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Unexplored strains and job satisfaction for individuals with visual and auditory impairments: an Italian study

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Abstract

Background The evidence on job conditions for disabled individuals in the workplace hampers understanding of their needs and the implementation of effective interventions to support their adjustment and integration. The current study contributed to this aim by examining previously unexplored aspects of the adjustment of people with sensory disabilities (PwSD) in bank work settings in Italy. In particular, it investigated for the first time three specific job strains: technostress (TS), cognitive overload (COL), and aging (AG) in PwSD as compared with typical development (PwTD), along with job satisfaction and accessibility.

Methods A multidimensional web survey was administered across the Italian national territory to a sample of PwSD ($n = 202$) and a sample of PwTD ($n = 2283$). Descriptive statistics were used to highlight perceived satisfaction with accessibility and accommodations in the workplace. A series of linear regression models aimed to measure the association between participants' age and final scores of the TS, COL, and AG questionnaires. A series of non-parametric tests (Mann-Whitney U-tests) were performed to compare the final COL, TS, and AG scores of PwSD and PwTD.

Results At a descriptive level, results highlighted that PwSD's job satisfaction was fairly positive. However, various concerns were brought to light, revealing notable differences between the hearing-impaired and visually impaired cohorts. Moreover, while PwSD displayed reduced scores in the TS questionnaire compared to PwTD, the opposite occurred for the AG questionnaire. Increasing age was related to TS and AG in the PwTD, but only to AG in PwSD.

Conclusions Our study investigated for the first time specific job strains in PwSD, thus contributing to a deeper understanding of adjustment to work in a bank worker population. Older adults tend to show higher levels of technostress and a reduced sense of self-efficacy, and these subjective experiences bring together PwTD and PwSD. Moreover, inclusivity and job satisfaction for PwSD, although moderately satisfying, still show several criticisms. Our data can stimulate future research aimed at deepening the work adjustment in PwSD.

Keywords Sensory disabilities, Technostress, Cognitive overload, Aging, Quality of life

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Introduction

In the last 20 years, a profound renewal in the conceptual paradigm concerning disability has been raised. In 2001, the World Health Organization (WHO) developed a bio-psycho-social model that eventually underpinned the International Classification of Functioning, Disability, and Health (ICF) [1]. In this multifaceted perspective, disability is conceived as the product of the interaction between individual factors and the context where the individual lives or acts. As a consequence, disability may have roots (a) in the limited capacity of the individual himself/herself in some functional domain, (b) in the environment due to the presence of barriers or vice-versa to the lack of facilitators, or, finally, (c) in the interaction between these factors.

An area of life where this framework can be purposefully applied is work. In Italy, the employment rate of people with disabilities aged 15–64 years old and who can work, despite restrictions in sensory, motor, or intellectual functions, ranges from 31.3 to 35.8% [2, 3]. Evidence-based policies for disabilities are required to promote an inclusive workplace, and in turn health and well-being, as advocated by the WHO [4]. The bio-psycho-social approach to inclusivity in the workplace requires to stress not only assistive technology and accommodations enabling people with disabilities to carry out job activities, but also socio-cultural issues, such as specific emotional needs, limited availability of tasks and career opportunities, and all the cultural aspects that policy and organizations have to consider to establish decision-making processes of inclusion and health [5]. The perception of work-life conditions of people with disabilities deserves significant attention to understand work adjustment, that is the positive relationship between individuals and the environment, underpinned by compatibility, reciprocity, and cooperation between individuals and their work context [6]. Steverson and Crudden [7] found that social interactions with colleagues and supervisors were significant predictors of the job satisfaction of employees with visual impairments. In this wider and complex architecture of inclusivity, research plays a crucial role, in identifying the factors affecting the health and well-being of people with disability in the workplace. Despite this, studies in the field frequently lack methodological accuracy or do not consider a wider net of factors affecting employment experienced by people with disability [8].

To date, corporate culture, inclusion, and accommodations represent the most frequent issues debated when challenging the work adjustment of people with disabilities. Corporate culture, that is, the pool of shared norms, values, attitudes, and practices that form the collective identity of a company, mainly at an implicit level [9], may facilitate or jeopardize the employment, career trajectories, and the inclusion of people with disabilities in the workplace [10]. Interpersonal interactions often reflect the broader institutional climate, and the challenges raised by the inclusion of disability in the workplace may elicit different emotional reactions [11, 12]. For this, the active role of companies in enhancing supportive cultures that benefit people with disabilities is increasingly advocated [13, 14].

The Convention on the Rights of Persons with Disabilities [15] establishes that the work environment has to include "reasonable accommodations" to minimize or even eliminate the disadvantages and to guarantee people with disabilities the full accomplishment of their rights at work. Accommodations include architectural facilitations, ergonomic features of the workstation, adjustments of the timetable, distribution of tasks, training, and tools and instruments to perform job activities [16]. In particular, assistive technology is defined as "any item, piece of equipment, software program, or product system that is used to increase, maintain, or improve the functional capabilities of persons with disabilities" [17]. Dong and Guerette [18] noted that assistive technology is among the most commonly requested accommodations and pointed out their role in facilitating a disability-friendly attitude, enhancing job satisfaction in the work environment, and promoting social participation and communication processes [19]. For instance, innovative applications of optometric tools, computer screen readers, and enlarging software allow people with visual impairments to adjust productively in the workplace, enhancing the ability to read at reasonable rates [20–23]. Analogously, the regular use of subtitles, the presence of sign-language interpreters, and some behavioral measures are crucial to overcoming barriers to full participation and supporting the integration of deaf and hard-of-hearing workers [24, 25]. Despite this, the adequacy of accommodations in the workplace, in some cases, is still more facilitated by subjective attitudes and personal initiatives than by objective and functional considerations [26]. Some studies found that underload/overload may occur on both physical and psychosocial levels. Though work capacities are assessed to assign suitable job tasks, underload and overload frequently occur at both physical and psychosocial levels [27, 28]. This evidence stresses the necessity of a more precise evaluation of the balance between work capacities and work demands as well as more attention should be paid to job training and to overloading on long-term work performance [12, 28, 29].

Unexplored job strains: technostress, cognitive overload, and aging

There are some additional job strains whose role in work adjustment has gained growing relevance, in particular

technostress (TS), cognitive overload (COL), and aging (AG).

Technostress

TS was originally defined as the inability to interact with information and communication technology (ICT) in a healthy manner [30] and more recently as any negative effect on behavioral, mental, and physical well-being caused by technology's direct or indirect use, generally associated with increasing work overload, a decrease in personal time, and higher risk for individuals' well-being [31, 32]. In fact, despite the undeniable advantages of ICT on production in terms of speed, multitasking, and information processing, several pieces of evidence have shown the detrimental effects of intensive work-related ICT use, such as work-family conflict, emotional exhaustion, poor sleep quality, and worse performances [33, 34]. This issue has been explored in the general population, but no study involved specifically people with disabilities. ICT lessens the individual and supports his/her working integration and productivity at work. There is a consensus about the fact that, despite the undeniable positive role of ICT, accessing certain software, websites, or digital documents can still represent a challenge in a technological workplace environment for people with visual impairment [35]. However, the possible burden related to the use of ICT, and specifically, TS, in workers with sensory disability has not been investigated yet [36, 37].

Cognitive overload

Cognitive overload (COL) refers to the unbalance between task demands and cognitive resources available at a given moment [38]. COL rises when a task requires an excessive effort due to a prolonged or intensive cognitive activity, mainly charged to working memory and attentional processes [39]. COL is related to an increase in errors, a decrease in cognitive performance, distractibility, and failures in information processing, as well as to unpleasant psycho-physical effects, such as headache and fatigue [40]. Electrophysiological studies support the hypothesis that neural mechanisms exist to compensate for cognitive fatigue when task demands exceed routine resources. However, this response of the organism, aimed at challenging the task, induces additional psycho-physiological stress [41–43]. COL has been investigated in learning contexts [44–46] and also in working scenarios, although to a lesser extent, mainly focusing on cognitive strains and ergonomic features [47, 48]. COL should be investigated apart from other forms of work-related stress, not only to highlight specific detrimental threats but also to adopt preventive measures tailored to ameliorate this issue [49]. To the best of our knowledge, COL in the workplace has been largely neglected in people with disabilities, thus leaving a gap concerning a crucial issue in the study of job-related well-being. We ignore whether people with and without sensory disabilities experience different levels of COL and if the same ergonomic measures are efficient for both.

Aging

For several decades, a constant demographic trend in Europe has been represented by an increasing number of older adults. Although a longer life expectancy is regarded as a positive sign of improved living conditions, an implication of this trend is an increasing percentage of older adults who remain in the workplace [50]. Thus, the development and implementation of best practices to reduce the challenges of workforce demographic aging become crucial [51]. Although the knowledge and expertise of older employees represent a crucial source of organizational capital [52], physiological changes in physical and cognitive resources and abilities, social roles, expectations and stereotypes, new technological challenges, and the inescapable changes tied to older stages of life [53–55], contribute to shape individuals' self-perception of the AG process in the workplace. Given these premises, the goal of successful AG and healthy adjustment of older people at work requires a multifaceted approach of investigation and intervention [56, 57]. To date, work-related AG has been mainly investigated, focusing either on chronological age and psycho-physical changes or taking a psychosocial and motivational perspective, in particular, centered on the subjective age bias [58–61]. These studies have pointed out the lights and shadows of the impact of self-perception and self-image on individual performance and well-being as well as on organizational effectiveness. In Italy, the majority of people with disabilities at work are included in the 50-59-year-old range, thus being widely characterized by the so-called aging workforce [2]. Despite this, AG in people with disabilities did not receive adequate attention.

Aims of the study

The present study aimed at investigating for the first time three job strains namely, TS, COL, and AG in the workplace in a relatively large sample of people with sensory disabilities (PwSD), and in particular to explore for the first time possible differences in two different PwSD groups (hearing impaired and visual impaired) as well as between PwSD and people with typical development (PwTD). As a secondary aim, we collected descriptive data concerning the perception of some structural and organizational factors as reported by the PwSD,

Materials and methods

Study design

A cross-sectional web-based survey design was adopted. All participants were provided with a detailed description

of the experimental procedures and required consent before participating in the study. Participation was voluntary and not rewarded in any form. The survey was anonymous, as each participant was assigned an alphanumeric code to ensure the confidentiality of information. Each subject could fill out the questionnaire only once. Questionnaires were distributed across the Italian territory, thus allowing the researchers to collect information from different regional socio-economic contexts. The study was conducted in accordance with the Declaration of Helsinki and under research protocols approved by local Ethical Committees (Scuola Normale Superiore and Scuola Superiore Sant'Anna Joint Ethical Committee: Protocol No. 04/2021). Questionnaires were first tested for their accessibility to visual and hearing impairment in pilot assessments.

People with typical development (PwTD)

A large panel of 8,306 employees of a large Italian banking group was invited to participate in an online survey. Inclusion criteria were: (a) age higher or equal to 18 years old and (b) Italian mother tongue or high-level knowledge of the Italian language; and (c) use of ICT (personal computer, tablet, smartphone, software, messaging and video-calling tools) during one's everyday work activity. The subjects covered different roles in the bank (i.e., responsible, not responsible, and operational coordinator of activities). They were part of different business units, i.e., government compliance area, legacy, operations, safety and protection department, organization, people management and human resources transformation, learning academy, corporate and management systems, and finance. Moreover, the participants were allocated to the whole national territory. The survey was distributed from April 19^{th,} 2021 to May 11^{th,} 2021.

People with sensory disabilities (PwSD)

An initial panel of 313 people with sensory disability (PwSD) of the same Italian banking group was invited to participate in an online survey. In addition to this, volunteers were also recruited by contacting the national associations for the blind (Unione Italiana Ciechi e Ipovedenti, UICI) and the deaf (Ente Nazionale Sordi, ENS). Messages to promote the study, including the survey link, were sent to all UIC and ENS associations in the whole Italian territory.

PwSD had to meet the: a) clinical diagnosis of significant visual.

To avoid misclassification, the same inclusion criteria were employed for PwTD and PwSD groups. In addition to this, PwSD had to be characterized by: (a) impairment or vision loss or (b) clinical diagnosis of significant hearing impairment or deafness. We did not limit the enrolment to specific onsets of visual and auditory impairment, which could be congenital or acquired. The survey was distributed from September 12^{th,} 2022 to September 30^{th,} 2022.

Assessment

Preliminary accessibility tests were performed before the online distribution of the survey. Four testers with different visual impairments (two from the bank and two from UICI) and four testers with different hearing impairments (two from the bank and two from ENS) were asked to complete the survey two weeks earlier than the actual beginning of the study. In particular, visually impaired volunteers were asked to test the accessibility of the survey with different accommodations and screen-reader tools, while all the testers were asked to check also for the inclusivity and clarity of language and questions. Only one bank visually impaired tester highlighted some difficulties, but they were solved and subsequent checks provided positive outcomes. The testers were not included in the initial panel invited to take part in the study.

Socio-demographic and job data

The survey for PwSD included questions about (a) demographic data, (b) job data (e.g., length of service and role, working hours, work tasks, and career trajectories), (c) data concerning the sensory disability (type, age of onset, use of aids to increase autonomy), (d) accessibility (level of satisfaction concerning the adjustment, accessibility of routes, workstation, accommodations).

Questionnaires

The three questionnaires to assess TS, COL, and AG were administered to PwTD and PwSD.

TS was investigated by the Work-related Technostress Questionnaire (WrTQ) [62], an Italian self-report scale including 17 items about work life, cognitive overload, intrusion, and psychophysical stress (Cronbach's $\alpha = 0.896$). Each item is rated on a 4-point Likert scale (0 = never to 3 = always) and consists of a statement describing a sensation or a state of mind; the subject is asked how often in the latest weeks he/she has felt these psychological and physical sensations during the work activity (e.g., "The prolonged and/or simultaneous use of several technological tools to work affects my quality of life negatively in the workplace"). The higher the score, the greater the perceived technostress.

COL was assessed by the Work-related Cognitive Load (WrCL) questionnaire, a self-report scale consisting of 14 items, exploring four factors: avoidance, cognitive fatigue, adverse affective reaction, and effort/outcome perception (Cronbach's $\alpha = 0.886$). As for the WrTQ, the subject has to state how often in the latest weeks he/she has felt these psychological and physical sensations during the work activity (e.g., "I feel a sensation of mental

effort even after a short or simple work task"). Each item is rated on a 4-point Likert scale (0 = never to 3 = always). The higher the score, the greater the perceived cognitive load.

Finally, we assessed AG by the Work-related Aging Questionnaire (WrAG), a 20-item self-report scale investigating the perceived functional change in the workplace, resistance to change, and self-image (Cronbach's $\alpha = 0.936$). As for the two previous scales, each item consists of a statement describing a state of mind or a self-appraisal of one's cognitive performance, as compared to 5 years earlier (e.g., "Compared to 5 years ago, to date I make a greater effort to concentrate when I have to fix priorities in work activities to carry out") whose frequency during the job activity is rated by the subject on a 4-point Likert scale (0 = never to 3 = always).

All three questionnaires were administered in the Italian language and underwent a validation procedure on a large Italian employee population and are copyrighted. For each questionnaire, we calculated a final score (COL, TS, and AG score), which is the sum of the scores obtained for each item.

Statistical analyses

The survey was designed to avoid missing values thus, there was no need to complete missing values.

In each group, we first run a series of linear regression models aiming to measure the association between participants' age and final scores of the TS, COL, and AG questionnaires. Due to the type of measure, a link between age and the AG scores was predicted in both PwTD and PwSD samples.

Then, we were particularly interested in evaluating whether the job strains measured by these three specific questionnaires could impact PwSD differently than PwTD. That is, we aimed to assess possible between-group differences in the final scores of the TS, COL, and AG questionnaires. To this aim, we preliminarily compared the age distributions across the groups of PwSD and PwTD to ensure that the two groups did not differ in this pivotal demographic parameter. Finally, given the non-normal distribution of the TS, COL, and AG scores, we performed a series of non-parametric tests (Mann-Whitney U-tests) to compare the final scores of PwSD and PwTD directly. Provided that we performed a series of tests ($N = 3$) between the two groups, the significance level was set at $p < 0.05$ and then adjusted with Bonferroni correction to account for multiple comparisons.

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Table 1 Demographic data and, final scores for each questionnaire and summary of statistics

	PwTD $N = 2285$	PwSD $N = 203$	p
Gender (Female; N, %)	1125 (49%)	89 (44%)	n.a.
Age (years; mean ± SD)	49.2 (± 7.0)	48.3 (± 9.1)	$p = 0.546$
COL final score (mean ± SD)	10.9 (± 5.2)	11.203 (± 6.8)	$p_{Bonf} = 0.049$[a]
TS final score (mean ± SD)	13.0 (± 7.9)	11.874 (± 7.7)	$p_{Bonf} < 0.001$[a]
AG final score (mean ± SD)	12.6 (± 9.9)	15.899 (± 11.8)	$p_{Bonf} = 0.825$

SD Standard deviation, *COL* Cognitive Overload, *TS* Technsostress, *AG* Ageing, *PwTD* People with typical development, *PwSD* People with sensory disability

[a]Significant differences

Results

Sample characteristics

2283 participants out of 8,306 people without sensory disability (PwTD) accepted to take part in the survey (27.5%). 112 individuals out of 313 people with sensory disability (PwSD) accepted to take part in the survey (35.8%). Moreover, 90 participants with sensory disability (PwSD, representing 44.5% of the total of the PwSD group) were recruited in the general population by contacting the national associations for the blind (Unione Italiana Ciechi e Ipovedenti, UICI) and the deaf (Ente Nazionale Sordi, ENS) with messages including the survey link in the whole Italian territory. For this latter form of recruitment, we cannot estimate the participation rate as we cannot know the total number of people who read the email. This additional pool of individuals with sensory disability was specifically recruited to increase as much as possible the numerosity of this group given the difference in numerosity compared to participants without sensory disability and thus, to be as informative as possible.

Demographic data of the PwSD sample are illustrated in Table 1; Fig. 1.

In the hearing impairment group, 14% reported partial deafness, while 86% had a profound hearing loss. The majority of respondents reported a very early onset of the hearing impairment: 63% at birth and 26% between 1 and 6 years old; only 11% reported the onset at an age higher than 6 years old. Hearing aids were worn by 48% of participants in this group, while 14% had a cochlear implant; finally, 19% had no hearing aids. Concerning the communication strategy, 69% of respondents preferred spoken Italian, 10% sign language (LIS), and 21% adopted a mixed strategy.

In the visual impairment group, 45% reported complete blindness, while 55% was partially sighted; in particular, 57% of partially sighted subjects had a loss of vision in the central visual field and 43% a loss of peripheral visual field. For the majority of the respondents, the onset was at birth (56%), while for the 20%, the onset of disability was later in their childhood or adolescence, and for the 24%, it was at an age higher than 20 years old. About half of the group (52%) used aids to facilitate their autonomy

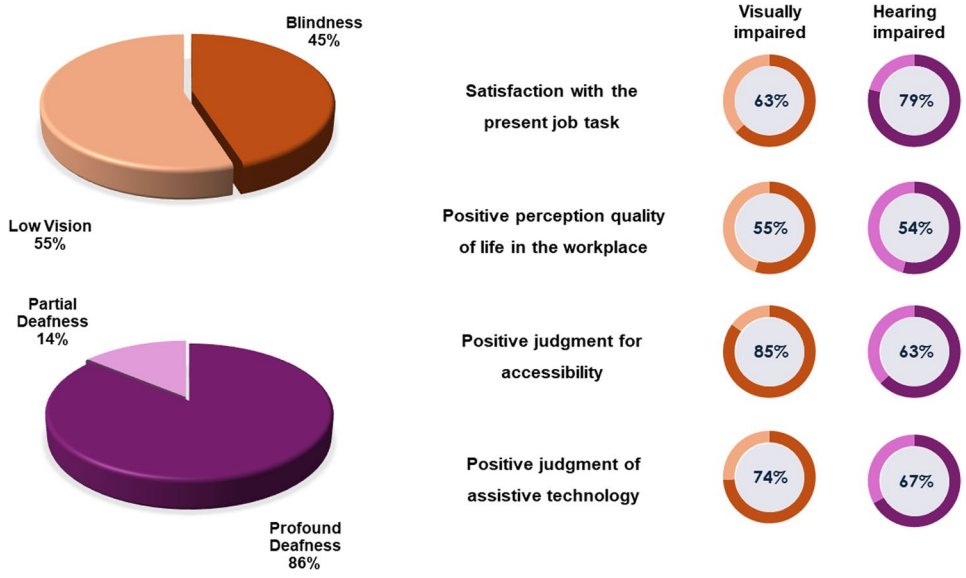

Fig. 1 Left Panel. Description of the PwSD sample in terms of partial or complete visual (top) or auditory (bottom) deprivation. Right panel. Satisfaction in specific parameters characterizing their job and accessibility satisfactions for the two subgroups

in going to the workplace (e.g., guide dog, white walking cane, technological tools for orienting, etc.) at least sometimes, while 48% never used these aids.

Job information and job satisfaction

Hearing impairment group

The great majority of the subjects of this group worked as an employee (82%), performing secretary, accounting, or commercial activities, while 6% worked as a computer technician. The remaining 12% performed other activities (business, social planning, etc.). The great majority of the group (85%) did a full-time job, and 15% did a part-time job.

About half of the respondents of this group (54%) stated that their occupation scarcely dealt with their previous course of studies. In comparison, 46% stated that their job activity partially or even highly fitted their previous studies.

Most of the subjects of this group changed their roles at least once (67%) since their intake. About a third (29%) have never changed their roles. Among those who changed their roles, 61% motivated the change with business needs, 14% with personal reasons (attitudes and concerns), 10% with career advancements, and 10% with health issues (the residual 5% ticked the "I do not know" answer). Overall, a large majority (79%) of the respondents stated that they were partially or even highly satisfied with their present job tasks, while the remaining 21% were scarcely satisfied with their occupation. However, while a third (30%) of the respondents would not ask for a change in their mansion, 49% would aspire to a change to improve their job position or to lessen the working time.

Overall, 54% of the hearing-impaired group declared to be fairly or fully satisfied with work conditions, while 46% stated to be scarcely satisfied (Fig. 1).

Visual impairment group

About half of the subjects of this group worked as an operator (51%), while about a third (32%) as an employee, involved in secretary, accounting or commercial activities. Some respondents worked in school or research (5%), as a computer technician (3%), as a physiotherapist (3%), or were concerned with other activities (6%). The great majority of the group (85%) did a full-time job, and 15% did a part-time job.

About half of the respondents of this group (52%) stated that their occupation scarcely dealt with their previous course of studies. In comparison, 48% stated that it partially or even highly fitted their previous educational course.

The majority of the participants (62%) performed the same role since their intake, while 38% have changed roles at least once. Nearly half of those who changed their job roles motivated the change due to business needs, while for 38% of them, the change was due to personal reasons (health conditions or concerns and attitudes). About 15% changed their role for other reasons (e.g., bad relationships in the office). Overall, 63% of the group stated that they were moderately or very satisfied with their present job tasks, while for the remaining 37%, the expectations were scarcely or even at all met. However, at the moment, 38% would not ask for a change of their present role, while 55% would aspire to change their role to improve their job position (only 7% would change to decrease their working time). Instead, 68% of the

respondents would attend a training course on ICT, and 31% would attend courses concerning their job activities.

Overall, 55% of the visually impaired group declared to be fairly or fully satisfied by work conditions, while 45% stated to be scarcely satisfied (Fig. 1).

Accessibility in the workplace

Hearing impairment group

Overall, accessibility in the workplace was deemed good or very good by 63% of the subjects of this group and scarcely satisfying by 37%. The use of assistive technology in this group was pretty frequent. Although 32% of respondents stated they never used assistive technology to perform work activities, 39% used it sometimes, and 29% used it regularly. Among those who were used to adopting assistive technology, 67% provided an optimistic or even very positive judgment about it, while 33% expressed dissatisfaction.

The most frequent difficulties related to hearing impairment jeopardizing work activities concerned communication with colleagues, especially during meetings (42%), the use of unsuitable telephone sets (18%), ambient noise (12%), communication with clients (10%), the lack of subtitles or LIS interpreter (8%), and a not inclusive attitude (8%). Among the most cited suggestions to improve their quality of life in the workplace, respondents highlighted the need to enhance inclusivity and raise awareness concerning specific features of people with sensory disability (30%), an improvement in communication tools (20%), the regular presence of a LIS translator and subtitles (30%), allowing people with hearing impairment to work in reserved offices or even in smart working to avoid ambient noise (18%).

Visual impairment group

The overall judgment on accessibility in the workplace was mainly positive: 85% deemed it sufficiently or very satisfying; differently, 15% stated it was not adequate. The vast majority of the group (93%) reported adopting accommodations and assistive technology to perform work activities. Among them, the accessibility of tools gained an excellent evaluation by 74%, against 26% of people who expressed a negative opinion. The most cited suggestions to improve accessibility pertained to the enrichment and upgrade of assistive technology (47%). Other requests concerned the presence of a Disability Manager or more significant interaction with the Company (9%), changes in the working time and the job role (14%), and suggested hamper communication and awareness (12%), greater attention to the ergonomic of places (available paths, workstations, and ambient lighting), and training courses (4%).

Within-group and between-group analysis of the TS, COL, and AG final scores

Direct between-group comparisons between the two groups indicated that the two groups did not differ in age distribution. Moreover, the PwTD group had a significantly higher TS score than the PwSD (pBonf < 0.001). Conversely, the PwSD group had a significantly higher AG score than the PwTD group (pBonf = 0.049). No significant difference emerged concerning the COL score between the two groups.

Within each group, we run a series of linear regression models to measure the association between participants' age and final scores of the AG, COL, and TS questionnaires. In the PwTD group, age was not associated with the COL final score (R-squared 0.0005, $p = 0.284$) but was positively associated with the final score of both TS and AG questionnaires (R-squared 0.007, $p < 0.001$ and R-squared 0.043, $p < 0.001$). That is, with increasing age, individuals of the PwTD group had higher final scores in both TS and AG questionnaires.

In the PwSD group, age was not associated with the final score COL nor with the final score of the TS questionnaire (R-squared 0.005, $p = 0.313$ and R-squared 0.003, $p = 0.446$). However, as expected, age was associated with the final score of the AG questionnaire (R-squared 0.026, $p = 0.0237$) also in the PwSD group.

Separately for each group, we tested the null hypothesis that the data of the COL, TS, and AG scores came from a standard normal distribution, using the one-sample Kolmogorov-Smirnov test; for all variables, the tests suggested that we could reject the hypothesis that the data were normally distributed. For this reason, we performed non-parametric tests for the between-group comparison. We then explored whether between-group differences emerged on the final scores of the TS, COL, and AG questionnaires. Notably, the age distributions across the groups of PwSD and PwTD did not differ (Mann Whitney U-test, $p = 0.546$). The final scores of the PwSD and PwTD groups differed for the TS and AG scores (Mann Whitney U-tests, $p_{Bonf}=0.049$ and $p_{Bonf}<0.001$, respectively) but not for the COL score Mann Whitney U-tests, $p_{Bonf}=0.825$; see Fig. 2).

Discussion

The main aim of our study was to explore work-related TS, COL, and AG in PwSD for the first time. We have developed a cross-sectional study that distributed a multidimensional web survey on an extensive adult Italian sample with sensory (visual and hearing) disabilities or with typical development. As a secondary aim, we investigated some opinions about job satisfaction in the PwSD. Our data highlighted three main results: first, increasing age has a partially different role in PwTD and PwSD in modulating the three dimensions investigated: TS, COL,

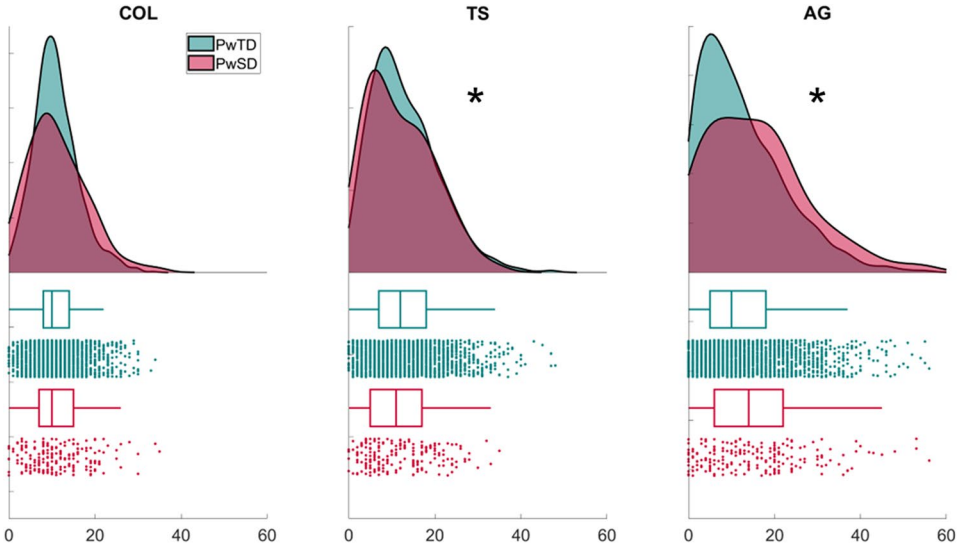

Fig. 2 Between-group comparison across the final scores of the three questionnaires COL, TS, and AG. The figure depicts the raincloud plots of the scores COL, TS, and AG for the two groups. The upper part of each panel shows the score distribution for the group (PwTD in green and PwSD in magenta). The lower part shows the associated box plot (with the median) and below single data points. In each plot, the x-axis represents the score value. When present, the asterisk highlights the statistical significance of the between-group comparison (Bonferroni corrected). The PwTD group had a higher TS score than the PwSD. Conversely, the PwSD group had higher AG score than the PwTD group. COL = Cognitive Overload; TS = Technostress; AG = Aging; PwSD = People with Sensory Disability; PwTD = People with Typical Development

and AG. Second, TS is higher in PwTD than in PwSD, while AG is higher in PwSD than in PwTD. Third, despite a mainly positive judgment of work conditions, the relevant differences emerged between the hearing and the visually impaired groups.

Technostress, aging and cognitive overload

About our first result, as expected, increasing age was positively related to AG in both PwTd and PwSD. This evidence supports the worsening self-perception preventing the adjustment to work for elderly workers, regardless of the presence of sensory disabilities. These data are in line with the literature. The decreasing number of younger workers, and the progressive increase of state retirement ages, will require people to work until later in life. On one side, previous research showed that delayed retirement positively shapes identity, favoring self-esteem and stimulating interpersonal relationships [63]. On the other side, other studies highlighted that beyond workers' chronological age, subjective age, that is, self-perceived functional ability and efficiency, plays a relevant role in shaping attitudes to work [64, 65]. However, our study investigates this issue also in PwSD, thus confirming the substantial stability of the phenomenon of aging through different worker categories and further stressing the need to challenge the issue of aging in the work context [51].

Specifically, the greater perception of progressive loss of skills as age increases reported by the PwSD than by PwTD deserves attention. In other words, PwSD perceive themselves as less efficient and productive than when they were younger, to a greater extent than their colleagues with typical development (note that the two groups had similar age distribution). Previous studies highlighted that the timing of disability onset may affect older adults' attitudes toward aging and in particular, late-onset: subjects with late-onset disability perceived their aging, capabilities, and social values more negatively as time goes by [66]. Nonetheless, social engagement and an active lifestyle, including work, may represent adaptive strategies promoting successful aging for older adults with disabilities and, consequently, a healthier job adjustment [67] Our data, although preliminary and collected in a limited sample of PwSD, could indicate greater challenges for the PwSD concerning their perceived job efficacy Possibly, the routinary activities, the limited expectations about career advancements, and the social issues preventing actual inclusivity in the Italian work environment may play a role in paving the way to a more acute aging effect in PwSD than in PwTD. Greater TS was only related to increasing age in the PwTD sample, thus revealing a better adjustment to ICTs in elderly workers with sensory disabilities. findings give rise to different hypotheses. Previous evidence highlighted fairly high levels of self-perceived skill and satisfaction in a sample of employed people with visual impairment [35]. Our data fit with this view, contributing innovative evidence about technostress and the direct comparison between PwSD and PwTD on the issue. On one side, we can suppose that PwSD is used to working with a more limited number of

ICTs, reducing their perceived load, as their familiarity and self-confidence in the use of ICT could be facilitated and TS lowered. However, this is merely a speculation, and further deepening of this point is required. On the other hand (and not necessarily in contradiction), previous research highlighted the crucial role played by ICT in PwSD's lives, facilitating social inclusion and education, fostering participation and autonomy, and thus promoting life satisfaction [68, 69].

Interestingly, PwTD and PwSD did not show differences concerning COL, a dimension characterized by relatively low levels in both samples. Possibly, this datum can be at least partially traced back to the inclusion of sensory disabilities only. Nonetheless, it suggests that in our sample work demand is well-balanced and appropriate also for the PwSD, differently from what was highlighted by previous studies [27, 28]. In turn, this may indicate that guidelines for an inclusive approach to work recruitment of PwSD are gaining a foothold.

Job satisfaction

About our third result, while the majority of our PwSD sample reported a fairly positive judgment on job conditions, about a third of our sample of PwSD reported a negative perception, and several criticalities have been stressed. Moreover, some aspects of working life are partially different in the hearing and visually-impaired groups. The first relevant difference concerns the job trajectory. Suppose the hearing-impaired group is characterized by a high rate of mobility, as a large part (67%) changed their job position since their intake. In that case, the visually impaired group is characterized by stable occupation, as only a smaller part (38%) changed mansions. This evidence is susceptible to various interpretations. We may hypothesize that the greater needs in terms of accommodations related to visual impairments might prevent greater flexibility, and the roles and activities deemed suitable for the visually impaired workers could be more limited. Most of the hearing-impaired subjects worked as employees, while more than half of the visual-impaired respondents worked as operators. Possibly, while an employee can perform differentiated activities, the classical role of the operator is quite still and scarcely open to the diversification of work mansions. In any case, in both groups, changes were primarily due to business needs rather than to the subjects' requests or ambitions, thus highlighting possibly limited self-control of job conditions. Interestingly, despite a widespread sense of satisfaction with their present mansions, a high rate of PwSD would aspire to a change to improve their position in the company, and this percentage is higher in the visually-impaired group. Notably, career advancements were reported by a very tiny percentage of the PwSD sample. This point allows us to speculate that the labor market in Italy fairly succeeds in upholding equal employment as warranted by legislative aspects, thus removing barriers [29] and hiring adequate rates of PwSD, but may still not be entirely receptive towards their expectations, thus failing to enhance their actual ability to work and their active role in the work cycle.

The second evidence of adjustment concerns accessibility in the workplace. In particular, although the majority of respondents stated to be fairly satisfied with accommodations in the workplace, a more significant effort to improve inclusivity is advocated, especially in the hearing-impaired group, and more modern and assistive technology is deemed necessary, especially in the visual-impaired group. These differences are consistent with different needs in the two sub-samples: the hearing-impaired subjects, on the one hand, use less assistive technology and facilities to perform their job activities, but on the other hand, are more sensitive to communication issues with clients and cooperation with colleagues. Previous studies too have stressed a reduced willingness to adjust to the needs of individuals with hearing loss of hearing loss and a lack of understanding of the implications in their work life [70]. Possibly, some peculiar tricks in everyday behaviors and little changes in habits would greatly facilitate inclusivity. On the contrary, visually impaired workers strictly depend on assistive technology to perform their job activities; it is no surprise that they emphasize the issue of a more adequate and modern ICT in the workplace. This datum is noteworthy, as previous studies reported a reluctance to ask for workplace accommodations [71], thus indicating an increase in self-awareness. Finally, only half of the PwSD sample expressed a positive opinion concerning their work life.

Limitations

Some limitations must be considered when interpreting the results of the present study. First, our main concern is selection bias. Results may not represent the general Italian population as most of the participants were employed in the same company. Similarly, we do not know whether the observed data are strictly related to specific professional groups, as the present study was conducted only in the banking sector. Thus, future studies involving different productive areas are needed to gain a deeper glance at the issue. Moreover, those who have accepted our invitation to participate in the study as volunteers may also be more engaged with the topic and are more sensitive toward psychological issues. Second, our study implied only hearing and visually impaired workers, who represent a part of workers with disabilities. The choice not to include other forms of disabilities (e.g., cognitive or motor disabilities) relies on the primary aims of the study, as the investigation of cognitive-related variables (TS, COL, and AG) would be blurred by possible

cognitive impairments or additional clinical conditions and any comparison against PwTD would be biased. However, future studies, including additional forms of disability, are highly required to investigate their self-perception of work adjustment in the workplace. Third, we explored only three issues, TS, COL, and AG, which are strictly related to work. Still, we did not assess additional dimensions of general psychological well-being, nor included a scale for the assessment of quality of life. This choice was driven by the need to best focus on the salience of TS, COL, and AG explored in PwSD for the first time. However, our results will pave the way for future studies aimed at deepening the relationship between specific strains and psychological aspects of this population. Fourth, the survey about job satisfaction was given only to PwSD, thus we did not have comparable data for the PwTD. This choice, although somehow limiting evidence, was driven by the nature of the questions, mainly related to accessibility and accommodation. Fifth, although the analysis of specific socio-economic contexts related to different Italian areas was beyond the scope of the present study, future studies including this factor may contribute to an even deeper understanding of the issues debated. In any case, the distribution across the national Italian territory is expected to enhance the generalizability of the results as limited to Italy. Finally, self-report assessment tools may show some limitations to the reliability of the information collected. However, our study aimed at assessing the subjective perception of individuals rather than verifying the actual work conditions, for a twofold reason: on one side, the subjective experience matters in adaptation, and on the other side the online distribution of the survey prevented the collection of any objective data.

Conclusions

In conclusion, our study described the perceived adaptation in the workplace of PwSD, particularly focusing for the first time on three work-related issues: TS, COL, and AG. Our data showed that the perceived adaptation of Italian PwSD in the workplace is reasonably satisfying. However, several issues were raised, and relevant differences emerged between the hearing and the visually impaired groups. Second, increasing age has a partially different role in PwTD and PwSD in modulating the three dimensions investigated: TS, COL, and AG. Third, TS is higher in PwTD than in PwSD, while AG is higher in PwSD than in PwTD.

Our results help to draw a multifaceted picture of the real needs of this population, which goes beyond the mere objective report of accommodations and quantitative data on employment. Differently, it provides the subjective perspective of workers concerning inclusivity, satisfaction, expectations, and needs. In turn, this approach is expected to promote health and well-being, as well as evidence-based policies for disabilities in the workplace. Notably, our data challenging for the first time the investigation of specific characteristics and subjective experiences of PwSD at work, contribute to indicating the direction to follow to overcome the barriers to employment for PwSD.

Given the pivotal importance of employment for people with disabilities, the demands and resources of PwSD highlighted in this study stress the relevance of a healthy workplace. Future research is needed to explore the development, implementation, and evaluation of workplace health promotion measures.

Moreover, our study contributes to encouraging policymakers to implement further reforms aimed at facilitating the inclusivity PwSD workforce and responding to the associated challenges of such a perspective.

Abbreviations

PwSD People with Sensory Disability
PwTD People with Typical Development
COL Cognitive Overload
TS Technostress
AG Aging

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Authors' contributions

MDO: Contributed to the conception and design of the work, data collection, and data interpretation, and was a major contributor in writing the manuscript. DEP: Contributed to the conception and design of the work, data collection, and data interpretation. GD: Contributed to the conception and design of the work. FM: Contributed to the conception and design of the work. ER: Coordinated research activity, performed a critical revision of the article, and was concerned with funding acquisition. DB: he was responsible for supervising research, performed a critical revision of the article, and gave final approval of the version to be published. All authors read and approved the final manuscript.

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Data availability

The data that support the findings of this study are available from Scuola IMT Alti Studi Lucca. Still, restrictions apply to the available data, which are not publicly available. The data are, however, available from the authors upon reasonable request.

Declarations

Ethics approval and consent to participate

The study was conducted in accordance with the Declaration of Helsinki and under research protocols approved by local Ethical Committees (Scuola Normale Superiore and Scuola Superiore Sant'Anna Joint Ethical Committee: Protocol No. 04/2021). All participants were provided with a detailed description of the experimental procedures and required consent before participating in the study.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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