

## A Systematic Review of Rehabilitation Interventions Aimed at Improving Participation in Life Domains for Young Adults with Disabilities

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### Abstract

**Background:** Youth living with chronic disabilities face challenges in various life domains, and effective rehabilitation services are essential in providing the necessary support to optimize their participation in the community. To date, there has not been any systematic review summarizing rehabilitation intervention studies that targeted this vulnerable population and their participation in various societal domains.

**Aim:** The purpose of this comprehensive review was to identify and critically appraise studies that aimed to improve participation outcome in young adults.

**Design:** Systematic review

**Settings:** Rehabilitation facilities, home, school, community, other

**Population:** Young adults with disabilities

**Method:** Systematic search in OVID MEDLINE, EMBASE, CINAHL, PsycINFO, Web of Knowledge Social Sciences Index (2000 to 2013). The International Classification of Functioning, Disability and Health (ICF) was used to classify the focus and outcome of the interventions.

**Results:** 104 multidisciplinary intervention studies were identified of which only 9 had a randomized design. Two of the randomized trials had a particular focus on young adults, one of which demonstrated a positive effect on the measured outcome as a result of the intervention. The review also revealed that studies targeting young adults often included subjects with multiple disabilities, had less focus on the ICF category "body functions" and evaluated a broader spectrum of participatory outcomes compared to studies including broader age categories. The majority of the studies did not explicitly illustrate the linkage between the applied interventions and the outcome measures or describe the processes of the interventions that might have affected the results. Furthermore, only 27% of the studies manipulated the environmental context as part of the interventions.

**Conclusions:** In this review, only one third of the multidisciplinary intervention studies specifically targeted young adults, while the other studies included a wide age range.

Very few studies were designed to be able to evaluate the outcome as a direct result of the applied intervention or described the specific elements involved in the interventions. This is of vital importance in the design and delivery of effective rehabilitation services and in enabling efficient transdisciplinary communication in this complex field.

**Clinical Rehabilitation Impact:** The ICF framework was found to be useful in this review for the classification of the components and outcomes in intervention studies. This framework may also provide a common language for the

implementation of rehabilitation interventions. However, better description and classification of the processes involved in rehabilitation interventions and their impact on outcomes are still needed in both research and clinical practice.

**Keywords:** Young adults; Participation; Disability; Rehabilitation

## Introduction

Young people with disabilities share the same goals and future expectations as other adolescents and ultimately desire to contribute to society, obtain gainful employment, achieve independence and form meaningful relationships [1, 2]. The term “young adults” is often used to describe the population that is undergoing a transition phase from school to work life and from living as dependents in parental homes to establishing their own homes and families [3]. In industrial countries, this phase starts between the late teens and early twenties; and the Norwegian government has defined young adults as individuals who are between 18 and 26 years of age [4].

Youth with disabilities have to face more complex challenges during this transition phase compared to their able-bodied counterparts when striving to fulfil age-appropriate roles and participate in their communities [5, 6]. Thus, rehabilitation services play an important role in facilitating participation in physical and societal activities by providing sufficient and effective support for this vulnerable group [7]. Rehabilitation interventions are planned and multidisciplinary measures or treatments which are designed to assist the users in improving or maintaining their level of functioning [7, 8]. Multidisciplinary approaches to rehabilitation may be effective in integrating the interrelated medical, functional and environmental elements in a synergistic manner, in order to overcome health-related problems or restrictions [9].

Young adults living with chronic disabilities often need support across their lifespan in order to alleviate their health-related, practical and day-to-day challenges. The support should facilitate a successful and progressive transition into adulthood where autonomous participation in society can be achieved [10]. Nevertheless, our knowledge about effective participation-enhancing rehabilitation strategies for this population is very limited [11]. Furthermore, it is also notable that there was not a lot of focus on participation in rehabilitation interventions [12]. In a systematic review by Rastogi et al., only 3 of the 43 identified interdisciplinary intervention studies on chronic pain in children and adolescents included participation as an outcome measure [13]. Moreover, the diverging definitions of participation also poses a challenge [14] - participation is broadly referred to as “involvement in life situations” [15]; but in practice, the use of the term and its measurement entail the dynamic interactions between individuals and their sociocultural environments. In this sense, the definition of ‘participation’ should not be considered a unidimensional concept.

Given the many aspects of rehabilitation interventions and participation, the International Classification of Functioning, Disability and Health (ICF), which was endorsed by the World Health Organization (WHO) in 2001, is a useful classification system for health and health-related domains [15]. It provides a framework that spans beyond traditional bio-medical concepts [16] and places health-related domains, such as participation, in an environmental context within which disabilities occur. Hence, it provides a platform for clinicians and researchers to classify and articulate complex

interventions and outcomes in rehabilitation [17]. To our knowledge, the ICF framework has never been used in systematic reviews that have aimed to identify the settings, targets and outcomes of interventions across diagnostic entities within disability research.

Existing knowledge may also be limited by the prevailing convention of organizing rehabilitation programs according to specific diagnostic entities. This ‘diagnosis-based’ mode of thinking fails to recognize the fact that a lot of the problems which rehabilitation services aim to address are shared across different conditions and diagnostic entities [18], while the functional and participatory challenges may vary between individuals within a singular diagnostic entity [19]. Hence, a comprehensive approach is needed by taking into consideration the health condition, physical functionality, degree of societal participation and various contextual factors across diagnostic groups in the design and evaluation of rehabilitation interventions. To our knowledge, the extent to which young adult focused research has taken such comprehensive approach in recent years has not been studied.

Furthermore, methodological challenges regarding intervention design and analytical approaches are also pertinent to this field, where interactions between individuals and various components of rehabilitation can often complicate the already complex interventions [7, 20]. Hence, the need for qualitative as well as quantitative studies, or a combination of both, has been recommended for the past several years [21].

In light of the multifactorial nature of rehabilitation, participation and challenges faced by young adults with disabilities, the overall goal of the current review was to identify and critically appraise studies that aimed to improve participation outcome in young adults. Using the ICF framework, we also wanted to evaluate the focus of the interventions and the outcome measurement; and to which extent studies with specific focus on young adults differ from those encompassing a broader age range in terms of settings, types of interventions and outcomes.

## Material and Methods

A systematic literature search was carried out to identify multidisciplinary rehabilitation interventions aiming to promote participation for young adults with chronic disabilities. A librarian was consulted in elaborating a thorough search strategy. Potential articles of interest were identified through a systematic search of the databases OVID MEDLINE, EMBASE, Cumulative Index of Nursing and Allied Health Literature (CINAHL), PsycINFO, Web of Knowledge and Social Sciences Index. In an effort to identify the most recent intervention studies around the time ICF was adopted by WHO (2001), and also due to the broad scope of the review, the search was limited to articles published from January 2000 to September 2013, since the introduction of ICF in 2001 has resulted in a shift of focus from ‘physical impairment’ to ‘participation’ as the goal of interventions in research as well as in clinical practice.

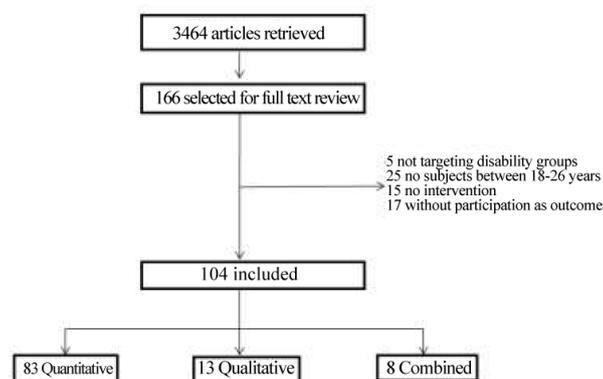
The optional age filter in MEDLINE did not yield any studies with young adults, so the age limits were incorporated into the overall search strategy (see full search strategy in appendix).

## Review Process: Inclusion/Exclusion

**Inclusion criteria were:** full text articles in English; including at least one subject between 18 and 26 years of age with physical or combined physical/cognitive disabilities for at least 2 years; involving inter- or multidisciplinary interventions (defined as interventions involving two or more professionals); and with participation set as a primary or secondary outcome.

Studies with global outcome measures were only included if the results presented matched one or more of the ICF subscales or components of participation. Interventions directed only towards staff, without effect evaluation on patients/clients, and studies targeting only intellectual disabilities were excluded. Intellectual disability is often considered as a separate category of disability and is managed outside the realm of rehabilitation services [22]. Furthermore, a literature review of participation promoting interventions for adults with intellectual disabilities was done by Howarth et al. in 2014 [23], and another one conducted by Adair et al. in 2015 for children with disabilities [24]. Accordingly, intellectual disability was excluded from the current review.

The search resulted in a total of 3464 original publications. All abstracts were screened, and the content was reviewed swiftly for 508 of the articles. 3298 publications were excluded because they were conference abstracts (without full text), without multidisciplinary interventions or did not include persons with chronic disability. Three pairs of reviewers subsequently scrutinized the 166 articles that had met the inclusion criteria (figure 1). In case of uncertainty, all the reviewers would review the articles in question followed by group discussions in order to reach a consensus. Subsequently, a total of 104 publications were included in the final analysis.



**Figure 1:** Selection process.

## Analysis and Statistics

A data extraction sheet was made capturing the design, methodological approach, target group(s), setting(s), intervention and outcome(s) of each study. The methodological approach was categorized into quantitative, qualitative or combined (a combination of both). To describe how the subjects were recruited and data collected chronologically, the studies were categorized into retrospective, cross-sectional or prospective design. Studies that were not prospective or cross-sectional were classified as retrospective, defined as studies that explored the relationship between a situation,

usually in the present, and other factors in the past. In addition, for the prospective studies, the experimental design (controlled, randomized, etc.) was described. Data collection methods of the qualitative studies were described as interviews, focus groups, text analysis and/or observation.

The age range of the subjects was reported for all the studies. When age range was not available from the full-text article, mean age and standard deviation (SD) were reported. For analysis, the studies were categorized as “within target age range” when the mean or median age was between 18 and 26. In two studies, no specific age information was reported (Luecking [25] and Burgstahler [26]). However, the subjects in Luecking’s study were primarily in their last year of public school; hence this study was assigned to the target age group.

The conditions underlying the disabilities were categorized into three major groups: neurological, pain or multiple disabilities. One study (Giesen et al.[27]) dealt with persons with visual impairment; due to the multitude of underlying causes of visual impairment, the study was classified as multiple disabilities. Settings for the interventions were categorized as somatic hospital unit, rehabilitation unit, school/university, work place, home, or other settings. The ICF was used to categorize the content of the rehabilitation interventions, the target of the described interventions, and the participatory outcome. The content of the rehabilitation interventions was linked to the second classification level of ICF. The targets of the interventions were categorized according to the ICF into the domains of body functions, activities (chapters d1, d2, d4 and d5), participation (chapters d3, d6, d7, d8 and d9) and environmental factors. Evaluation of the participatory outcome was grouped into the chapters communication (d350-d3599), domestic life (d6) and relationships (d7). The chapter “major life areas” (d8) was further subdivided into education (d810-d839) and work (d840-839); and “community, social and civic life” into community life (d910), recreation (d920) and other (d930 to d999). Uncertainties encountered during the linking process were resolved through iterative discussions in the working group.

Chi-square statistics were used to test for differences in target groups, settings, interventions and outcomes across age strata. One-way analysis of variance (ANOVA) was applied to detect possible differences in the number of settings, intervention targets and outcomes between different study designs and age strata. The analyses were performed in SPSS v 21.0. A p-value <0.05 was adopted.

## Results

### Design

The majority of the studies had a quantitative design (n=83) and 8 used a combination of quantitative and qualitative methods (table 1). One study, by Kowalske et al. [28], which presented three cases, was difficult to classify; after a detailed review of the article, it was categorized as a qualitative study, resulting in a total of 13 qualitative studies in the current review. Of the 83 quantitative studies, 53 had a prospective design and 13 had a control group, of which 9 were randomized. One of the qualitative and 5 of the combined studies had a prospective design, and 2 combined studies were controlled, of which one was randomized.

### Target groups

Most of the studies covered a broad age range (table 1). In 34 of the studies the mean or median age was between 18 and 26 years, and

these studies will be referred to as young adult focused studies in this review. There was no significant difference in the numbers of qualitative, combined and quantitative studies between the studies with a strong focus on young adults and the ones comprising adults in general ( $X^2=1.40$ ,  $p=0.50$ ).

The diagnostic target groups varied markedly ranging from a selected few conditions such as cerebral palsy or spinal cord injuries to a variety of disabilities (table 1). "Multiple disabilities" was the most chosen group and "painful conditions" was the least chosen in the young adult focused studies ( $X^2=9.70$ ,  $p=0.008$ ).

### Settings

In three of the studies the settings of the intervention were impossible to identify. Rehabilitation unit was the most reported setting (included in 58 studies), followed by home (25 studies), work (19 studies) and school (11 studies). Somatic hospitals and other settings were reported in 10 and 29 of the studies respectively. A total of 39 studies were conducted in multiple settings. Young adult focused studies were conducted in a home setting significantly more often, 38% versus 17% in non-young adult focused studies ( $X^2<5.58$   $p=0.01$ ). Young adult focused studies were also conducted in a rehabilitation unit (38%) less frequently compared to the non-young adult focused group (64%) ( $X^2=6.30$   $p=0.01$ ). No difference was found in the numbers of settings reported between the age groups ( $p=0.92$ ).

### Focus of interventions

In 12 % of the studies, the target of the intervention was hard to assess. In 67% of the studies multiple ICF domains were targeted. Participation was the most common target of the intervention (61% of the studies) followed by activities (46%), body functions (40%) and environmental factors (28%). Significant difference was found in terms of intervention targets between the age groups, with body functions being a more frequent target in the studies among general adults (47% ) compared to 26% in young adults ( $X^2=4.06$   $p=0.04$ ). The studies targeted an average of 1.75 ICF domains with no difference between the two age groups ( $p=0.75$ ).

### Domains of outcome measures

Outcomes that were linked to single ICF chapters were reported in 58% of the studies, and 18% of the studies reported outcomes that were linked to two or more ICF chapters. Work (d840-839) was the most reported outcome (74%), followed by community life (d910) (31%), education (d810-d839) (26%), recreation (d920) (25%), relationship (d7) (21%), home (d6) (14%), other (d930 to d999) (4%) and communication (d350-d3599) (3%). Young adult focused studies involved multiple chapters significantly more often than the non-young adult-focused studies ( $p=0.02$ ). Furthermore, communication, relationship, education, societal life and recreation were outcomes that were evaluated significantly more frequently in the young adult focused studies ( $X^2>4.72$ ,  $p<0.03$ ), whereas work was more frequently evaluated among the non-young adult focused studies ( $X^2=3.96$ ,  $p=0.047$ ).

### Association between interventions and intended outcomes

For subjects with multiple disabilities, participation was more frequently targeted in the intervention compared to those with painful or neurological conditions ( $X^2=10.55$ ,  $p=0.005$ .) The frequencies of

various ICF chapters included as outcome measures did not differ significantly across pain, neurological and/or multiple disability ( $X^2<2.21$ ,  $p>0.14$ ).

### Evaluating the "effect" of multidisciplinary interventions

In 61 (73%) of the quantitative studies, participation was measured both before and after the interventions allowing the changes in participation to be evaluated. Only 9 of these studies had a randomized design where actual changes could be interpreted as attributable to the interventions of which only 2 targeted young adults (Salazar [29] and Cox [30], table 1. Salazar assessed the return to work rate after a rehabilitation program compared to a limited home-based program for active-duty military personnel with moderate to severe Traumatic Brain Injury (TBI). No statistically significant difference was found in the "return to employment and fitness for duty" rate between the intervention group ( $n=67$ ) and the control group ( $n=53$ ). Cox evaluated the effects of virtual driving simulation on driving performance and behaviour among male subjects who had sustained traumatic brain injury in military service. Statistically significant improvement in driving performance was found in the intervention group compared to the control group which received "residential rehabilitation". Vanderploeg [31] included persons with TBI above 17 years and compared cognitive versus functional oriented rehabilitation. Interestingly, improved return to work was achieved in younger adults in the cognitive compared to the functional oriented intervention group. Kemp et al. [32] evaluated perceived social participation after exercise in spinal cord injured subjects, but although the study was randomized, the participatory outcome was only evaluated in the intervention group. The other randomized studies focused on patients with pain or work disability, generally with positive effects of multidisciplinary interventions regarding return to work. No subgroup analyses of young subjects were conducted.

For the qualitative studies, 6 of them focused directly on the intervention. Draaistra et al. [33] focused on the perception of goal setting in persons with spinal cord injury (SCI). Participants from four age strata were included (one of them was between 16-25). Interviews and text analysis were used. No direct outcome was evaluated, but the focus was on the processes of and implications on nursing practice in rehabilitation. Taylor et al. [34] conducted document analysis and semi-structured interviews regarding the success of a rehabilitation program targeting employment and social participation for young subjects with disabilities (18-25 years of age). Todis et al. [35] identified 'experienced challenges', coping strategies and other factors influential to post-secondary education outcomes in subjects with TBI between 17 and 23 years of age. The liaison between disability services and support agencies, in addition to participants' attitudes, were highlighted as determining factors for success. Hutchinson et al. [36] explored the essential elements conducive to the successful return to work for two adolescents (18 years old) in a work placement program through interviews and participant observation. Social support, linkage between interests and career-related goals, self-efficacy, goal-setting and actualization were found to contribute to success in the workplace. Kowalske et al. [28] used three case studies, one of which involved a young adult, to illustrate the factors associated with vocational success. The authors underscored the importance of developing specialized treatments that are focused on environmental factors and not only based on individual attributes. Glavare 2012 [37] also focused on the intervention and applied a grounded theory to evaluate the pathway of returning to work through interviews and text analysis. They concluded that professional, individualized support and

user involvement in the rehabilitation process were important factors in promoting successful return to work.

Five of the eight combined studies placed the focus of the qualitative component directly on the applied intervention. Balcazar et al. [38] studied a mentoring program for individuals with violently acquired SCI through interviews and by qualitatively examining the relationships between the mentors, hospital staff and the mentees. The way the program had affected the degree of community reintegration of the mentees was evaluated. Harr et al. [39] presented a single case study using interviews and text analysis to examine the effect of performing household tasks, which was the rehabilitation intervention. Autonomy, self-determination and degree of participation at home and in the community of a youth with Spina Bifida were evaluated. Kelly [40] carried out a prospective, controlled study and included interviews and text analysis to investigate how peer support in the rehabilitation intervention impacted the development of community competence of individuals with violently acquired spinal cord injury. The effect was evaluated by comparing individuals with and without peer support regarding their knowledge and use of community resources. Peer role models were deemed to be facilitative in connecting the injured individuals to each other and improving access to the community supports necessary for successful post-injury adjustment. Balcazar, Harr and Kelly all focused on young adults.

The other combined studies included broader age ranges. Block et al. [41] combined a prospective, controlled, non-randomized study with interviews and text analysis to compare changes in participants' self-efficacy, ability to set/achieve goals, and perceived independent-living status in an empowerment program. The changes in self-efficacy

were significantly greater in the intervention group. Progress towards goal attainment was assessed qualitatively and the participants in the program reported increased independence, community access and participation. Van Beurden et al. [42] evaluated a new return-to-work program for workers who were on sick leave due to musculoskeletal disorders. The study was randomized with an intervention group and a "treatment-as-usual" group, followed up by interviews and focus group discussions. The focus of the study was to describe the implementation of the new program as well as the experience of the stakeholders and participants. The effect on the level of return to work was not evaluated.

The last three combined studies did not focus on the applied interventions. McLean et al. [43] carried out a prospective controlled study and interviews to study the barriers that preclude patients with mild-to-moderate physical disability from returning to work, without relating the study directly to the rehabilitation intervention. Glassel et al. [44] explored the experiences of individuals in vocational rehabilitation through focus group discussions and subsequent text analysis without relating the experiences to the intervention or evaluating the effect of the intervention. Young et al. [45] conducted qualitative interviews and subsequently quantified the results in order to test the effectiveness, acceptability and utility of an alternative intervention evaluation approach which took into consideration cognitive and behavioural factors that could influence return-to-work outcomes.

In terms of study design, all qualitative studies except one had a retrospective design.

Author	Title	Target group	Age (years)	Design
Quantitative				
Ahlgren	Work resumption or not after rehabilitation? A descriptive study from six social insurance offices	Multiple disabilities	16-64	Retrospective
Balcazar	Strengths and challenges of intervention research in vocational rehabilitation: an illustration of agency-university collaboration	Multiple disabilities	15-47	Randomized
Beach	Predicting employment outcomes of consumers of state-operated comprehensive rehabilitation centers	Multiple disabilities	Mean 23, SD 7*	Retrospective
Bedell	Social participation of children and youth with acquired brain injuries discharged from inpatient rehabilitation: a follow-up study	Neuro	3-21	Retrospective
Bjomson	Relationship of therapy to postsecondary education and employment in young adults with physical disabilities	Neuro	19-23*	Retrospective
Boosman	Evaluation of change in fatigue, self-efficacy and health-related quality of life, after a group educational intervention programme for persons with neuromuscular diseases or multiple sclerosis: a pilot study	Neuro	Mean 49, SD 13	Prospective
Brewer	Evaluation of a Multi-site Transition to Adulthood Program for Youth with Disabilities	Multiple disabilities	15-21*	Retrospective
Buchner	Age as a predicting factor in the therapy outcome of multidisciplinary treatment of patients with chronic low back pain--a prospective longitudinal clinical study in 405 patients	Pain	18-65	Prospective
Buchner	The influence of the grade of chronicity on the outcome of multidisciplinary therapy for chronic low back pain	Pain	18-65	Prospective
Buffart	Promoting physical activity in an adolescent and a young adult with physical disabilities	Neuro	17-23*	Prospective

Burgstahler [26]	A collaborative model to promote career success for students with disabilities	Multiple disabilities	Not stated	Prospective
Chan	Predicting employment outcomes of rehabilitation clients with orthopedic disabilities: A CHAID analysis	Multiple disabilities	Mean 41, SD 11	Retrospective
Chan	A cross-sectional study of the demographic, cultural, clinical and rehabilitation associated variables predicting return to employment after disability onset in an Asian society	Multiple disabilities	≥15	Retrospective
Cox [30]	Driving rehabilitation for military personnel recovering from traumatic brain injury using virtual reality driving simulation: a feasibility study	Neuro	23-31*	Randomized
De Blecourt	Preliminary evaluation of a multidisciplinary pain management program for children and adolescents with chronic musculoskeletal pain	Pain	8-21	Propsective
De Jong	Reduction of pain-related fear and increased function and participation in work-related upper extremity pain (WRUEP): effects of exposure in vivo	Pain	21-53	Randomized
de Kloet	Gaming supports youth with acquired brain injury? A pilot study	Neuro	8-30*	Prospective
De Kort	The Come Back Programme: a rehabilitation programme for patients with brain injury with psychosocial problems despite previous rehabilitation	Neuro	17-39*	Retrospective
Donnelly	Client-centred assessment and the identification of meaningful treatment goals for individuals with a spinal cord injury	Neuro	17-83	Retrospective
Dutta	Vocational rehabilitation services and employment outcomes for people with disabilities: a United States study	Multiple disabilities	Mean 38, SD 14	Retrospective
Elfving	What factors predict full or partial return to work among sickness absentees with spinal pain participating in rehabilitation?	Pain	22-63	Prospective
Endermann	A time-limited residential unit for young adults with epilepsy and mild cognitive impairment: results of a prospective pre-post-study	Multiple disabilities	17-36	Prospective
Evans	An evaluation of the "Youth en Route" program	Multiple disabilities	16-29*	Prospective
Faleafa	Community rehabilitation outcomes across cultures following traumatic brain injury	TBI	18-65	Retrospective
Flannery	Improving employment outcomes of individuals with disabilities through short-term postsecondary training	Multiple disabilities	26-35	Retrospective
Fleming	Participation in leisure activities during brain injury rehabilitation	TBI, Neuro	18-65	Retrospective
Foy	Increase in functional abilities following a residential educational and neurorehabilitation programme in young adults with acquired brain injury	TBI	16-36*	Retrospective
Gamble	Supported employment: disparities in vocational rehabilitation outcomes, expenditures and service time for persons with traumatic brain injury	TBI	16-71	Retrospective
Garcia-Iriarte	Analysis of case managers' support of youth with disabilities transitioning from school to work	Multiple disabilities	16-21*	Retrospective
Gauntlett-Gilbert	Acceptance and values-based treatment of adolescents with chronic pain: outcomes and their relationship to acceptance	Pain	11-19	Prospective
Georgievski	Rehabilitation in the community	Multiple disabilities	8-76	Retrospective
Giesen [27]	Transition-Age Youths with Visual Impairments in Vocational Rehabilitation: A New Look at Competitive Outcomes and Services	Multiple disabilities	<22	Retrospective
Hampel	Effects of gender and cognitive-behavioral management of depressive symptoms on rehabilitation outcome among inpatient orthopedic patients with chronic low back pain: a 1 year longitudinal study	Pain	24-62	Controlled
Heinemann	Relationship of psychology inpatient rehabilitation services and patient characteristics to outcomes following spinal cord injury: the SCIRehab project	Neuro	≥12	Prospective
Hultberg	Effects of co-financed interdisciplinary teamwork on sick leave for people with musculoskeletal disorders	Pain	16-64	Prospective

Hutzler	Psychosocial effects of reverse-integrated basketball activity compared to separate and no physical activity in young people with physical disability	Multiple disabilities	12-25*	Prospective
Iakova	Self perceptions as predictors for return to work 2 years after rehabilitation in orthopedic trauma inpatients	Multiple disabilities	<60	Prospective
Inge	Vocational outcomes for persons with severe physical disabilities: design and implementation of workplace supports	Multiple disabilities	17-35	Retrospective
Janssen	Structured game-related group therapy for an adolescent with Acquired Brain Injury: A case report	Neuro	18*	Prospective
Johnstone	The impact of concomitant disabilities on employment outcomes for state vocational rehabilitation clients with traumatic brain injury	TBI	17-56	Prospective
Kemp [32]	Effects of reduction in shoulder pain on quality of life and community activities among people living long-term with SCI paraplegia: a randomized control trial	Neuro	22-72	Randomized
Kennedy	Self-regulated learning in a dynamic coaching model for supporting college students with traumatic brain injury: two case reports	TBI	20*	Propective
Kim	Community integration outcomes after traumatic brain injury due to physical assault	TBI	16-64	Retrospective
Klonoff	Milieu-based neurorehabilitation in patients with traumatic brain injury: outcome at up to 11 years postdischarge	TBI	14-62	Prospective
Klonoff	Psychosocial outcomes 1-7 years after comprehensive milieu-oriented neurorehabilitation: The role of pre-injury status	Neuro	Mean 36, SD 12	Controlled
Kolakowsky-Hayner	An effective community-based mentoring program for return to work and school after brain and spinal cord injury	Neuro	16-26*	Prospective
Kosciulek	A test of the theory of informed consumer choice in vocational rehabilitation	Multiple disabilities	15-59	Prospective
Lambeek	Randomised controlled trial of integrated care to reduce disability from chronic low back pain in working and private life	Pain	18-65	Randomized
Lancioni	Enabling a young man with minimal motor behavior to manage independent his leisure television engagement	Tetraparesis	18*	Prospective
Lancioni	Technology-aided leisure and communication opportunities for two post-coma persons emerged from a minimally conscious state and affected by multiple disabilities	Multiple disabilities	24 – 44*	Prospective
Larsson, 2000, Sweden	Rehabilitation of long-term sick-listed patients in Sweden through techniques of sports medicine	Pain	18-65	Retrospective
Leung	Prediction of vocational outcome of people with brain injury after rehabilitation: a discriminant analysis	Neuro (TBI)	18-65	Retrospective
Lim	Chronic fatigue syndrome: successful outcome of an intensive inpatient programme	Neuro	10-19	Prospective
Lofvanler	"Unable and useless" or "able and useful"? A before and after study in the primary care of self-rated inability to work in young immigrants having long-standing pain	Pain	20-45	Prospective
Luecking [25]	Integrating service systems at the point of transition for youth with significant support needs: a model that works	Multiple disabilities	Unstated age *	Retrospective
Lund	Long-term outcomes for individuals who use augmentative and alternative communication: part I--what is a "good" outcome?	Neuro	19-23*	Prospective
Malec	A medical/vocational case coordination system for persons with brain injury: an evaluation of employment outcomes	TBI	Mean 37, SD 12	Prospective
Malec	Replicated positive results for the VCC model of vocational intervention after ABI within the social model of disability	Neuro	Mean 34.2, SD 14	Prospective
Marnetoft	Factors associated with successful vocational rehabilitation in a Swedish rural area	Multiple disabilities	Mean 43, SD unknown	Retrospective

Mayor	Effect of age on outcomes of tertiary rehabilitation for chronic disabling spinal disorders	Pain	Mean 39, SD 3	Prospective
Mohanty	Home based neuropsychological rehabilitation in severe traumatic brain injury: A case report	Neuro	24*	Prospective
Murad	Occupational competence and its relationship to emotional health in injured workers in return to work programs: A Malaysian study	Pain	18-35	Controlled
Ni	Transition success: what factors relate to VR acceptance and employment outcomes?	Multiple disabilities	18-25*	Retrospective
O'Mahar	A camp-based intervention targeting independence among individuals with spina bifida	Neuro	7-27	Propsective
Oyeflaten	Multiple transitions in sick leave, disability benefits, and return to work. - A 4-year follow-up of patients participating in a work-related rehabilitation program	Multiple disabilities	22-66	Prospective
Puumalainen	Participation in community and political life of persons with severe disabilities	Multiple disabilities	20-64	Retrospective
Roche-Leboucher	Multidisciplinary intensive functional restoration versus outpatient active physiotherapy in chronic low back pain: a randomized controlled trial	Pain	24-50	Randomized
Salazar [29]	Cognitive rehabilitation for traumatic brain injury: A randomized trial. Defense and Veterans Head Injury Program (DVHIP) Study Group	TBI	25, SD 6*	Radomized
Saltapidas	The influence of cultural background on motivation for and participation in rehabilitation and outcome following traumatic brain injury	Neuro	17-72	Prospective
Sander	Relationship of caregiver and family functioning to participation outcomes after postacute rehabilitation for traumatic brain injury: a multicenter investigation	Neuro	Mean 32, SD 14	Prospective
Shem	Return to work and school: a model mentoring program for youth and young adults with spinal cord injury	Neuro	16-26*	Prospective
Sherer	Therapeutic alliance in post-acute brain injury rehabilitation: Predictors of strength of alliance and impact of alliance on outcome	Neuro	Mean 29, SD 13	Prospective
Spooren	Evaluation of a task-oriented client-centered upper extremity skilled performance training module in persons with tetraplegia	Neuro	18-70	Prospective Controlled
Tokcan	Item-specific functional recovery in children and youth with acquired brain injury	Neuro	1-19	Prospective
van Velzen	Return to work after spinal cord injury: is it related to wheelchair capacity at discharge from clinical rehabilitation?	Neuro	18-65	Prospective
Vanderploeg	Rehabilitation of traumatic brain injury in active duty military personnel and veterans: Defense and Veterans Brain Injury Center randomized controlled trial of two rehabilitation approaches	Neuro	≥18	Randomized
Verhoef	Sex education, relationships, and sexuality in young adults with spina bifida	Neuro	16-25*	Retrospective
Verhoef	A new intervention to improve work participation of young adults with physical disabilities: a feasibility study	Multiple disabilities	16-25*	Prospective
Wallstedt-Paulsson	Outcome of work rehabilitation for people with various disabilities and stability at a one-year follow-up	Multiple disabilities	Mean 42, SD unstated	Retrospective
Watson	Influence of benefit type on presenting characteristics and outcome from an occupationally orientated rehabilitation programme for unemployed people with chronic low back pain	Pain	Mean 42, SD 8	Prospective
Wicksell	Exposure and acceptance in the rehabilitation of adolescents with idiopathic chronic pain - a pilot study	Pain	13-20*	Prospective
Qualitative				
Draaistra [33]	Patients' perceptions of their roles in goal setting in a spinal cord injury regional rehabilitation program	Neuro	16-55	Retrospective

Glavare [37]	Between unemployment and employment: experience of unemployed long-term pain sufferers	Pain	22-58	Retrospective
Hooson	Patients' experience of return to work rehabilitation following traumatic brain injury: a phenomenological study	Neuro	23-62	Retrospective
Hutchinson [36]	Negotiating accommodations so that work-based education facilitates career development for youth with disabilities	Multiple disabilities	18*	Retrospective
Ishida	Needs assessment for income generation training of youths in leprosy families of a leprosy village in Myanmar	Neuro	14-70	Retrospective
Kowalske [28]	Vocational reentry following TBI: an enablement mode	TBI	16-54	Retrospective
Lindsay	Skill development in an employment-training program for adolescents with disabilities	Multiple disabilities	15-21*	Retrospective
Rehm	Parent and youth priorities during the transition to adulthood for youth with special health care needs and developmental disability	Multiple disabilities	14-26*	Retrospective
Ripat	The role of assistive technology in self-perceived participation	Neuro	≥20*	Retrospective
Self	Physical activity experiences of individuals living with a traumatic brain injury: a qualitative research exploration	Neuro	18-61	Retrospective
Sharp	Fitting back in: Adolescents returning to school after severe acquired brain injury	Neuro	14-19	Retrospective
Taylor [34]	Preparing young adults with disability for employment	Multiple disabilities	18-25*	Retrospective
Todis [35]	Redefining success: results of a qualitative study of postsecondary transition outcomes for youth with traumatic brain injury	TBI	17-23*	Prospective
Combined				
Balcazar [38]	Using peer mentoring to support the rehabilitation of individuals with violently acquired spinal cord injuries	Neuro	18-38*	Propective
Block [41]	Project Shake-It-Up: using health promotion, capacity building and a disability studies framework to increase self efficacy	Neuro	20-73	Prospective
Glässel [44]	Vocational rehabilitation from the client's perspective using the International Classification of Functioning, Disability and Health (ICF) as a reference	Multiple disabilities	21-58	Retrospective
Harr [39]	Case study on effect of household task participation on home, community, and work opportunities for a youth with multiple disabilities	Multiple disabilities	20*	Prospective
Kelly [40]	Community competence and violently acquired spinal cord injury: Employment as a peer role model	Neuro	22-30*	Prospective Controlled
McLean [43]	Employment status six months after discharge from inpatient rehabilitation for a mild-to-moderate physical disability	Multiple disabilities	21-65	Prospective
Van Beurden [42]	A participatory return-to-work program for temporary agency workers and unemployed workers sick-listed due to musculoskeletal disorders: a process evaluation alongside a randomized controlled trial	Pain	18-64	Randomized
Young [45]	A social psychology approach to measuring vocational rehabilitation intervention effectiveness	Neuro	18-63	Retrospective

**Table 1:** Reviewed Articles. Neuro: Neurological disorder; Rehab: Rehabilitation unit. \*Studies with mean or median age between 18 and 26 years.

## Discussion

The present review identified over 100 multidisciplinary intervention studies on subjects with chronic disabilities with the aim of improving their participation in various life domains. A 'quantitative' approach was the predominant study design. One third of the studies specifically targeted young adults - these studies more often included subjects with multiple disabilities, included less often the ICF category "body functions" and evaluated a broader spectrum of

participatory outcomes. Very few studies had designs and approaches that could evaluate the effect on participation as a result of the applied interventions. Only one randomized controlled trial, which tested the effectiveness of virtual reality simulation training on driving performance after TBI, demonstrated positive effects that were directly attributable to the intervention.

Disability can stem from a multitude of causes, and the consequences can influence the physical, cognitive and mental aspects

of daily functioning [46], which may in turn restrict participation in various life situations. Hence, the world report on disability focuses on the life situations of people with disabilities and summarizes evidences of the need for rehabilitation to promote participation [11]. The challenge for rehabilitation research is to identify effective interventions and their components in order to optimize an individual's ability to participate in various aspects of life, such as education, work, community activities and personal relationships. Despite this, only 9 randomized trials were identified. Several studies demonstrated positive effects of multidisciplinary rehabilitation on return to work. Effects of multidisciplinary interventions were also documented in previous reviews for painful conditions [47]. The subgroup analysis conducted by Vanderploeg et al [31], indicates that different strategies may be effective in young adults.

For young persons with disabilities, the transition period between adolescence and adulthood is particularly challenging. These individuals face significant obstacles when trying to attain a normative level of participation due to the challenges imposed by their impairments [48]. If rehabilitation fails to address these important participation-related issues, developmental progress will be impeded, resulting in a lack of perceived self-control, self-efficacy and, subsequently, a negative outlook for the future in these young individuals [49]. The challenges during this transitional phase are usually related to settlement, work career, relationship and community integration [50], and the age range during which these challenges occur varies according to individual and sociocultural norms. In the current review, youth is defined as a person between 18-26 years of age. According to the United Nations Human Rights Convention, a child is defined as a person under the age of 18 [51]. This is also the age cut-off to differentiate access to child health services vs. adult health services in the majority of European countries [52]. The fact that most interventions were not directed specifically at young adults indicates that the particular challenges faced by youth with disabilities in their transition into independent and meaningful adult lives are not sufficiently recognized in disability research. However, when the studies were restricted to young adults, subjects with a larger variety of disabilities were included, suggesting a less specific diagnostic focus. In addition, the interventions took place more often at school and at home, and less frequently in rehabilitation units. Participation was targeted in the interventions to a larger extent, and multiple outcome domains evaluated, indicating search for documentation for effective rehabilitation over a wide range of life areas [3].

With the ICF [15] adopted by the World Health Assembly (WHA) in 2001, a common framework for describing the relationship between to health conditions, physical function and structure, activities, and contextual factors was established. However, it is often challenging to evaluate participation as an intervention outcome, and there is no consensus on a standard criterion for defining and measuring participation [14]. In the present review, we applied the ICF framework and classified the outcomes of the studies according to the chapters within the domain of "Activities and Participation". The advantage of this approach was that the targets of the interventions could be classified within the same framework, allowing comparison between researchers and clinical interventions. However, the ICF framework does not have the capacity to classify important processes and effective elements of the intervention [18], which would have been needed to move this review from a descriptive overview to a comprehensive extraction of effective rehabilitation actions across various study designs.

It is also noteworthy that relatively few studies (27%) attempted to manipulate the "environment" as a means of intervention [53]. This is particularly important because physical and social barriers can exacerbate disability; whereas a facilitative environment can have a significant influence on whether a disabled person can actively participate in different life situations [54]. Environmental support is also identified as one of the key factors for a successful transition into adulthood for youth with disabilities [55]. Some suggest that a reduction of activity limitations and modification of the environment (e.g. accessible spaces, attitudes about disability, availability of information regarding resources) are important mediating factors in the acquisition of adult social roles and participation [56,57]. Therefore we would argue that future interventions should incorporate environmental supports in their design in order to facilitate participation of young adults with disabilities in their communities [58].

Moreover, the general experimental designs of intervention studies should be improved to better evaluate complex rehabilitation programs. Through the current review, we found that nearly 40% of the studies that included participation as a major outcome did not target participation in the intervention; even fewer studies evaluated the changes in the degree of participation as a result of the applied interventions. In order to document the effects and effectiveness of a particular intervention, a closer link between the focus of the intervention and the intended outcomes must be established. This can be achieved by using well developed intervention classification schemes in the design and reporting of randomized controlled trials (RCTs). RCTs are deemed to represent the gold standard for quantitative effect studies [59]. This is because controlled, randomized experimental designs are necessary to control for both known and unknown confounding variables, such that outcomes can be more confidently attributed to the structured intervention [60]. Furthermore, rehabilitation interventions are oftentimes complex and multidimensional and their effects may be influenced by individual processes and interactions between different elements of the interventions [61]. Thus, the development of well designed, common classification schemes that can document the multitude of interacting factors and underlying mechanisms of rehabilitation interventions is necessary. This will serve to better communication and advance knowledge in the rehabilitation field for both research purposes and clinical applications [62,63].

Lastly, our review demonstrated that there were relatively few qualitative studies in the examined literature and even fewer qualitative studies with a prospective design. Qualitative approaches, with focus on individuals' experience in different arenas may serve to illuminate the intricate interplay between disabled youth and the barriers they face in their everyday life [64]. They can also provide useful information regarding active components of rehabilitation, the processes involved and important contextual factors [65]. Furthermore, beyond retrospective reporting, it is important to examine the subjective experiences of the users during the course of the rehabilitation. This will help to minimize recall bias, which can diminish the fidelity of research data.

## Limitation

Since participation entails a wide range of activities and intricate concepts, it might be possible that our search strategy, albeit comprehensive, might not have exhausted all the possible search terms present in the literature. Some relevant articles might have been

omitted as a result. The search strategy was set up to identify studies with interventions, which may be one of the reasons why the literature included in the current review was dominated by quantitative studies.

## Conclusion

Although the literature has an abundance of studies aiming to address the complex problems associated with young adults with disabilities, very few well-designed studies have specifically evaluated the effects of the interventions on participation. Only a paucity of the studies combined qualitative and quantitative approaches to examine the effective components of the interventions. In addition, this review indicates that ICF provides a useful platform for mapping intervention targets, settings and outcomes, but the development of appropriate classification schemes to describe and specify the processes involved in rehabilitation is still needed. Future interventions should also target mediating environmental factors that have considerable impact on participation and functional outcomes.

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## Declaration of interest

The authors report no conflicts of interest.

## Appendix: Search Strategy

### Database: PsycINFO <1806 to July Week 2 2013>

#### Search Strategy:

1. disabilities/ (11849)
2. (disabilit\$ or disabled).tw. (91212)
3. handicap\$.tw. (21032)
4. (physical\$ adj3 impair\$).tw. (2061)
5. (impaired adj (person\$ or patient\$)).tw. (1283)
6. (limb adj (deformit\$ or deformat\$ or defect\$)).tw. (25)
7. (amputee\$ or amputation\$).tw. (1427)
8. musculoskeletal disorders/ (1819)
9. exp neuromuscular disorders/ (10695)
10. muscle disease\$.tw. (125)
11. musculoskeletal.tw. (3224)
12. musculo skeletal.tw. (86)
13. achondroplasia.tw. (36)
14. osteogenesis imperfecta.tw. (27)
15. marfan\$.tw. (54)
16. spina bifida\$.tw. (812)
17. (muscular adj (dystroph\$ or atroph\$)).tw. (1297)
18. Muscular Atrophy/ (375)
19. (myopathy or myopathies).tw. (824)
20. (myositi\$ or polymyositi\$).tw. (212)
21. exp Dystonia/ (5854)
22. dystonia.tw. (2421)
23. back pain\$.tw. (3673)
24. neck pain\$.tw. (630)
25. shoulder pain\$.tw. (271)
26. back pain/ (2628)
27. fibromyalgia.tw. (2102)
28. osteoarthr\$.tw. (1097)
29. (arthritis or arthritides).tw. (3794)
30. polyarthriti\$.tw. (51)
31. inflammatory joint disease\$.tw. (8)
32. (rheumatic disease\$ or rheumatism).tw. (467)
33. bechterew\$.tw. (31)
34. spondyl\$.tw. (213)
35. dysmeli\$.tw. (3)
36. Myasthenia Gravis/ (479)
37. myasthenia.tw. (681)
38. exp Paralysis/ (5815)
39. parapleg\$.tw. (893)
40. hemipleg\$.tw. (1844)
41. tetrapleg\$.tw. (230)
42. cerebellar ataxia\$.tw. (680)
43. Cerebral Palsy/ (3251)
44. (cerebral adj2 palsy).tw. (4807)
45. traumatic brain injur\$.tw. (9455)
46. spinal cord injur\$.tw. (3549)
47. ehlers danlos.tw. (36)
48. dyskinesias/ or exp chorea/ (2415)
49. (huntington\$ or chorea).tw. (3860)
50. exp Hydrocephalus/ (705)
51. hydrocephalus.tw. (1320)
52. exp Epilepsy/ (18048)
53. (seizure\$ or epilep\$).tw. (36498)
54. exp Neuromuscular Diseases/ (0)
55. guillain barre\$.tw. (477)
56. polyneuropath\$.tw. (856)
57. neuropath\$.tw. (15198)
58. exp Multiple Sclerosis/ (7249)
59. multiple sclerosis.tw. (9047)
60. or/1-59 (207820)
61. (young\$ or youth\$ or juvenile\$ or teenager\$ or adolescen\$ or emerging adulthood).tw. (360615)
62. young child\$.tw. (27815)(youth\$ or juvenile\$ or teenager\$ or adolescen\$ or emerging adulthood).tw. (225243)
63. 62 not 63 (25626)
64. 61 not 64 (334989)
65. 60 and 65 (19709)
66. interdisciplinary treatment approach/ (5790)
67. (multidisciplinary or (multi adj disciplinary) or multiprofessional or (multi adj professional)).tw. (13601)
69. (interdisciplinary or (inter adj disciplinary) or interprofessional or (inter adj professional)).tw. (16527)
71. cross disciplinary.tw. (1065)
72. rehabilitation/ (13392)
73. exp vocational rehabilitation/ (5766)
74. psychosocial rehabilitation/ (3304)

75. rehabilit\$.tw. (42700)  
76. goal setting.tw. (4100)  
77. goal attainment.tw. (1591)  
78. goals/ (9108)  
79. goal setting/ (1931)  
80. or/67-78 (92038)  
81. exp participation/ (11952)  
82. education/ or high school education/ or higher education/ (33161)  
83. (education\$ or school or schools).tw. (503856)  
84. (work or job\$ or employment or career\$).tw. (410310)  
85. (vocation\$ or occupation or occupations).tw. (47454)  
86. exp occupations/ (7234)  
87. human activities/ or social participation/ or automobile driving/ or travel/ (1653)  
88. (sport\$ or athletic\$).tw. (23380)  
89. (social adj3 (activit\$ or participat\$)).tw. (11308)  
90. ((social or community) adj life).tw. (5396)  
91. socialization/ (8419)  
92. independent living.tw. (2005)  
93. independent living programs/ (355)  
94. self care skills/ (3186)  
95. (cultural adj3 (activit\$ or participat\$)).tw. (1411)  
96. (home adj3 activit\$).tw. (1312)  
97. leisure time/ or hobbies/ or holidays/ or recreation/ (8130)  
98. leisure activit\$.tw. (2608)  
99. recreation\$.tw. (9139)  
100. or/80-98 (890020)  
101. 66 and 79 and 99 (925)  
102. limit 100 to (english language and yr="2000 -Current") (483)  
103. limit 101 to "0110 peer-reviewed journal" (269)  
104. limit 102 to "reviews (best balance of sensitivity and specificity)" (61)  
105. 102 not 103 (208)

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