

Factors associated with sustaining work after an acquired brain injury: a scoping review

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Purpose: Maintaining work in the long term represents a major challenge for people with acquired brain injury (ABI) as evidenced by a high rate of premature labour market dropouts. The present study aimed to compile factors associated with working in the long term after sustaining an ABI.

Materials and methods: We carried out a scoping review synthesizing quantitative and qualitative research conducted between 2000 and 2021. Databases searched comprised PubMed, CINAHL Complete, PsycINFO, Scopus, and Web of Science.

Results: Ten quantitative and nine qualitative studies were included, all but one from high-resource countries. Quantitative research predominantly comprised longitudinal follow-ups on individuals' work status several years post ABI onset, showing an effect of injury-related and sociodemographic factors. Qualitative studies mostly dealt with work maintenance and revealed a key role of cognitive difficulties, psychological personal factors (e.g. adequate coping strategies) and environmental factors (e.g. flexible work schedules, supportive colleagues).

Conclusions: The factors identified in our review should receive particular attention in vocational integration and job retention programs to support work participation of people with ABI in the long term. There is a need for measures that regularly monitor and promote a good match between individuals and their work environment.

Keywords: working in the long term, sustained work, work stability, acquired brain injury

Introduction

Returning to work (RTW) after sustaining a brain injury is a major challenge for affected individuals, and maintaining employment throughout the working life appears to be an even greater one [1,2]. Labour market participation is a key aspect of social inclusion for working age persons with acquired brain injury (ABI) [3]. Besides the economic benefit, most working persons report higher well-being and life satisfaction, while unemployment is associated with depression, loss of self-worth, and financial hardship [4,5].

ABI includes all types of injury to the brain that occur after birth and either result from a traumatic brain injury or from non-traumatic events such as stroke [6]. Worldwide, 10.9 million people of working age live with the consequences of a stroke, 2.1 million of whom live in Europe [7-9]. A total of 55.5 million people worldwide live with a traumatic brain injury [10], of which, depending on the country, up to 85% are aged younger than 50 [10]. The high prevalence and burden of disability make ABI a globally relevant public health, social security, and economic issue [11-13]. ABI may involve a variety of limitations in neurological, physical, cognitive, and behavioural functioning [14-17]. While some symptoms heal within days to weeks, some persist over the lifespan and cause significant restrictions in activities of daily living as well as social and work participation [15,18,19].

Employment rates of affected individuals drop considerably after the injury and vary worldwide from 35% to 71%, depending on country-specific factors as well as how ABI and employment were defined in different studies [20-23]. The challenge of reintegrating people with ABI into the labour market has led to a wealth of research on how to optimize vocational rehabilitation and integration as well as disability management services. Prognostic factors for RTW mainly comprise socio-demographics, ABI severity, and post-injury cognitive and physical functioning [24-26]. However,

evidence on factors that influence long-term work outcomes, in particular on factors that enable or hinder individuals with ABI to stay employed over time, is limited. Cuthbert et al. studied the post-injury employment patterns of persons with moderate to severe traumatic brain injury and found a decreased employment probability 5 and 10 years post-ABI [27], which was supported by the systemic review of Gromley et al. [22]. Furthermore, the review by Van Velzen et al. found low employment rates of 12% to 25% ten years post-ABI [21].

Despite the tremendous individual diversity of recovery and time needed to RTW, the majority of persons with ABI who go back to work will do so within two years post-injury [21,23,28]. After acute care, rehabilitation and an initial RTW, typically a vocational integration phase starts, which may include supported employment or job coaching services that are conducted at the affected persons' workplace [29]. Such interventions support workers with ABI, their employer, and their work colleagues in adjusting to the new vocational situation, with the aim to optimize the match between the workers' abilities and needs, and the demands and supplies of their jobs and workplaces [30,31]. If everything goes well, the integration phase leads to a stable and durable employment.

After the integration phase, affected persons and their employers are usually no longer supported by vocational specialists. Decisions on disability benefits such as pensions, the provision of assistive devices, or workplace adaptations are made, and the initial "goodwill" from employers and colleagues might diminish [32]. If at a later stage in work life, a demands-abilities misfit (e.g., worker fails to meet the demands of the job), or a needs-supplies misfit (e.g., lack of support by the employer) occurs, it can lead to an increased rate of mistakes, sickness absences, and job dissatisfaction, which may

ultimately cause the employee to quit the job, or the employer to dismiss the employee with ABI [30].

Knowledge on factors that foster or prevent working in the long term may enable those affected, their practitioners, as well as their employers to promptly identify issues to prevent job loss. Therefore, the objective of our study is to compile factors associated with sustaining work in the long term after an acquired brain injury i.e., more than five years after sustaining an ABI.

Methods

We conducted a scoping review following Arksey and O'Malley's [33] six-step framework. Scoping reviews are used to provide a broad overview on the scope or coverage of available literature on a given topic [34]. The first step of the framework (i.e. identification of the research question) has been discussed in the introduction section, the remaining five steps (identifying relevant studies; study selection; charting the data; collating, summarizing, and reporting the results; consultation) are outlined in the following paragraphs.

Identifying relevant studies

We conducted a comprehensive literature search in February 2021 using the following electronic databases: PubMed, CINAHL Complete, PsycINFO, Scopus and Web of Science. We also hand-searched reference lists of included articles and consulted grey literature (Open Grey, Google Scholar) to identify other potentially relevant studies.

The search strategy was adapted for each database and consisted of several terms related to ABI, work, factors associated with work, and their synonyms, joined by AND/OR Boolean operators (see Appendix). Where possible, we applied medical subject headings (MeSH) terms.

Study selection

A priori, we decided to include quantitative and qualitative studies reporting on factors associated with working in the long-term after sustaining an ABI. Only research articles in English or German were considered. Additional inclusion and exclusion criteria were then established post hoc during the literature search and informed by the emerging evidence from the preliminary search results.

Studies were selected based on content-related and time-related criteria. Regarding the content-related criteria, we decided to include only studies with a focus on paid work (i.e. gainful, competitive or supported employment) of working-age individuals (15-64 years [35,36]). We excluded studies considering people involved in sheltered work, vocational training or education as employed. Regarding the time-related criterion, for the quantitative studies we decided to focus on research involving participants with a minimum time since ABI of five years, as most studies do not report time since RTW or length of employment for their samples. This decision was based on the evidence that a majority of people with ABI who would ever go back to work, do so within two years after their injury [21, 23, 28]. By extending this time frame, we intended to account for the initial RTW period and to ensure that most participants would have had the opportunity to gain some work routine. Therefore, for the purposes of our study, we defined working in the long term as being employed at five years or later after injury onset. For qualitative studies, we included studies with a focus on the experience of working in the long term or maintaining work, independently of the “five-year post ABI onset” criterion. Additionally, we decided to include only studies published from 2000 onwards in order to focus on the contemporary labour market.

We imported the articles into an Endnote library and then transferred them to a Microsoft Access database to facilitate title/abstract screening. Two of the authors (MF and KK) independently screened all titles and abstracts against the predetermined and

post hoc inclusion and exclusion criteria. Disagreements were resolved through discussion between the two authors. The same procedure was applied to the full text screening phase (figure 1).

<Insert Figure 1 around here>

Charting the data

Study information including objective, study design, number of participants, main findings, and factors associated with working in the long term after ABI, were extracted and charted using MAXQDA [37].

Collating, Summarizing, and Reporting the Results

We summarized and synthesized factors associated with working in the long term, separately for quantitative and qualitative studies. The study findings were mapped to the corresponding components of the biopsychosocial model of the International Classification of Functioning, Disability, and Health (ICF) [38] (see figure 2). For qualitative studies, three authors with different professional backgrounds (KK: psychology and sociology, MF: physical therapy, BT: sociology) summarized and synthesized the findings in the following steps. First, KK identified factors impacting the participants' long-term work situation and organized them according to the components of the ICF model. Second, MF verified the factors and their allocation. Then, KK and MF grouped the identified factors within each ICF component based on their content relatedness and formulated specific themes. In the final step, these themes were discussed and refined with BT [39].

<Insert Figure 2 around here>

Consultation

The final step of Arksey and O'Malley's framework is optional and relates to the involvement of key informants who are knowledgeable about the topic of a scoping study and may provide additional insights to those found in the literature [33]. In the present study, this step was omitted as one of the co-authors (RE) took over the key informant role.

Results

Descriptive Characteristics of Included Studies

As indicated in figure 1, the initial search yielded 3,772 articles. Of these, 16 studies were included after removing duplicates and after abstract and full text screening. One additional study [40] was identified based on hand searching of the selected articles' reference lists and another two studies [41,42] were added based on the advice of our key informant. Finally, a total of 19 studies were included, all conducted between 2001 and 2021. Eighteen studies were conducted in high resources countries (nine in the USA, eight in Europe, and one in Australia) and one in a lower-middle resource country (India). Of the 19 included studies, ten were quantitative and nine qualitative. All quantitative studies represented longitudinal follow-ups within the frame of different cohort studies with initial data collected immediately after ABI (table 1) [43-51]. These studies reported information about work status of participants at a given point in time without indicating work duration or stability. Furthermore, eight of the ten studies report findings related to the same cohort. The seven qualitative studies primarily provided information about barriers and facilitators for job maintenance, work stability and long-term employment [41,52-57] (table 2). Seven of them used semi-structured interviews [41,42,53-55,57,58], one in-depth interviews [56], and one qualitative analysis of posts of an online forum for stroke survivors [52]. Two qualitative articles primarily investigated RTW-related factors

[54,55], but were included because they also provided relevant information on factors influencing working in the long term.

<Insert Table 1 around here>

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Factors Associated with Working in the Long Term: Results from Quantitative Studies

Figure 3 illustrates the factors associated with working in the long term that were extracted from the quantitative studies, organized according to the ICF components.

<Insert Figure 3 around here>

ABI-related Factors

Younger age at injury was positively and older age at injury negatively associated with working in the long term after sustaining an ABI [44,47,50]. Lower ABI severity, assessed with the *Injury Severity Score* [46] or the *Glasgow Coma Scale* [48], also had a positive impact. The same was true for length of stay in acute care [43,48,49] or rehabilitation [37, 43] and a shorter posttraumatic amnesia span [40,50,51]. Two studies also revealed a positive effect of a non-violent ABI etiology, such as vehicular, sports-related, fall, or pedestrian accident [40,48].

Functioning-related Factors

A lower level of cognitive and physical functioning at hospital discharge, assessed with the *Functional Independence Measure*, the *Functional Assessment Measure*, the *Barthel Index* [40,47-50], was positively associated with working in the long term. In contrast, a diagnosis of depression one or two years post-injury showed a negative effect [45]. The ability to drive, to use public transport and to manage one's own finances were positively

associated with working at five years post-ABI [46].

Personal Factors

In the quantitative studies included, personal factors mainly reflected socio-demographic characteristics. A higher level of education [40,46,48,50,51] and being employed at ABI onset [40,43,46,48,49] were positively associated with working in the long term, while lower pre-ABI education levels and unemployment at ABI onset had a negative effect [43,51]. Yet in two studies, the pre-injury employment status as well as the pre-injury education level showed no significant association with working in the long term [44,49]. Manual pre-injury jobs proved obstructive for working in the long term [47]. RTW within a year post-ABI [47] and involvement in paid work at one and two year post-injury [44] had a positive effect. The same was true for being male [43, 46-50] and for being married or in a relationship at ABI onset [46,48], while affiliation with a minority group [40,43,46,48] turned out to be a risk factor for working in the long-term.

Factors Associated with Working in the Long Term: Results from Qualitative Studies

Qualitative studies revealed barriers and facilitators for long term work and job maintenance at the level of functioning, psychological personal factors and the environment (table 3). Functioning-related factors primarily reflected the theme “injury-related impairments”. Psychological personal factors were covered by the following themes (1) understanding the injury, expectations and self-awareness; (2) adapting skills and developing strategies to cope with cognitive impairments; and (3) motivation and job satisfaction. Environmental factors comprised the major themes: (1) social support; (2) work environment; and (3) services, systems and policies.

<Insert Table 3 about here>

Functioning-Related Factors

Post injury impairments. People with ABI discussed a wide range of injury-related impairments they have to cope with in their everyday work. These impairments were either visible, such as walking difficulties or speech problems, or of invisible nature, such as fatigue, concentration deficits, memory issues and personality changes resulting in higher irritability, mood swings and impulsive behaviour at work [41,42,52,53,58]. A key issue reported was the “invisibility” of ABI-related impairments [52,53], manifesting as limitations in performing work and daily life tasks. This invisibility may lead to misunderstandings and inflated expectations by employers, work colleagues, families or even health professionals [52,53,58]. For example, some people with ABI mentioned that they had difficulties convincing their employers that their decreased work performance was due to their ABI-related fatigue and not due to “laziness”. Such situations often resulted in frustration and helplessness. Individuals also mentioned that they feel understood only by other persons with ABI, but neither by their health professionals nor by their employers [52]. Some participants felt they were like a fraud, because they may have looked “normal”, but did not feel or behave normally. Yet a few persons also mentioned that sustaining their ABI at work increased their employer’s and colleagues’ awareness of invisible impairments, resulting in more support and understanding. However, several individuals decided against disclosing their ABI and the related difficulties at work. Consequently, employers and colleagues did not realize that affected persons were different than before the injury and continued to treat them as if nothing happened, leading to misunderstandings and creating a barrier for support [52].

In some cases, people realized their difficulties only after their RTW. For example, they perceived more problems in dealing with stress than before their injury and felt that stress worsened their ABI-related impairments like pain or fatigue [52,57]. In

addition, people with ABI highlighted their experience of ongoing difficulties associated with ABI-related impairments, in particular fatigue and the way it affected their work productivity and their daily living due to an increased need for resting time after work [52,53,57]. Moreover, affected persons reported a broad range of problems that indirectly hampered their work situation in the long term. They highlighted extra time needed to get ready in the morning and an increased need for sleep in general or in the afternoon, leading to an inability to work full time. Inability to drive due to ABI-related impairments and side effects of drugs that interfered with work were also perceived as major barriers [42,52,57].

Psychological Personal Factors

Understanding injury, expectations and self-awareness. People with ABI reported that understanding the nature of their injury, including the emerging visible and invisible impairments, was a prerequisite for realizing symptoms and new behaviours as consequences of the injury, which in turn facilitated the adjustment to their daily reality with ABI [52,56]. Affected persons noted that high self-awareness regarding their cognitive and social abilities was helpful for developing strategies to cope with ABI-related impairments, while low self-awareness, the underestimation of one's disability, overly high expectations or starting with an overly high workload too soon after ABI onset were risk factors for maintaining work in the long term [52]. Several individuals reported that being back at work was more difficult than expected. Being aware of one's ABI-related impairments was also seen as crucial to arrange suitable work accommodations promoting a stable RTW [53,57], while lack of recognition of one's deficits or the inadequate use of coping strategies to deal with work-related difficulties threatened job sustainability [52].

Adapting skills and developing strategies to cope with cognitive impairments. The amount of effort people needed to invest to adapt to their life with ABI differed depending on the nature and severity of their impairments, and on how their pre-injury life looked like. Individuals who were able to accept their post-injury reality, in particular their decreased function and increased resting needs, had better prospects for a durable work integration [52]. Many people with ABI reported that they had to reassess and adapt their priorities including their lifestyle, employment identity and attitude towards work, often resulting in a diminished subjective importance of work [57]. At the same time, “pushing oneself” to go back to previous responsibilities was commonly described as not accepting one’s ABI-related limitations. Sticking to the old employment identity triggered stress and overload, and was perceived as a barrier to job maintenance [52,57]. Yet several affected persons also reported that their wish to be “normal” and to return to a regular work routine motivated them to recover faster [42].

For many individuals, returning to work after ABI required the development of strategies to adequately cope with their limitations [52,53,56,57]. Successful cognition-focused strategies included not giving up, slowing down, accepting changes, and positive thinking, while promising action-focused strategies included getting support or advice and developing ways of how to deal with fatigue and ABI-related problems. More general coping strategies included changing one’s lifestyle, setting goals or staying active [52].

Motivation and job satisfaction. Intrinsic, unconditional motivation and the desire to be independent were perceived as major facilitators for working in the long term [52]. At the same time, an excessive motivation to quickly go back to work and take over pre-injury responsibilities was reported as a barrier, as this can lead to massive overload and even burnout. In a few cases, leisure and work interests were reported as additional motivational factors to maintain work in the long term. There were several individuals

who changed their job to something they used to enjoy for leisure prior to ABI onset. For instance, a former skier with ABI who initially could not find a stable employment started to work in a winter resort as a ski instructor [53]. Yet several persons reported that they were unable to keep complex jobs after their ABI onset, and that they perceived their new, less complex jobs as dissatisfactory [41,52]. Commonly, individuals struggled with grief over lost abilities and functions, frustration due to unfulfilled ambitions, and disappointment over deprived career opportunities [56,57].

Environmental Factors

Social support. Social support was perceived as a strong facilitator for stable long-term work. In particular, employers with a personal experience of disability were seen as key facilitators [53]. Sympathetic and patient employers were more likely to arrange work accommodations that facilitated the performance of work tasks and helped people to stay employed [52,53,57]. Work colleagues who were willing to support their co-workers with ABI represented facilitators as well [52,57], while lack of support at the workplace was experienced as a barrier. Co-workers who were demeaning and talked down or bullied their colleagues with ABI were perceived to hamper working in the long term [52]. The same was true for frequent conflicts with supervisors or co-workers or a lack of acceptance that let individuals feel out of place [41,52,57].

Health professionals were perceived both as a facilitator and a barrier to work maintenance. Supportive and understanding general practitioners who are willing to apply for work adjustments or reduced working hours were described as significant facilitators, while health professionals who were unwilling to prescribe medications or prolong a sick leave were perceived as barriers [52].

Support of peers with ABI who provided advice either on online forums or in support groups represented an additional facilitator brought up by affected persons [52].

Work environment. Work accommodations in terms of modified work roles and responsibilities, workplace adjustments, reduced work hours or duties, flexible work schedules and working from home were perceived facilitators for working in the long term [42,52,53,56-58]. Furthermore, “co-worker-twinning” (pairing an individual with ABI with a co-worker who supports the person on a daily basis) turned out to be a successful strategy to promote work tenure [53]. Finally, working in a large company with the possibility to switch to a more suitable position within the company represented an additional facilitator [53].

People with ABI highlighted that many employers and colleagues assumed that after returning to work, affected persons have fully recovered from their symptoms, while not being aware that some ABI-related limitations are invisible, persisting, or may only manifest themselves once a person is back at the workplace [52,57]. In the long term, such a lack of understanding of the nature of ABI may lead to unrealistic expectations of work performance and misunderstandings at work.

Although modified work roles post-ABI were reported to support job maintenance, they may also have a negative impact in the long run if people with ABI feel unsatisfied with their new role and do not receive a promotion after several years of work experience [41,54]. For example, a participant who was actually employed as a cashier post ABI onset reported that the team did not allow her to perform this task because they were unwilling to check the cash balance after her shifts. Instead, she was asked to clean the store or sort the shelves, which made her feel frustrated and unsatisfied with her job [41].

Services, systems and policies. Individuals also reported a variety of services they experienced as helpful to stay employed. These services were perceived as particularly supportive when different sources, such as the occupational health and human resource department of an organization joined forces to plan customized steps for securing a stable work situation after RTW [52].

Vocational rehabilitation services were perceived as beneficial for several reasons [42,52,53]. They can empower affected individuals by boosting their self-confidence. Moreover, they may foster the placement in well-matching jobs, including follow-up support at the workplace. Such a long-term support was perceived particularly helpful if a job coach regularly contacted the affected worker until he or she decided that support is no longer needed (“opt out”), while services where the individual had to contact the job coach in case of problems (“opt in”) were perceived less effective. In several cases, the “opt out” follow-up prevented a job loss because it triggered a timely intervention by the job coach or the employer [53].

People with ABI also highlighted the importance of continued medical or psychiatric treatment after initial rehabilitation, including physiotherapy or antidepressant medication. Finally, giving people with ABI the possible option to retire earlier for medical reasons was seen as helpful for keeping them on the job, as it relieves the individuals of the pressure to meet all requirements of their job [42,52].

Social security regulations were perceived as both facilitators and barriers to maintaining work over the long term [41]. The receipt of a partial disability pension was perceived to provide financial stability and security. At the same time, a social security legislation with fixed income limits for being eligible to receive a disability pension represented a barrier for working in the long term, in particular for workers who were willing to increase their working hours. People with ABI mentioned that eventually they

felt more secure with a disability pension instead of looking for a superior or better-paid job because they feared that such a job might be more difficult to keep in the long run [41]. Financial considerations were one of the strongest reasons that people with ABI stayed at work despite experiencing it as challenging [52].

Discussion

Based on a scoping review, we systematically collected and synthesized the available quantitative and qualitative research on factors associated with sustaining work in the long term after an ABI. Quantitative evidence consisted exclusively of longitudinal follow-up studies, providing insights into injury-related, functioning-related and sociodemographic determinants of individuals' work status at a given time point after ABI onset and not allowing for sound conclusions regarding long-term work stability. Qualitative findings primarily evidenced the importance of psychological personal and environmental factors beyond functioning-related aspects for job maintenance and long-term work stability.

The factors identified in our review partly overlap with those identified in studies focusing more specifically on the RTW transition after sustaining an ABI. Common factors important for RTW as well as for working in the long term are linked to injury-related characteristics, such as etiology and age at ABI onset, ABI severity, injury-related impairments and activity limitations [14,59], as well as features of the work and social environment [20,60]. Thus, while cognitive difficulties reduce the likelihood of RTW, they also present barriers to sustaining work in the long term by limiting the scope of possible job tasks and suitable job alternatives. Materne et al. [55] showed that, people with ABI fear changes in the organization and change in a job itself, because this would require an adaption to new circumstances, learning new routines, and dealing with new work colleagues. Such adaptations require more time and energy than before the injury,

leading to individuals with ABI staying in unsuitable, and potentially less satisfying, jobs that increase the risk of dropping out of the labour market [61].

Our review shows that the factors that facilitate RTW can change in importance and meaning and may even turn out to become a barrier over time. We found such a transformation for adjusted work tasks and responsibilities. At the beginning, people with ABI appreciated their modified job roles because they supported their RTW and provided a feeling of normality and stability. Yet, after some years they realized that reduced responsibilities prevented their job promotion, hence creating financial burdens and job dissatisfaction [41,54]. A similar change in meaning was observed for financial pressure, which has been reported as a motivator for RTW. However, the need for a sufficiently high income may lead to a work overload in the long term [52,54]. Putting pressure on affected individuals who are forced to stay at work while ignoring warning signals of depleting personal resources may not only result in stress but also negatively affect health, increase sickness absences and labour market dropouts [62]. Social security regulations also tend to have different effects, depending on the stage of a person's RTW and employment trajectory. While disability pensions were a facilitator for RTW, fixed disability pension schemes that determine how much a person is allowed to earn in the general labour market may become a barrier to career development. Several participants emphasized that they refrained from looking for a better-paid and more satisfying job because they were afraid that they would not be able to keep it and in the long run may lose both: their pension and their new job [41].

By reporting on factors that influence working in the long term, our review also touches the concept of "sustainable employment". Sustainable employment may be defined as a work situation, where a match between a person, the job and the workplace supports the person to stay healthy and satisfied at work over time, with a work

performance that meets the expectations of the person as well as the employer [63]. The different indicators for sustainable employment (i.e., person-job match, job satisfaction, job performance, job stability, health) are interrelated and reflect requirements for successful long-term work. Our findings suggest that ensuring a sustainable vocational integration after ABI is a continuous and dynamic process that involves adaptations in different life domains throughout the work life. As sustainable employment comprises both objective and subjective indicators, it is important that studies on the long-term employment go beyond time-related outcomes of work stability such as work duration, but also address work quality outcomes such as perceived job match, job satisfaction and health. The available evidence emphasizes a need for continuous assessment of the vocational situation of persons with ABI [42,52,53,58], because there is low accuracy of predicting working in the long term based on early assessments. For instance, severity of injury showed poor predictive value with regard to one's future employment status. Pössl et al. present data on patients with poor work-related outcome despite of having a good prognosis at hospital discharge, while other patients showed good outcomes despite of a poor prognosis, indicating that current early assessments (or their outcomes) may be insufficient to predict working in the long term [58]. Furthermore, work trajectories of patients with good work outcome despite poor prognosis at discharge serve as a reminder that recovery time is individualized and cannot always be predicted correctly. RTW might be a first step but not necessarily always leads to sustainable employment post-ABI. While a fast RTW or a high amount of work hours after RTW are often used to operationalize the success of vocational rehabilitation process, such factors are not necessarily indicative of the long-term success. For instance, work overload can lead to excessive fatigue and to feelings of being overwhelmed, which can limit social and leisure activities [42,53,54,57,62], which in turn can negatively impact health and well-being.

Moreover, staying in dissatisfying jobs or in jobs with overly high demands may lead to a depletion of personal resources, increasing the risk of dropping out from the labour market. Thus, for evaluating the sustainability of RTW services as well as for promoting sustainable employment, it is crucial to regularly monitor, follow-up and optimize the match between the person and the job/workplace. This can involve interventions at the level of the worker (e.g., job skills training or developing the strategies to cope with injury-related limitations at work) as well as at the level of the job or workplace (e.g., adjustment of work tasks). Furthermore, as the consequences of ABI can lead to a fluctuation in work performance, regular evaluation of work accommodations and workplace support should be performed to ensure a good match between the worker's ABI-specific needs and the characteristics of the work environment [64].

Our finding that vocational rehabilitation was perceived as beneficial for working in the long term is in line with two qualitative meta-analyses emphasizing the importance of initial RTW services for vocational reintegration [60,65]. Taken together, the evidence on vocational rehabilitation strongly suggests that a carefully structured and well-guided initial RTW may have long-lasting positive effects for both the individuals with ABI and their employers [42,53,66,67]. In addition to these findings, our review shows that vocational services are beneficial beyond initial RTW. Ongoing support at the workplace, for instance in terms of job coaching or supported employment, may result in keeping people at work, even when a risk of drop out is imminent [53]. Bonnetterre et al. [68] suggest that individualized follow-up programs with vocational integration professionals who monitor individuals with ABI continuously for some years post-RTW could stabilize the persons in their employment and increase the probability of receiving a permanent work contract.

Strengths and Limitations

A main strength of our study is its comprehensive scope with the inclusion of both quantitative and qualitative studies. While the quantitative studies provide more robust information on factors associated with working in the long term, the qualitative studies provide much more insights into the dynamics of long-term employment, in particular the work experiences of affected persons and how particular factors influence employment over time.

However, our review is also subject to several limitations. First, in this study we did not distinguish between traumatic and non-traumatic cause of ABI because only one of the quantitative studies addressed non-traumatic brain injuries. Although the impact of identified factors may differ between health conditions evidence suggests that the long-term consequences of ABI apply to both [20]. Nevertheless, additional quantitative studies should be conducted to examine factors associated with working in the long term of people with non-traumatic ABI. Second, the studies retained in this review mainly included individuals with moderate to severe brain injuries. It can thus not be assumed that our results are directly transferable to the population of people with mild ABI. Furthermore, our search was limited to the selected databases and time coverage. Articles published before 2000 were excluded to focus on the contemporary labour market reality. Therefore, some factors might have been omitted. Additionally, we considered only articles in English or German due to the authors' proficiency in these languages, which might have excluded some studies.

Implications for Rehabilitation Practice

Our review reports on factors associated with sustaining work in the long term that should receive particular attention in vocational integration and job retention strategies for

persons with ABI. For instance, strategies employed by people with ABI to cope with injury-related limitations are not always sustainable in the long-term perspective. In particular, future interventions should provide individuals with tools to foster their work life balance, develop strategies against cognitive impairments and improve metacognition, defined as awareness of person's cognitive limitations.

It was also reported that simply a feeling of being understood, accepted or supported was already a significant facilitator of working in the long term. This may suggest that individuals with ABI struggle with loneliness and social exclusion due to the lack of understanding the complex nature of their impairments. Future interventions should focus on raising awareness among the community, health professionals, and employers about invisible limitations and persistent difficulties following an ABI. ABI is a chronic health condition and people with ABI tend to experience fluctuations in their work performance over time. Social and governmental policies should be designed in a way that encourages people with ABI to seek career advancement and promotion without the fear of losing social benefits if they fail.

The results of our review show that long-term support programs, access to medical interventions, and to vocational rehabilitation specialists are important for individuals with ABI to maintain their work in the long term. However, it has been reported that those services are limited or difficult to access beyond a certain time after ABI [42,67,69]. Policy makers should ensure prolonged availability of vocational rehabilitation and ongoing workplace supports, including disability management options, to help persons with ABI stay employed. Interventions and continuous assessment should be offered beyond RTW services to address the dynamic nature of person-job match and related indicators of working in the long term.

Implication for Future Research

Future studies should report detailed work-related outcomes such as time to first RTW, stability of employment and duration of current employment. The information presented in the initially identified studies was limited and diverse with regard to the study sample, time points of data collection, operationalization of work and work-related outcomes. Inclusion of studies with not specified times since injury, a lack of information concerning years of employment duration after the injury or time to RTW would preclude reliable interpretation and synthesis of the findings, therefore most of initially identified quantitative studies were excluded. In particular, the lack of information concerning time to RTW prompted us to use time since ABI as a time-related selection criterion leading to two heterogeneous types of results in this study: factors associated with work maintenance explored by qualitative studies and factors associated with working in the long term reported by quantitative studies without knowledge on work duration. Detailed and standardized descriptions of a study samples would allow for meaningful data interpretation and enable comparison across study findings.

Additionally, prospective longitudinal studies providing a comprehensive view on the work life course of persons with ABI are needed to investigate the determinants of key transitions (e.g. return to work, dropouts, retirement) and the sustainability of particular work life trajectories. Ideally those studies should be combined with qualitative studies providing information about the dynamics across the work life course of affected individuals. With regard to outcome evaluation of vocational integration services, it appears important to make use of work-related outcomes that are more indicative for sustainable work and working in the long term such as job satisfaction, employer support, or workplace description. These findings from qualitative research should be tested in hypothesis-driven longitudinal studies. Finally, quantitative studies that not only provide

a retrospective follow-up after the vocational or medical services but which also prospectively collect data within the services along with follow-up's are needed. This would allow for quality evaluation of – for example – job coaching services and considerably help to optimize the services quality with respect to the promotion of sustainable work for affected individuals.

Conclusions

The current scoping study synthesized quantitative and qualitative evidence on factors associated with sustaining work in the long term with an ABI. Results highlight that the long-term work situation of those affected is influenced most strongly by ABI-related impairments (e.g., invisibility of impairments), psychological personal factors (e.g., coping strategies) and aspects of the work environment (e.g., employer support). Future interventions should focus on empowering people with ABI to develop coping strategies that help them to deal with injury-related impairments at work. Moreover, educational programs for affected persons as well as employers and health professionals should be promoted to increase their awareness about persisting invisible difficulties as a basis to create a supportive and stable work environment for individuals with ABI. Future research should strive for longitudinal life course studies to provide a comprehensive view about the factors affecting the sustainability of long-term work trajectories. Finally, policy makers should invest in the regular monitoring of person-job match as well as in rehabilitative, integrative and preventative measures to ensure a sustainable employment.

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Declaration of interest

The authors report no conflicts of interest.

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Table 1. Description of included quantitative studies

Author(s), year, [Ref.], country	Objective	Methodological description Design (D); Source population (SP); Inclusion procedure (IP); Enrollment period (EP); Statistical analysis (SA); Measurement time point (MP)	Participants N; Type of ABI (traumatic, non-traumatic); Gender; Current age; Age at time of injury; Time since injury	Work outcome / Employment status	Results
Arango-Lasprilla et al., 2011, [48], USA	After controlling for demographic and injury characteristics: To determine differences in employment rates among whites, blacks, and Hispanics with TBI at 1, 2, or 5yr. after injury. To evaluate changes in postinjury employment rates over time for whites, blacks, and Hispanics. To evaluate if changes in postinjury employment rates over time differ for whites, blacks, and Hispanics	(D) Longitudinal multicenter inception cohort. (SP) TBI-Model Systems National Database (TBIMS-NDB). (IP) 3940 subjects selected, whose injury occurred prior to 2005. 536 subjects excluded due to missing employment data. (EP) NI (SA) Analysis of potential bias 'participants vs. excluded'; descriptives; generalized linear mixed models; adjusted model. (MP) Acute care: baseline data. 1, 2, 5yr. follow up.	N= 3204 Moderate to severe TBI (determined as loss of consciousness longer than 30 min) Gender: 75.44 % male Race: 67% Caucasian Current age: NI Age at injury: 33.6 (SD 11.7) Time since injury: 5yr.	Employment: Competitive employment (≥minimum wage, legal or illegal employment, on leave with pay) vs. not competitive employment (student, special education, homemaker, retired, unemployed, volunteer, and others). Employment status before injury: 74% employed. Employment status at 5yr. postinjury: NI.	Adjusted employment rates 5yr. after injury among races /ethnicities (OR (95%CI)): <ul style="list-style-type: none"> The odds of employment were significantly greater for 'whites' compared with African Americans aOR 2.12 (1.63-2.75) The odds of employment did not significantly differ for 'whites' vs. Hispanics and for Hispanics vs. African American aOR 1.48 (0.92-2.37) and 1.43 (0.86-2.37) Confounding factors that have significant relationships with employment rates post injury: <ul style="list-style-type: none"> Age at injury "5-yr. decrease": OR 1.34 (1.27-1.41) Gender (male) OR 1.42 (1.18-1.69) Marital status 1.38 (1.15-1.65) Level of education before injury: > high school vs high school, OR 1.70 (1.43-2.01); >high school vs. < high school, OR 3.07 (2.48-3.80); high school vs. < high school, OR 1.81 (1.47-2.22) Employment status before injury, employed vs. unemployed OR 3.43 (2.66-4.43); employed vs. other 3.14 (2.33-4.25) Cause of injury: vehicular vs. other, OR 1.31 (1.00-1.70); vehicular vs. violent, OR 1.74 (1.35-2.24); Fall vs. violent, OR 1.52 (1.11-2.07) GCS score: moderate vs. mild, OR 1.41 (1.09-1.82); Severe vs. mild, OR 1.26 (1.02-1.56) FIM cognitive: 1-unit increase = OR1.21 (1.12-1.32) and FIM motor score at discharge: 1-unit increase = OR 1.07 (1.03-1.10) DRS score at discharge: 5-unit decrease= OR 1.38 (1.10-1.73) LOS (1day decrease) in acute: OR 1.11 (1.06-1.16) and LOS in rehabilitation care: OR 1.08 (1.05-1.10)
Awan et al., 2019, [44], USA	To characterize the interrelationship between substance abuse (SA) and employment among individuals with moderate to severe TBI.	(D) Longitudinal multicenter inception cohort (SP) National Trauma Database (NTDB) and TBI-Model Systems National Database (TBIMS-NDB) (IP) 4632 subjects matched, 3180 cases eligible, 290 excluded due to missing outcome variables. (EP) NI (SA) Analysis of potential bias 'participants vs. excluded'; descriptives; comparisons substance abuse (SA) - noSA, cross-lagged structural equation modeling (CLSEM), cross-sectional logistic regressions. (MP) Acute care: baseline data. 1, 2, 5 yr. follow up: SA and employment status data.	N= 2890 (N=1271 for CLSME) Moderate to severe TBI Gender: 76.47 % male Age at yr. 5: NI Age at injury: 35 (IQR 24-47) Time since injury: 5yr.	Employment: Employed (full and part-time) vs. unemployed (retirement, work-related leave, unpaid work, volunteering, household work). Employment trajectories: 1-Stable (S): employed at yr. 1, 2 and 5. 2-Unstable (US): employed at one or two follow up time points. 3-Delayed (D): employed only at yr. 5 or 2 and 5. 4-No paid employment (NPE). SA: illicit drugs, binge drinking during last month, heavy drinking (14 drinks per week in men, 7 in women). Employment status before injury: 76.93%. Employment status at 1 yr.: 33.32 % employed. Employment status at 5 yr.: 38.65% employed.	Predictors of employment at yr. 5, OR (95%CI): (Logistic regression controlled for marital status, education, preinjury SA, post injury re-hospitalization, TBI severity, and pre-injury employment) <ul style="list-style-type: none"> Older age predicted unemployment OR 0.95 (0.94-0.97). Employment at yr.-1 and yr. 2 significantly predicted employment at yr.5 OR 3.92 (2.58-5.92), 8.52 (5.76-12.71) Preinjury SA predicted lower proportion of employment across follow up. Confounder-adjusted temporal relationships between employment and SA <ul style="list-style-type: none"> Prevalence of SA increased across all follow-ups, peaking at yr.-5 in all employment groups, with the highest prevalence in the stable employment group Descriptive findings: <ul style="list-style-type: none"> 54.53% of individuals were stably employed over 5yr., 8.45% were unstably employed, 10.86% had delayed employment and 26.13% were unemployed. Individuals excluded from CLSME analysis due to missing data were less educated and unemployed.
DiSanto et al., 2019, [46], USA	To characterize employment stability and identify predictive factors of employment stability in individuals after moderate to severe TBI.	(D) Longitudinal multicenter inception cohort. (SP) TBI-Model Systems National Database (TBIMS-NDB). (IP) 9656 eligible; 3125 excluded for missing data; 848 excluded for being students. (EP) Participants injured since 2001 (since 2007 for mental health and cognition variables). (SA) Analysis of potential bias 'participants vs. excluded'; Descriptives, correlation, multinomial logistic regression. (MP) data collection: emergency, acute care, rehabilitation, 1, 2 and 5 yr. follow up post injury.	N=5683 (analytic cohort 4995) Moderate to severe TBI Gender: 76% male Current age: NI Age at injury: 36.51 (SD 12.35) Time since injury: 5yr.	Employment: Employed (full and part-time) vs. not paid employment (retired, work-related leave, unpaid work, volunteering, household work). Employment trajectories: Stable (S): employed at yr. 1, 2 and 5. Unstable (US): employed at one or two follow up time points. Delayed (D): employed only at yr. 5 or 2 and 5. No paid employment (NPE). Employment status before injury: NI. Current employment status: (S) 27.20%, (D) 10.24%, (U) 9.31%.	Predictors of employment stability. RRR (95% CI) Age, race, injury severity and driving independently predicted all three employment-trajectories. Reference group: (NPE) <ul style="list-style-type: none"> Age (S): RRR 0.95 (0.94-0.96); (US): RRR 0.97 (0.96-0.98); (D): RRR 0.96 (0.95-0.97) Race, 'white' vs. 'black' (S): RRR 0.38 (0.29-0.50); (US): RRR 0.38 (0.27-0.54); (D): RRR 0.65 (0.48-0.88) Injury severity, severe vs. moderate (S): RRR 0.22 (0.18-0.27); (US): RRR 0.48 (0.37-0.62); (D): RRR 0.74 (0.57-0.96). Extremely severe vs. moderate: (S): RRR 0.05 (0.03-0.09); (US): RRR 0.19 (0.11-0.34); (D): RRR 0.53 (0.35-0.82). Transportation (relying on driver vs. driving independently): (S): RRR 0.04 (0.03-0.05); (US): RRR 0.12 (0.09-0.17); (D): RRR 0.12 (0.09-0.16); Preinjury employment, gender, education, marital status and annual earnings predicted a reduced likelihood of (S) relative to (NPE) <ul style="list-style-type: none"> Preinjury employment (no paid employment vs. employed) (S) RRR 0.04 (0.01-0.28) Gender (women vs. male) (S): RRR 0.73 (0.59-0.91) Education (<high school vs. ≥college) (S): RRR 0.21 (0.15-0.28); (high school vs. ≥college) (S): RRR 0.38 (0.30-0.50)

					<ul style="list-style-type: none"> Marital status (divorced, widowed, separated vs. married) (S): RRR 0.68 (0.53-0.86) Annual earnings (20'000-49'000\$ vs. 50'000\$+) (S): RRR 0.07 (0.54-0.89) Anxiety or depression at 1yr. post injury predicted stable employment vs. (NPE) (adjusted model, N= 953) (S): RRR 0.23 (0.12-0.47); RRR 0.48 (0.29-0.82). Descriptive findings: Study sample compared to those excluded from analysis tended to be older, female, married, educated, severely injured, employed preinjury, white, privately insured, injured in vehicular accident and driving independently post-injury
Gary et al., 2009, [43], USA	To examine racial differences in competitive employment outcomes at 1, 2 and 5 yr. after TBI and to determine whether changes in not competitive employment rates over time differ between 'blacks' and 'whites' with TBI after adjusting for demographic and injury characteristics.	(D) Longitudinal cohort. (SP) TBI-Model Systems National Database (TBIMS-NDB). (IP) 2395 individuals selected, 373 excluded because of missing data. (EP) Injury occurred between 1989-2001. (SA) Analysis of potential bias 'participants vs. excluded'. Comparisons to identify differences in covariates, generalized linear mixed models. (MP) admission and 1, 2, 5 yr. follow up post injury.	N= 2022 Moderate to severe TBI Gender: 75.5% male Race: 69.9% Caucasian Current age: NI Age at injury: 34.5 yr. Time since injury: 5yr.	Employment: Competitively employed (paid employment, full-time or part-time) vs. not competitively employed (unemployed, full or part-time student, special education, homemaker, volunteer work, retired, and others). Employment status before injury: 72% employed. Employment status 5yr. post injury: 41.94 employed.	Factors significantly affecting changes in post-injury employment status over time: Age at injury, preinjury employment status, preinjury marital status, admission DRS, discharge DRS, acute LOS, and rehabilitation LOS. Factors associated with employment status 5yr. post-injury The odds of not being competitively employed vs. being competitively employed were significantly greater for: <ul style="list-style-type: none"> African American vs. 'whites': aOR 3.15 (2.30-4.30) Age: (43yr.vs. 24yr.): aOR 3.40 (2.67-4.32) Gender (female vs. male): aOR 1.26 (1.01-1.57) Factors associated with being not competitively employed vs. employed at follow up <ul style="list-style-type: none"> Preinjury employment status (not employed vs. employed) aOR 3.39 (2.67-4.32) Preinjury education level <high school vs. ≥high school: aOR 2.34 (1.86-2.94) Preinjury marital status not married vs. married: aOR 1.39 (1.11-1.74) Admission DRS (17 vs. 8): aOR 1.43 (1.15-1.77) Discharge DRS (7 vs.4): aOR 1.51 (1.33-1.72) Acute LOS (28 vs. 10d): aOR 1.80 (1.55-2.09) Rehabilitation LOS (38-14d): aOR 1.27 (1.11-1.46) Cause of injury (violent vs. nonviolent): aOR 1.46 (1.09-1.94) Descriptive findings: The excluded compared to the study sample were significantly different with respect to race (less African American), lower employment rate at admission, lower pre-jury level of education, higher percentage of violent injuries, higher mean admission GCS score, and a lower mean admission DRS.
Gary et al., 2010,[40], USA	To examine differences between minorities and 'whites' in competitive employment outcomes 10 yr. after injury while controlling for demographic and injury characteristics that may affect employment or differ significantly between minorities and 'whites'.	(D) Longitudinal cohort. (SP) TBI-Model Systems National Database (TBIMS-NDB). (IP) 823 participants selected, 441 excluded because of missing data. (EP) injured before 1999. (SA) Analysis of potential bias 'participants vs. excluded'; comparisons to identify significant differences; Logistic regressions. (MP) admission, 10yr. follow up post injury.	N= 382 Moderate to severe TBI Gender: 75.65% male Race: 49.2% 'white' Current age: NI Age at injury: 28.30yr. (SD 9.2) Time since injury: 10yr.	Employment: Competitively employed (paid employment, full-time or part-time) vs. not competitively employed (unemployed, full or part-time student, special education, homemaker, volunteer work, retired, and others). Employment status before injury: 63.25% employed. Employment status 10yr. post injury: 48.8% employed.	Factors associated with employment status at 10yr. follow up: <ul style="list-style-type: none"> The odds of employment were 2.73 times greater for 'whites' than minorities. OR 2.73 (1.81-4.13), aOR 2.3 (1.47-3.83) Age (21yr vs 34yr): OR 1.27 (0.96-1.7) n.s.; aOR 1.49 (1.07-2.06) Employed at injury: OR 2.45 (1.59-3.76); aOR 2.12 (1.31- 3.42) Levels of education (>HS vs. <HS): OR 1.98 (1.14-3.19); Cause of injury (not violent vs. violent): OR 3.22 (1.98-5.24); aOR 2.55 (1.48-4.40) PTA (12 vs. 40 d): OR 1.39 (1.05-1.84) Admission FIM (79.5 vs. 34): OR 1.52 (1.07-2.15) Discharge FIM (115 vs. 96): OR 1.38 (1.14-1.67) Total LOS (28 vs. 71d): OR 1.72 (1.31-2.25); aOR (2.19 (1.61-2.97) Descriptives: The participants excluded from analysis were more likely to have below a high school level of education (46% vs. 34%), a higher mean age at injury (30.5 vs. 28.3 yr.), lower FIM (less independence) at discharge (98.7 vs. 102.7), higher DRS (more disability) at discharge (5.7 vs. 5.2), and greater total LOS in acute and rehabilitation care (59 vs. 54 days).
Grauwmeijer et al., 2017, [49], Netherlands	To evaluate employment outcome and its predictors up to 10 yr. after injury.	(D) Longitudinal cohort. (SP) Rotterdam TBI study. (IP) 549 participants screened; 153 died, 229 excluded, 54 denied participation. (EP) 1999-Apr. 2004. (SA) Analysis of potential bias 'participants vs. excluded'; generalized estimating equations (GEE) to fit a logistic regression analysis with repeated measurements. (MP) Admission, hospital discharge, 3, 6, 12, 18 month, 2, 3 and 10 yr. follow up post injury.	N= 109 (N=48 in 10yr. follow up) TBI Gender: 67% male Current age: NI Age at injury: 34.3 (SD 12.7) Time since injury: 9.9 yr. (SD 1.8)	Employment: Employed (all payed vocational activities) vs. unemployed (any voluntary vocation without payment, students, homemakers, early retirement, sick leave). Employment status before injury: 90% employed. Employment status 10 yr. post injury: 43% (N=26/48) employed.	Factors significantly associated with employment status, OR (95%CI): Length of hospital stay (d) and TBI severity (discharge FIM, discharge FAM, discharge BI, discharge GOS score.) Predictors estimating the employment probability over 10 yr. follow up. (longitudinal analysis) <ul style="list-style-type: none"> Estimated employment probability peaked at 2yr. follow up with 57% and 43% at 10yr. Time after TBI: OR 2.61 (1.95-3.51) Employed pre-injury: OR 8.21 (3.38-19.92) LOS (days in hospital): OR 0.98 (0.96- 0.99) FAM score: OR 1.05 (1.02; 1.08) Descriptives: The participants lost to follow up were more often employed pre-injury

Klyce et al., 2019, [45], USA	To examine the predictive ability of depression when considering future long-term employment outcomes for individuals with moderate-to-severe TBI after controlling for key preinjury and injury-related variables.	(D) Longitudinal cohort. (SP) TBI-Model Systems National Database (TBIMS-NDB). (IP) Original sample from a classification tree model study [Stromberg et al. 2019], individuals without depression data were excluded. (EP) injury since 1997. (SA) Descriptives, logistic regression (based on previous decision tree analysis). (MP) Acute care, 2 and 5 yr. follow up.	N= 2784 Moderate to severe TBI Gender: 75.2% male Current age: NI Age at injury: 32.0 (IQR 23.0-46.0) Time since injury: 5yr.	Competitive employment: Employed (full or part-time employment of at least minimum wage) vs. supported employment was excluded. Employment status before injury: 75% employed (83.4% student or employed). Employment status 5yr. post injury: 44.5% employed.	Predictors of employment status 5 yr. postinjury, OR (95%CI): Subgroups or individuals with higher rates of being depressed at 1 or 2yr. post injury corresponded to lower levels of being employed at subsequent follow-up. • Being depressed at yr. 1 predicted unemployment at yr. 5: OR 1.88 (1.48-2.40) • Being depressed at yr. 2 predicted unemployment at yr. 5: OR 1.72 (1.36-2.17)
O'Neil-Pirozzi et al., 2021, [50], USA	To examine the impact of specific FIM-measured cognitive-communication deficits (memory, problem solving, comprehension, expression, and social interaction) post-TBI at inpatient rehabilitation discharge, and at 1 yr. and 2 yr. postinjury on (1-yr. and) 5-yr. employment outcomes and the influence of demographic and injury variables	(D); Longitudinal cohort. (SP); TBI-Model Systems National Database (TBIMS-NDB). (IP); 13429 participants enrolled, excluded: 5608 not working at time of injury, 3064 incomplete follow ups, 392 missing any FIM cognitive data, 332 age 60 or over, 335 missing employment status, 134 missing injury severity, 21 missing education status. (EP) 1988- 31. Dec. 2013. (SA) Receiver operating curve (ROC) for FIM items to predict employment based on cutoff scores. Binary logistic regression, unadjusted and adjusted models were analyzed. (MP) 5 yr. post injury.	N= 3543; Moderate to severe TBI: indicated by duration of posttraumatic amnesia (PTA), using the Mississippi Intervals (moderate = 0-14 days, moderate to severe = 15-28 days, severe = 29-70 days, extremely severe = 71 days or more) Gender = 76% male Race = 73.2% 'white' Education = 18.3 % less than high school, 36.2% high school, 28.5 some college, 16.9% college Age at time of injury: 34.1, (±12.5) Range: 16 to 59 yr. Time since injury = 5 yr.	Competitively employed: (full-time and part-time work) Employment status at injury: 100% employed. Employment status 1yr. post injury: 44.5% employed. Employment status 2yr. post injury: 48.5% employed Employment status 5yr. post injury: 50% employed.	Predictors of employment status 5 yr. postinjury OR (95%CI): FIM cognitive item at discharge predicted employment at 5yr.: Unadjusted model "Comprehension" OR 2.13 (1.86-2.43), "Expression" OR 2.24 (1.95-2.56). Adjusted model "Comprehension" OR 1.57 (1.35-1.82), "Expression" OR 1.64 (1.41-2.56), "Social Interaction OR 1.49 (1.28-1.73), "Problem Solving OR 1.69 (1.45-196), "Memory OR 1.66 (1.43-1.92). Covariates: Across all models, male were more likely to be employed than females OR 0.69 (CI 0.96-0.97). Higher education was associated with being employed with OR from 1.46-1.48 for (high school vs. < high school) and OR from 4.51-4.56 for (college vs. < high school). Participants with less severe injuries (moderate vs. severe) were more likely to be employed with OR from 2.58-2.71. Age at injury showed a minimal effect with OR 0.96 (0.96-0.97). Work status at injury (full vs. part time) had no significant effect.
Sen et al., 2019, [47], UK	To identify factors and trends in return-to-work (RTW) at different time-points post-stroke, in a multi-ethnic urban population.	(D) Longitudinal cohort. (SP) South London Stroke Registry (SLSR). (IP) 5609 participants enrolled, 940 in payed work preinjury. (EP) Stroke between 1995-2014. (SA) Univariate comparisons, multivariable logistic regression. (MP) Acute care (baseline), 1, 5, 10 yr. post stroke.	N= 940 First ever stroke Gender: 68.2% male Race: 54.1% caucasian Current age: NI Age at injury: 53.4yr. Time since injury: 10yr.	Employment: Paid work Employment status before injury: 100%. Employment status 5yr. post injury 12% (N=113). Employment status 10yr. post injury: 3% (N=27).	Factors significantly associated with working at 5 and 10yr.: • Lower mean age (5 and 10yr.), being male (5yr.), manual labor (10yr.), intact motor function (10yr.). Odds of working 5 and 10yr. post stroke • Functional independence (BI) was associated with an increased likelihood of RTW 5yr post stroke: OR 3.76 (1.34-10.58), wOR 3.55 (1.17-10.75). • Increasing age was a negative predictor for working at 5 and 10yr.: OR 0.93 (0.9-0.97), wOR 0.94 (0.90-0.98); and OR 0.89 (0.81-0.97), wOR (0.83-0.96). • Returning to work within 1yr. was a positive predictor for working at 5yr.: OR 11.9 (4.66-30.43), wOR 13.68 (5.03-37.24); and for working at 10yr.: OR 8.15 (1.46-45.53), wOR 9.07 (2.07-39.8). • Patient in manual occupation was less likely to be in paid work at 10yr.: OR 0.22 (0.04-1.13), wOR 0.17 (0.04-0.66).
Stromberg et al., 2018,[51], USA	To create a user-friendly prognostic model, for work in the long-term outcomes, based on patient characteristics available upon rehabilitation discharge, in individuals who incurred a moderate to severe closed TBI.	(D) Statistical decision tree analysis. (SP) TBI-Model Systems National Database (TBIMS-NDB). (IP) Eligible 9238, 4311 excluded yr. 1 to 5 due to several reasons. (EP) Injured between 1997 -2017. (SA) Decision tree methodology; classification rule with unbiased interaction selection and estimation algorithm. (MP) Acute care (baseline) 1, 2, 5 yr. post injury.	N yr.1= 7867 (N=6687 training; N= 1180 test). N yr.5= 4927 (N=4188 training; N=624 test). Moderate to severe TBI. Gender: 75 % male. Current age: NI. Age at injury: 33.0 (IQR 23.0-46.0). Time since injury: 5yr. Inclusion age 18-59 yr.	Employment: Current competitive employment (full or part-time job, at least minimum wage, and not in supported employment) vs. not competitively employed. Employment status before injury: 73% employed. Employment status 5 yr. post injury: 40.6% employed.	Pattern associated with post injure employment 5yr post injury: • Shorter post-traumatic amnesia and more education led to the best outcome. • Longer post-traumatic amnesia and lower education led to the worst outcome.

Abbreviations: NI=no information, OR=odds ratio, aOR=adjusted odds ratio, wOR=odds ratio with inverse probability weights, GCS=Glasgow coma scale, GOS=Glasgow outcome scale, FIM=functional independence measure,

DRS=disability rating scale, FAM=functional assessment measure, BI=Barthel index, LOS=length of stay, RRR=relative risk reduction, PTA=post traumatic amnesia,

Table 2. Description of included qualitative studies

Author(s), year, [Ref.], country	Study objective	Study design	Participants (type of ABI, sample size, gender, age range, employment status at ABI=ES)	Results
Balasoorya-Smeekens et al., 2016, [52], UK	To explore barriers and facilitators to staying in work following stroke.	Thematic analysis of posts regarding staying in work following stroke using the archives of an online forum for stroke survivors.	Persons with stroke N= 60 m= 29, f=23 NI=8 Age at stroke: 44.5 (26-66) ES= no information Time since injury: NI Earliest RTW: Directly-up to 3 months n=8 3 months up to 6 months n=9 6 months up to 12 months n=6 1-2 yr. n=7 Over 2 yr. n=1 No information n=29	Barriers to successfully staying in work: <ul style="list-style-type: none"> lack of understanding of stroke—in particular invisible impairments—of survivors, employers and general practitioners (GPs), lack of support in terms of formal adjustments, and 'feeling supported'. Facilitators to successfully staying in work: <ul style="list-style-type: none"> coping strategies, support at the workplace, supportive employer.
Libeson et al., 2020, [54], Australia	To understand the RTW experience of individuals with TBI who received comprehensive vocational rehabilitation and to identify facilitating and limiting factors in the RTW process.	Semi-structured interviews. Purpose sampling from Epworth HealthCare Rehabilitation, Victoria. Inductive thematic analysis.	Persons with TBI N=15 m=8, f=7 Age at TBI (24-60) ES= employed Time since injury: 1-8yr.	Factors associated with RTW outcome: <ul style="list-style-type: none"> work satisfaction, future vocational outlook, quality of life.
Macaden et al., 2010, [53], India	To explore factors affecting sustaining employment in people with acquired brain injury (ABI).	Semi-structured interviews. Critical case sampling: a case included one person who underwent vocational rehabilitation and sustained work for a minimum of 3y thereafter, a family member, a co-worker or employer and a job coach or VR specialist. Framework analysis.	Persons with ABI N= 8 persons with ABI (TBI 5, stroke 3) N= 7 family members, 6 employers, 8 VR-professionals. ABI persons: m= 7, f=1 Age at study (23-50) ES= employed 6, unemployed 2) Time since injury:	Facilitators of sustained employment: <ul style="list-style-type: none"> similarity between pre-injury work or leisure interest and post-injury work, unconditional motivation, insight and the ability to cope with cognitive and behavioral sequelae, the vocational rehabilitation programme building up confidence, providing continued follow up and providing co-worker 'twins' in the work place, employers with a personal experience of disability.
Materne et al., 2017, [55], Sweden	To increase knowledge of opportunities and barriers for a successful RTW in patients with ABI.	Semi-structured interviews. Purposive sampling from a county in Sweden. Qualitative content analysis	Persons with ABI N=10 (stroke 7, TBI 1, Tumor 1) m=5, f=5 Age at interview (27-55) ES=employed Time since injury: 3-9 yr.	Factors negatively associated with sustainable employment: <ul style="list-style-type: none"> Communication, learning and other cognitive difficulties Cognitive fatigue Social dependence and lower self-esteem
Oppermann, 2004, [41], USA	To describe qualitatively, the meaning individuals ascribe to returning to work after traumatic injury to the brain	Semi-structured interviews. Rehabilitation hospital, Midwest, USA. Multiple Case study design.	Persons with TBI N= 2 m=0, f=2 Age at injury (23, 24) ES at interview= A: employed part time, B: unemployed but looking for a job. Time since injury: 7&23 yr.	Defining the meaning of work, revealed three themes: (a) experience of finding work after injury, (b) experience of maintaining work, (c) Independence related to work.
Palstam et al., 2018, [57], Sweden	To explore the experience of returning to work and maintaining work 7 to 8 yr. after experiencing a stroke.	Individual face-to-face, semi-structured interviews. Participants identified from the Extended Stroke Arm Longitudinal study at the University of Gothenburg. Inductive thematic analysis.	Persons with stroke or intracerebral hemorrhage N=13 m=8, f=5 Age at interview 50 (39-64) ES= employed Time since injury: 7-8yr.	RTW and work maintenance experience led to four themes: <ul style="list-style-type: none"> motivated for RTW while struggling with impairments, mixed feelings in the RTW process, still at work though restricted: a) setting limits, b) work-related stress, social support for a sustainable work situation.
Phillips et al., 2018, [42], UK	This study aims to determine the feasibility of longer-term follow-up and explore work status 6 yr. post stroke. To identify and explore factors affecting long-term work outcomes from the	Semi-structured telephone interview, with questions informed by The WORK Disability Paradigm by Loisel and the ICF. Participants were recruited from UK NHS hospital.	Persons with stroke N=6 m=5, f=1 Age at interview 63 (51-73) ES at interview = 5 employed, 1= retired, Time since injury: 6yr.	Enablers to work included: <ul style="list-style-type: none"> supportive employers and work colleagues, family support, support from the occupational therapist with returning to work, antidepressants and medical retirement, adaptations at work. Factors negatively associated with sustainable employment: <ul style="list-style-type: none"> the invisibility of impairments,

	perspective of stroke survivors who were working before stroke onset.			<ul style="list-style-type: none"> • not driving, • reduced cognitive abilities, • fatigue, • Employers' concerns about job pressures.
Pössl et al., 2001, [58], Germany	To investigate stability of employment after brain injury.	Semi-structured interviews. Participants were recruited from an employment re-entry program at City hospital Bogenhausen, Munich.	Persons with ABI N=43 (TBI 24, Stroke 15, other 3) m=27, f=16 Age at injury 33.3 (17-50) ES= no information Time since injury: 7yr.	Factors negatively associated with sustainable employment: <ul style="list-style-type: none"> • cognitive difficulties, • behavioral problems, • work place factors: <ul style="list-style-type: none"> - being expected too much because of impairments invisibility, - being transferred to a different position, against one's will.
Törnbom et al., 2019, [56], Sweden	To enhance the understanding of long-term participation in working-aged people 7-8 yr. after stroke.	Semi-structured and In-depth interviews. Participants from the extended Stroke Arm Longitudinal Study at the University of Gothenburg. Inductive thematic analysis.	Persons with stroke N=11 m=7, f=4 Age at interview 48 (32-61) ES= employed Time since injury: 7-8yr.	Facilitators of working in the long term: <ul style="list-style-type: none"> • having independence and control over work tasks, • awareness of stroke consequences, • coping strategies, • flexible working conditions. Barriers to working in the long term: <ul style="list-style-type: none"> • cognitive problems (tiredness, problems with staying focused and information processing) • feeling ambiguous and frustrated because of not fulfilled ambitions

Table 3. Synthesis of findings from qualitative studies

Post injury impairments		
Factors positively associated with working in the long term	Factors negatively associated with working in the long term	Strategies identified by people with ABI
	<p>Impaired physical functions impacting work</p> <ul style="list-style-type: none"> Physical problems [52,57,58] Language or speaking problems [52,58] Communication [55] Insomnia [42,52,58] Nightmares [58] Headache [57,58] Visual impairments [58] Vertigo and balance disorders [57] <p>Impairments invisible to others impacting work [42,52]</p> <ul style="list-style-type: none"> Fatigue [52,57,58] Excessive need for rest after work [57] Impaired learning [55,58] Cognitive/mental fatigue [53,55] Social dependence and lower self-esteem [54] Need to sleep in the afternoon (e.g., therefore not being able to work full-time) [52] Psychological problems [52] Memory or cognitive problems [42,52,56,58] Concentration problems [57,58] Problems with short-term memory [58] Irritability and uncontrollable, aggressive outbursts [58] Inflexibility and inability to adjust to job requirements [58] Developing psycho-vegetative symptoms [58] <p>Problems directly impacting work [52]</p> <ul style="list-style-type: none"> Making mistakes [52] Difficulties in applying for a job (the actual application process) [52] (Work)-Stress augments impairments [52] Too high demands on multitasking and processing information leading to confusion and insecurity [57] Work stress leads to stroke-like symptoms and fear of a new stroke [57] <p>Problems indirectly impacting work [52]</p> <ul style="list-style-type: none"> Not being able to drive (to work) [42,52,53] A must to commute to work by using public transport [52,53] More time needed in the morning to get ready [52] Doing less responsible tasks at the work place than the position on one is employed for [41,57] 	<p>Coping with difficulties, listening to own body [52] Reducing stress levels (e.g., by changing jobs) [52]</p> <p>Dealing with fatigue [52,53]</p> <ul style="list-style-type: none"> Learning about fatigue and how to manage it [52] Taking naps/going to bed early [52] Using coping skills for cognitive difficulties [53]
Understanding the injury, expectations and self-awareness		
Factors positively associated with working in the long term	Factors negatively associated with working in the long term	Strategies identified by people with ABI
<p>Understanding the injury [52]</p> <ul style="list-style-type: none"> Need to understand one's problems to develop the ability to cope with them [52] Awareness of stroke consequences and coping strategies [56] Awareness of one's rights [57] <p>Pre-injury issues</p> <ul style="list-style-type: none"> Recognizing and coping with adverse pre-injury personality traits [53] 	<p>Lack of self-awareness [52]</p> <p>Taking on too much at work [52]</p> <p>Underestimating own disabilities [52]</p> <ul style="list-style-type: none"> Being unaware of making mistakes [52] Problems getting worse due to work [52] Overestimating of own disabilities [52] Poor awareness or coping skills [53] <p>Knowledge of ABI [52]</p> <ul style="list-style-type: none"> A lack of understanding of ABI related problems [52] Feeling like a fraud if having invisible problems [52] <p>Normality [52]</p> <ul style="list-style-type: none"> Looking normal, not feeling or being normal (leading to a lack of understanding of a person's difficulties) [52] Acting normal (at the cost of increasing tiredness by trying to 'keep up') [52] Not functioning like before [52] 	<p>Anticipation of the work difficulties and making appropriate arrangements related to this (i.e., coping by the person with ABI, as well as strategies in the workplace) [52]</p> <p>Dealing with ABI-related problems [52]</p> <ul style="list-style-type: none"> Asking work colleagues for help with mobility and communication [52] Evaluate the use of assistive technology [52] Taking breaks at work and reduce travel to work [52] Planning in advance and in detail how to fix a problem at work [52] <p>Accepting change [52]</p> <ul style="list-style-type: none"> Acceptance (e.g., of the impairments, of the new self, or the new situation) [52] Listen to the body [52] Be prepared for bad days [52] Expecting and accepting physical difficulties, and not doing too much [52]
Adapting skills and developing strategies to cope with impairments		
Factors positively associated with working in the long term	Factors negatively associated with working in the long term	Strategies identified by people with ABI
<p>Acceptance [52]</p> <ul style="list-style-type: none"> Accepting that one cannot function like before [52] Change of priorities [52] Re-labelling of one's identity [52] <p>Being able to stand up for oneself [57]</p>	<p>Acceptance [52]</p> <ul style="list-style-type: none"> Pushing oneself (i.e., not accepting changed abilities and / or identity) [52] Unable to accept that one cannot function like before [52] <p>Problems with following the right steps towards making adjustments [52]</p> <ul style="list-style-type: none"> E.g., not talking to Occupational Health [52] 	<p>Do not give up [52]</p> <ul style="list-style-type: none"> Not giving up/keep going/keep trying [52] Pushing oneself/going on like before the stroke [52] Setting goals and keeping active [52] <p>Slow down</p> <ul style="list-style-type: none"> Taking it easy/not overdoing things/building up gradually [52]

	<ul style="list-style-type: none"> • Not wanting to share stroke-related difficulties with others at work (resulting in less understanding of the persons' difficulties) [52] • Embarrassment regarding sharing problems with other people [52] • Passivity and lack of drive [53] • Not acting on insight [53] • Not coping with confabulatory memory [53] • Not compensating for poor organization [53] • Not coping with anger [53] • Not coping with paranoia [53] • Feeling unable to continue to work [58] 	<ul style="list-style-type: none"> • Not pushing oneself/be kind to oneself [52] • Choosing not to participate in social activities due to fatigue, to focus on work tasks [57] <p>Thoughts [52]</p> <ul style="list-style-type: none"> • Working as a way to forget/to be "normal" [52] • Thinking of what one can do instead of cannot do [52] <p>Get support/advice [52]</p> <ul style="list-style-type: none"> • Limiting ambition by delegating tasks or accepting a more subordinate work role [57] • Set up an ABI group to get support [52] • Reading the Stroke Association website for advice helps recovery [52]
Lack of energy to exercise because of fatigue and work demands [57]		

Motivation and job satisfaction

Factors positively associated with working in the long term	Factors negatively associated with working in the long term	Strategies identified by people with ABI
Wanting to be normal [52] High work satisfaction [54] Higher quality of life as a result of being employed [54] Being an outstanding employee [53] The opportunity to make personal choices about working procedures, independence, having control over how to solve problems [56] Previous leisure interests, work skills and work interests [53] Need to work because of money issues (e.g., not entitled to benefits) [52]	Lack of motivation [52,53] Difficulties to feel job satisfaction [41] Lower self-esteem [55] Pressure to be at one's best or to make up for one's lacks [41] Negative views regarding work [52] <ul style="list-style-type: none"> • Poor future vocational outlook [54] • Lack of confidence (to be able to perform at work) [52] • Feeling vulnerable at work [52] • Feeling out of place and lack of acceptance [41] • Being transferred to a different position, against one's will [58] • Feeling ambiguous and frustrated because of not fulfilled ambitions [41,56,57] 	High extra time investment to fulfil work responsibilities [41] Taking antidepressant to improve confidence at work (1, 5)

Social support: family, employer, colleagues

Factors positively associated with working in the long term	Factors negatively associated with working in the long term	Strategies identified by people with ABI
Family <ul style="list-style-type: none"> • Supportive family and friends [42,52] • Having a pet improves general mood, and ability to deal with job [52] Support at the workplace [52] Employer <ul style="list-style-type: none"> • Having a supportive and patient employer [42,52,53,57] (Especially employers with previous experience of disability) • Employer subsidizes transportation to work [52] • Employer supports adjustments that are needed [52,57] Co-workers <ul style="list-style-type: none"> • Having supporting colleagues [42,52,53] • Enjoying being back at work, and talking with friends/colleagues [52] • Sharing work situations with others [52] • Supportive colleagues helping out with commute [52] • Supportive colleagues helping out with problematic work tasks [57] Others <ul style="list-style-type: none"> • Advice and support from others with stroke (Online forum, patient organization) [52] 	Employer <ul style="list-style-type: none"> • Lack of support at work [52,57] • Employers' concerns about job pressures [42] • Being bullied at work by employer/manager or colleagues [52] • Too much pressure by employer [58] • Colleagues and employer think that the patient is making up the problems [52] • Needs for adaptation remain unheard [57] Co-workers <ul style="list-style-type: none"> • Lack of support by colleagues [52] • Co-workers make it difficult to maintain a job [41] • Being demeaning by other co-workers and talked down [41] • Being overestimated about performance ability by colleagues and superior [58] • Stress among co-workers [53] Other issues <ul style="list-style-type: none"> • Being socially dependent [55] • Lack of energy after work making impossible to engage in social contacts [58] • Feeling lonely [52] 	Improve the employers' understanding of stroke and stroke-related problems [52] Deal with other people [52] <ul style="list-style-type: none"> • Coping with comments and jokes made by others by ignoring them, or using humor [52] • Thinking about what to say (as a reply to potential comments) before meeting colleagues [52] • Providing explanations to others (about being different than before the injury especially about 'invisible' impairments) [52]

Work environment

Factors positively associated with working in the long term	Factors negatively associated with working in the long term	Strategies identified by people with ABI
Work organization <ul style="list-style-type: none"> • Flexible working conditions (reduced hours, changed schedules) [56] • Creating opportunities for rest and undisturbed work [57] • Setting limits for interaction with colleagues to focus on own tasks [57] • Being allowed to work at own pace [57] • Having opportunities to prepare and plan work according to own functional level [57] • Being treated like anyone else when impairment does not interfere with work [57] • Changing jobs in a large company [53] Feeling safe to communicate openly about impairments [57]	Work organization <ul style="list-style-type: none"> • Work created stress (work demands of being constantly available to customers, patients or colleagues) [57] • A competitive work environment [57] • Lack of control over workload and irregular inflow of work [57] • Having to adjust to changing work schedules [57] • Being forced to work overtime or having to manage the same work demands as before stroke [57] Layoffs [53] Misunderstandings at the workplace [41] Unwilling to change jobs in a large company [53]	Strategies in the workplace [52] <ul style="list-style-type: none"> • Adjustments to the workplace [52] • Reduced hours or duties [42,52] • Altered roles [42] • Taking time [52] • Working at home [52] • Going home if tired [52] Involve occupational Health department [52] Involve Union (to keep a job) [52] Change the job for a job that is manageable [52]

Services, health system and policies

Factors positively associated with working in the long term	Factors negatively associated with working in the long term	Strategies identified by people with ABI
Vocational rehabilitation program [52] <ul style="list-style-type: none"> • Building confidence [53] • 'Opt-out' follow up in the maintenance phase [53] • An appropriate, interesting placement [53] • Prioritizing physical exercise to be able to function better at work [57] 	ABI related medical issues [52] <ul style="list-style-type: none"> • Fear of a subsequent stroke [52] • Reducing exercises due to fear of a new stroke [57] • Medication side effects interfering with work [52] 	Staying in less interesting but more manageable job [41]

<p>Improvement of health by medical interventions, physiotherapy, medication [52]</p> <p>General Practitioner's influence (GP) [52]</p> <ul style="list-style-type: none"> • Signing fit to work [52] • Encouraging gradual return to work [52] • Leaving it up to the patient to decide what is best concerning work [52] • Being empathetic [52] <p>Assistance from labor union or social insurance agency [57]</p> <p>Possibility of retirement due to medical reasons [42,52]</p>	<p>GP's influence [52]</p> <ul style="list-style-type: none"> • GPs lack of understanding the problems of the patients [52] • GP not willing to extend sick leave (despite patient having various ABI-related problems) [52] • Signing not fit to work or encourages retirement [52] • Not prescribing antidepressants [52] <p>Poor health not related to ABI [53]</p> <p>Assistance from a labor union or social insurance agency leads to feeling exposed [57]</p> <p>Not entitled to benefits or retirement (e.g., consultant not signing the form) [52]</p> <p>Limit of income one cannot exceed to be eligible for social benefits [41]</p>	
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