefined cut-off points were available, the capability set score was divided into four categories (score 0–3, score 4–5, score 6, and score 7). This division was based on the current dataset, aiming for an equal distribution of teachers across the categories.

### Covariates

Age ( $\leq 45$ , 46–55, and  $\geq 56$  years), sex (male; female), level of education (high = higher professional education and university; low/medium = lower and medium professional education), type of tasks (teaching versus a mix of teaching with other tasks, such as management, staff or supportive tasks), and current work hours per week ( $< 30$ , 30–36, 37–40, and  $> 40$  hours) were retrieved from the survey. Teachers were also asked if they worked as a physical education teacher (yes/no). Although noise exposure in general classrooms poses no risk of noise-induced hearing loss (NIHL) in teachers (Kristiansen et al. 2014), physical education teachers work in an environment that may cause NIHL (Greier et al. 2018). This NIHL would pose an extra burden during their classes (Kramer, Kapteyn, and Houtgast 2006; Hua et al. 2015). In general, chronic health issues may hinder the achievement of work values. Furthermore, specific chronic health issues, e.g. diabetes, have been associated with a higher prevalence of hearing loss (Akinpelu, Mujica-Mota, and Daniel 2014; Mujica-Mota, Patel, and Saliba 2018). For these reasons we used self-rated health as a covariate in the analyses. Self-rated health was measured with a question from the Short Form (SF) 12 “In general, how would you rate your health?” with the response categories “excellent”, “very good”, “good”, “fair”, or “poor” (Ware, Kosinski, and Keller 1996). As only few teachers ( $n = 5$ ) reported poor health, we combined “fair” and “poor” in one category.

### Statistical analysis

All statistical analyses were conducted in IBM SPSS Statistics for Windows, version 24.0 (Armonk, NY, released 2016). Because there were less than 1% missings, we decided not to impute missing data. We performed chi-square tests to compare the baseline characteristics of teachers with poor hearing to those with insufficient or good hearing. For each of the seven work values we used the non-parametric Kruskal-Wallis test to compare good, insufficient, and poor hearing teachers. We examined differences in the importance attributed to the value, whether the work context offered opportunities to realise the value, and whether the teacher actually managed to achieve the value. Differences in the number (%) of participants with discrepancies across the groups of teachers with good, insufficient and poor hearing were analysed by using chi-square tests. Based on the number of statistical tests, the significance level was set at 1%.

To examine the cross-sectional association of hearing loss with the capability set score, we used an ordinal regression model with hearing status as the independent variable and the

capability set categories as outcome. The analysis was adjusted for age, sex, level of education, type of task, current work hours, working as a physical education teacher, and self-rated health.

Ordinal regression analysis is an extension of the binomial logistic regression analysis for outcomes with more than two categories. Ordinal regression assumes that one regression equation applies to all categories of the outcome variable. This assumption is checked with the test-of-parallel-lines. A non-significant test-of-parallel-lines indicates that the association between independent variable and outcome does not vary significantly across the outcome categories. Hence, one odds ratio (OR) and 95% confidence interval (CI) represent the association between variable and outcome in all categories of the outcome.  $OR > 1$  reflects a positive relation i.e. hearing loss was associated with a better outcome.  $OR < 1$  indicates that hearing loss was associated with a poorer outcome.

## Results

### Characteristics of the study sample and outcome measures

A total of 880 persons completed the internet survey; 79 (9.0%) were non-teaching staff and were therefore excluded from the analyses. Among the remaining 801 teachers, 68 did not report the result of the online digits-in-noise hearing screening test in the survey. Four of these 68 teachers reported to use hearing aids and were therefore included in the poor hearing group. The other 64 (7.3%) teachers were excluded because their hearing status could not be determined. The final study sample consisted of 737 teachers, of whom 505 (69%) had good hearing, 146 (20%) had insufficient hearing, and 86 (12%) had poor hearing (Supplemental Appendix 2).

Teachers with poor and insufficient hearing were significantly ( $p=0.000$ ) older than good hearing teachers (Supplemental Appendix 2). Teachers with poor and insufficient hearing were significantly more likely to be men (49% and 47%, respectively,  $p=0.002$ ), as compared with teachers with good hearing (34%). Self-rated health was lowest among teachers with poor hearing and highest among those with good hearing ( $p=0.000$ ). Teachers with poor and insufficient hearing significantly more often (43% and 34%, respectively) had low (i.e. 0–3) capability set scores as compared with 21% of the good hearing teachers ( $p=0.000$ ). The other variables did not differ significantly between the groups.

### Overview of scoring of work capabilities

The importance of work values and the opportunities offered in the workplace to realise work values did not differ at the 1% level between teachers with poor, insufficient, and good hearing (Table 1). However, teachers with poor and insufficient hearing had significantly more difficulties achieving the work values themselves as compared with good hearing teachers, except for developing knowledge and skills, and earning a good income.

### Association of hearing loss with the capability set

Teachers with poor and insufficient hearing had lower capability set scores ( $OR = 0.55$ ; 95% CI 0.36–0.83 and  $OR = 0.64$ ; 95% CI 0.46–0.89, respectively) as compared with good hearing teachers. After adjustment for the covariates age, sex, level of education, type of task, current work hours, and working as a physical education teacher these differences remained significant:  $OR =$

**Table 1.** Overview of scoring of work capabilities of teachers with poor hearing ( $n=86$ ), insufficient hearing ( $n=146$ ), and good hearing ( $n=505$ ).

	Poor hearing mean (SD)	Insufficient hearing mean (SD)	Good hearing mean (SD)	<i>p</i> Value Kruskal-Wallis
It is important for me to ...				
Range 0 (i.e. strongly disagree) – 5 (i.e. strongly agree)				
be able to use my knowledge and skills at work	4.73 (0.50)	4.75 (0.45)	4.74 (0.45)	0.98
be able to develop my knowledge and skills at work	4.23 (0.63)	4.34 (0.63)	4.35 (0.58)	0.26
be involved in important decisions concerning my work	4.50 (0.66)	4.34 (0.65)	4.38 (0.61)	0.09
have or build meaningful relationships at work (e.g. with colleagues or clients)	4.65 (0.55)	4.48 (0.59)	4.52 (0.57)	0.06
Be able to set my own goals at work	4.28 (0.57)	4.28 (0.68)	4.23 (0.56)	0.29
Be able to earn a good income	4.28 (0.52)	4.05 (0.69)	4.05 (0.66)	0.01
Be able to make a meaningful contribution through my work	4.49 (0.57)	4.48 (0.64)	4.58 (0.55)	0.13
My current employment offers me enough opportunities to ...				
Range 0 (i.e. strongly disagree) – 5 (i.e. strongly agree)				
Use my knowledge and skills at work	4.22 (0.74)	4.04 (0.80)	4.23 (0.69)	0.03
Develop my knowledge and skills at work	3.92 (0.71)	3.80 (0.74)	3.88 (0.74)	0.50
Be involved in important decisions concerning my work	3.52 (0.86)	3.47 (0.90)	3.65 (0.77)	0.06
Have or build meaningful relationships at work (e.g. With colleagues or clients)	3.99 (0.73)	3.99 (0.78)	4.10 (0.74)	0.16
To set my own goals at work	3.77 (0.68)	3.77 (0.67)	3.86 (0.67)	0.16
Earn a good income	3.58 (0.74)	3.33 (0.81)	3.42 (0.78)	0.07
Make a meaningful contribution through my work	3.94 (0.76)	4.03 (0.68)	4.12 (0.68)	0.06
I manage to actually achieve to ...				
Range 0 (i.e. strongly disagree) – 5 (i.e. strongly agree)				
Use my knowledge and skills at work	3.87 (0.82)	3.88 (0.82)	4.10 (0.64)	<0.01
Develop my knowledge and skills at work	3.52 (0.76)	3.51 (0.83)	3.65 (0.71)	0.11
Be involved in important decisions concerning my work	3.40 (0.87)	3.23 (0.90)	3.52 (0.76)	<0.01
Have or build meaningful relationships at work (e.g. With colleagues or clients)	3.85 (0.74)	3.79 (0.80)	4.02 (0.73)	<0.01
Set my own goals at work	3.48 (0.72)	3.65 (0.68)	3.74 (0.64)	<0.01
Earn a good income	3.56 (0.73)	3.32 (0.85)	3.39 (0.80)	0.13
Make a meaningful contribution through my work	3.71 (0.72)	3.84 (0.77)	4.00 (0.65)	<0.01

**Table 2.** Discrepancies in work values.

Work value	Important but not enabled in work				Important and enabled but not achieved			
	Hearing, n (%)			p Value Chi square	Hearing, n (%)			p Value Chi square
	Poor	Insufficient	Good		Poor	Insufficient	Good	
use knowledge and skills	8 (9)	25 (17)	40 (8)	<0.01	19 (22)	16 (11)	37 (7)	<0.01
develop knowledge and skills	16 (19)	32 (22)	102 (20)	0.82	22 (26)	35 (24)	91 (18)	0.11
involved in important decisions	35 (41)	53 (36)	150 (30)	0.07	9 (10)	21 (14)	60 (12)	0.63
meaningful relationships at work	16 (19)	23 (16)	75 (15)	0.67	6 (7)	15 (10)	35 (7)	0.40
set own goals at work	22 (26)	30 (21)	90 (18)	0.22	20 (23)	15 (10)	55 (11)	<0.01
earn a good income	29 (34)	59 (40)	180 (36)	0.50	3 (3)	2 (1)	26 (5)	0.13
make a meaningful contribution	13 (15)	22 (15)	57 (11)	0.35	13 (15)	17 (12)	33 (7)	0.01

The table shows the number (%) of teachers with poor ( $n=86$ ), insufficient ( $n=146$ ), or good ( $n=505$ ) hearing who rated a work value important but could not realise the work value because they were not enabled by their work, as well as those who could not achieve the work value despite being enabled by work.

0.57; 95% CI 0.37–0.87 for teachers with poor hearing and OR = 0.68; 95% CI 0.48–0.96 for teachers with insufficient hearing as compared with good hearing teachers. The ORs attenuated and significance was lost when self-rated health was added as covariate: OR = 0.64; 95% CI 0.41–1.00 for teachers with poor hearing and OR = 0.86; 95% CI 0.60–1.22 for teachers with insufficient hearing as compared with good hearing teachers.

### Discrepancies in work values

Seventeen percent of the teachers with insufficient hearing who rated using knowledge and skills important reported that the work situation did not enable using knowledge and skills in work, as compared to 8% of the teachers with good hearing and 9% of the teachers with poor hearing. For the other work values, discrepancies between the importance of work values and being enabled by the work situation to achieve them did not differ between teachers with good, insufficient, and poor hearing (Table 2).

Twenty-two percent of the teachers with poor hearing and 11% of those with insufficient hearing who rated using knowledge and skills important had problems using knowledge and skills in an enabling work situation as compared with 7% of the teachers with good hearing. Teachers with poor hearing also failed to set their own goals at work in an enabling work situation more often (23%) than those with insufficient hearing (11%) or good hearing (10%). Teachers with hearing loss more frequently felt they could not make a meaningful contribution to work in an enabling work situation, although the difference with good hearing teachers was on the verge of significance.

### Discussion

The present study investigated sustainable employability of teachers with hearing loss by using the capability model as theoretical framework (van der Klink et al. 2016). Our hypothesis that the importance of work values and the opportunities offered in the workplace to realise work values would not differ between teachers with and without hearing loss was confirmed by the scoring of the work capabilities. However, teachers with poor and insufficient hearing had significantly more difficulties achieving the work values as compared with good hearing teachers. Teachers with hearing loss also had a smaller capability set, reflected in lower capability set scores than those with good hearing. After adjustment for the covariates age, sex, level of education, type of task, current work hours, and working as a physical education teacher these differences remained significant. When self-rated health was added as covariate, significance was lost. Teachers with insufficient hearing significantly more often than those with

poor and good hearing felt that the work situation did not enable using knowledge and skills in work. For two work values, i.e. using one's knowledge and skills and setting one's own goals, teachers with poor hearing more frequently than teachers with insufficient or good hearing reported they were not able to achieve the work value, despite being enabled in their work situation. Our results indicate that hearing loss was negatively associated with sustainable employability of teachers.

When comparing the capability set scores of teachers with insufficient and poor hearing with the scores of teachers with good hearing, significance was lost after adding self-rated health as covariate. Possibly, teachers with hearing loss experience poor self-rated health. This could be an indication of an indirect pathway between hearing loss and sustainable employability, mediated by self-rated health. For this reason, we also present results without self-rated health as covariate. Further longitudinal research is needed to examine the pathways between hearing loss and sustainable employability, because we could not make causal inferences from the present, cross-sectional study.

In a previous study based on the capability model, van Gorp et al. (2018) showed that workers with MS rated the use of knowledge and skills, involvement in important decisions, building and maintaining meaningful contacts, and making a meaningful contribution more important and they were more often able to achieve these work values than workers in the general population. Furthermore, workers with MS had a larger capability set than the general population. Van Gorp et al. included workers with RRMS. Patients with this relapsing-remitting form of MS face attacks of neurological complaints, followed by remissions during which the symptoms disappear, partly or completely. This allows them to continue to work, often for many years. Van Gorp et al. suggest that these workers with MS might re-evaluate what is important in life and work. The gradual process of hearing loss is less evident and less drastic in terms of changing life than MS. As a consequence, hearing loss may not initiate a similar re-evaluation of what is important in life and work. This might explain why we found no differences in the importance attributed to work values between teachers with poor, insufficient, and good hearing. The opportunities offered at the workplace were also not rated differently between the subgroups, indicating that the work context offers the same opportunities to teachers with and without hearing loss. However, teachers with hearing loss had more difficulties achieving 5 out of 7 work values as compared with good hearing teachers. This contrasts to findings of van Gorp et al, who reported that workers with MS were more often able to achieve important work values than workers in the general population. The authors noted that the vast majority (94%) of workers with MS disclosed their disease status to their supervisor. For many workers with MS

work accommodations were made, thereby facilitating the achievement of work values. It has been shown that for employees with MS, disclosure of their diagnosis at work may increase job retention (Kirk-Brown et al. 2014).

Teachers may initially be unaware of their hearing loss. When they recognise hearing loss, it may take time to acknowledge and accept hearing loss and its consequences (Svinndal, Jensen, and Rise 2020a). Additionally, workers might be anxious to disclose their condition to co-workers and the supervisor (Southall, Jennings, and Gagné 2011). In a qualitative study, managers of workers with hearing loss felt great responsibility for their workers' functioning, but hearing loss issues were easily forgotten (Svinndal, Jensen, and Rise 2020b). Furthermore, providing appropriate accommodations for reduced auditory functioning in a classroom can be complex, especially in primary education where pupils tend to be very lively and dynamic. These factors may delay and hinder taking supportive measures at the workplace to deal with hearing loss, thus making it harder to achieve important work values.

Another factor that may be relevant when comparing the outcomes of the present study with van Gorp's study, is the focus on hearing loss in teachers, a profession with high audiological demands. Van Gorp et al. included workers with MS, but they did neither report the professions of their participants nor the type and level of their disabilities. Therefore, we can only speculate about the effects of the MS impairments on the fitness to do their work. These effects may be more diffuse and not as impactful as in our study population.

Regarding the discrepancies between the importance and achievement of work values, teachers with poor hearing more often than those with good hearing failed to use knowledge and skills, despite an enabling work situation. We assume their hearing loss hinders them to do their work in this context that is particularly challenging for a worker with impaired hearing. Teachers with poor hearing also report more often that they are not able to set their own work goals. This might be explained by a limited flexibility in the tasks of a teacher, for whom teaching is the main activity. Another explanation could be that fatigue caused by hearing loss hinders teachers to explore new possibilities in their work. Furthermore, teachers with insufficient hearing more often than those with good hearing felt that the work situation did not enable using knowledge and skills in work. Interestingly, workers with poor hearing did not report more discrepancies in this work value than those with good hearing. It might be that teachers with insufficient hearing were unaware of their hearing loss and therefore had not yet taken any actions, e.g. work accommodation or an audiological consultation.

In our comparison of teachers with poor, insufficient, and good hearing, we found that teachers with poor hearing had more difficulties in achieving two of the work values. Van Gorp et al. (2018) also reported discrepancies between the importance and achievement of values among workers with MS, despite an enabling work situation. Abma et al. (2016) assumed that these discrepancies indicate that something outside the work situation, e.g. a health condition, hinders workers to achieve an important work value. In teachers with hearing loss, the adverse health effects of effortful audiological functioning may interfere with the possibility to achieve these work values, even though opportunities are offered at work.

### **Strengths and limitations**

A strength of the study is that we determined the hearing status by using a valid and reliable online digits-in-noise hearing

screening test (NHT), rather than using worker-reported hearing loss. Thus, we were able to assign teachers to one of three groups: good hearing, insufficient hearing, and poor hearing. Particularly the results of workers with insufficient hearing add to the existing knowledge of studies on workers who already knew their hearing was impaired (Kramer, Kapteyn, and Houtgast 2006; Hua et al. 2013; Svinndal et al. 2018). Teachers were asked to report their NHT score in the survey directly after the hearing screening test, thus restricting recall bias. However, teachers with an "insufficient" or "poor" NHT test result may be reluctant to report this in the survey. If they had reported a "good" result, teachers with hearing loss would be incorrectly assigned to the good hearing group, which could have biased our results towards the null.

The use of an innovative model of sustainable employability, based on the capability approach (van der Klink et al. 2016), is another strength of the study. However, the Capability Set for Work Questionnaire (CSWQ) is fairly new. Although the questionnaire is increasingly applied, both in occupational healthcare and in research, cut-off points for capability set scores are not yet available. We dealt with the absence of cut-off points by defining outcome categories based on the distribution of the CSWQ score. As a consequence the category with the lowest capability set scores might be too large, resulting in an underestimation of the association between hearing loss and capability set scores. A further limitation is the cross-sectional nature of the study. Cross-sectional studies can be used to note differences between groups without drawing causal conclusions. Hence, we cannot conclude that hearing loss results in smaller capability set scores. However, our finding that teachers with poor hearing had lower capability set scores than those with insufficient hearing, who in turn had lower scores than teachers with good hearing might suggest that this relation could exist. Longitudinal cohort studies with repeated measurements of the hearing status over time are needed to investigate if increasing hearing loss results in smaller capability set scores.

Another limitation of our study is that it was not possible to determine whether or not the study population was representative. In our study population the importance of work values ranged between 4.1 and 4.8, which is higher than previously reported by Abma et al. (2016) for the general working population (range 3.8–4.3). It is conceivable that the importance of work values differs across occupations. Teachers might rate work values in a different way than workers in other jobs. Differences in educational levels may also influence this rating. Of our participants, 91% had a high education level, vs. 32% in the general working population studied by Abma et al. (2016). Another explanation for the higher scores on important work values may be that teachers with positive expectations were overrepresented in the study population because they were more motivated to participate in the study. We dealt with this limitation by comparing poor, insufficient, and good hearing teachers, without making inferences on the prevalence of hearing loss among teachers.

Finally, the different (i.e. primary, secondary, and professional education) settings vary from an acoustical point of view and in terms of different demands on auditory functioning. Although the survey questionnaire asked for tasks (i.e. teaching versus a mix of teaching with other tasks), it did not ask for the type of setting. Therefore, we could not differentiate our results between settings. Future research could focus on the sustained employability of teachers with hearing loss in different educational settings.



## Implications

We used the capability approach to assess teachers' sustainable employability (Abma et al. 2016; van der Klink et al. 2016). This model considers which values are important and realisable for people in their work context, thereby making it possible to choose relevant policies and interventions to promote sustainable employability (van der Klink 2019). Audiological and occupational healthcare professionals could use the CSWQ to identify discrepancies between the importance, opportunities and actual achievement of work values. For good hearing teachers and teachers with hearing loss the most important value is the use of knowledge and skills at work. The lower scores on being able to achieve this work value indicated that teachers with hearing loss more often face difficulties in using their knowledge and skills at work. This may indicate that for these teachers the auditory demands and the acoustic circumstance in their workplace hinder them to make proper use of this skill in their daily work. In a participatory workplace intervention, occupational healthcare professionals can discuss and prioritise difficulties and barriers in work with the teacher and the supervisor, and search for solutions to use knowledge and skills in work and facilitate the achievement of other important work values.

In the literature on vocational rehabilitation of workers with hearing loss, several interventions can be identified. In a quantitative study Hua et al. (2015) found factors that facilitate working with hearing loss, such as identifying the need of assistive listening devices, teaching the individual with hearing loss about communication strategies, work adjustments (technically or acoustically), and informing stakeholders (e.g. managers and co-workers) about the consequences of hearing loss. Information about the consequences of hearing loss is especially important to create understanding, and a supportive atmosphere at the workplace (Svinndal, Jensen, and Rise 2020a). There is only limited evidence about which interventions are most effective and for whom (Gussenhoven et al. 2013). The CSWQ and our present study results could be used to choose relevant interventions for personalised vocational rehabilitation, addressing the work values that are important for individual workers with hearing loss.

## Conclusions

Hearing loss was negatively associated with sustainable employability of teachers. The use of knowledge and skills at work and the inability to set one's own goals are work values that could be addressed in interventions to promote sustained employability of teachers with hearing loss. The findings emphasise the importance of assessing the hearing status of teachers.

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No potential conflict of interest was reported by the author(s).

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