SCIRE
SPINAL CORD INJURY RESEARCH EVIDENCE
Professional

Self-Management Following Spinal Cord Injury

SEB Ryan
B Mortenson
A McIntyre
P Cao
L Cameron
R Teasell

Our Partners:

Ryan SEB, Mortenson B, McIntyre A, Cao P, Cameron L, Teasell R (2025). *Self-Management Following Spinal Cord Injury*. In Eng JJ, Teasell RW, Miller WC, Wolfe DL, Townson AF, Hsieh JTC, Connolly SJ, Noonan VK, Loh E, Sproule S, McIntyre A, Querée M (Eds). Spinal Cord Injury Research Evidence. https://scireproject.com/evidence/self-management/

Key Points

Mobile self-management phone applications may decrease UTI incidence. Further research is required.

There is moderate evidence that peer mentoring decreases the incidence of hospital readmission.

Home-based exercise or mindfulness programs may improve pain following SCI. More research is required.

There is moderate evidence that sexual education improves sexual satisfaction following SCI.

Wheelchair skills programs may improve wheelchair skills, further research is required.

Oral hygiene training may improve gingival health, further research is required.

There is minimal evidence regarding the efficacy of nutritional programs on body composition.

There is conflicting evidence regarding the efficacy of cognitive behavioral therapy at improving pain.

There is conflicting evidence regarding the efficacy of education programs at preventing UTI.

There is moderate evidence that virtual counselling does not decrease the incidence of secondary complications.

Pressure ulcer management and education programs do not decrease pressure ulcer incidence or severity.

Cognitive behavioral based programs do not improve symptoms of anxiety or depression long-term following SCI.

Table of Contents

1 Executive Summary

Self-management describes a person's ability to monitor their chronic conditions and maintain their own physical, emotional, and mental condition. (Barlow et al. 2002). Our review identified five investigated self management topics among people with spinal cord injury, including mental health, secondary health complications, pain, sexual function, and miscellaneous management. Intervention strategies included, individual, group, and peer mentoring interventions offered in person or remotely, synchronously, or asynchronously. There is moderate evidence that mobile applications, peer mentorship programs, home-based exercise programs and sexual health, oral health and wheelchair education programs can improve outcomes for persons with SCI. There is mixed evidence on the utility of home counselling and psychotherapy programs, nutritional programs, pressure ulcer or urinary tract infection (UTI) education programs decrease adverse outcomes in persons with SCI. Most interventions are lacking sufficient evidence to draw conclusions, and further research should be conducted on mindfulness, peer mentorship and smartphone application interventions.

2 Introduction

The onset of a spinal cord injury (SCI) is a life-altering event and often leads to a wide range of chronic health conditions, such as sensory and motor impairment, impaired bowel and bladder function, pressure ulcers, spasticity, neuropathic and/or musculoskeletal pain, and depression (McIntyre et al. 2020). Research has shown that despite the considerable increase in life expectancy among individuals with SCI in recent decades, secondary health conditions stemming from SCI continue to hinder the functional independence and social participation of those living with SCI throughout their life span (Gassaway et al. 2019; Wilde et al. 2016). Physical access and transportation barriers often prevent visits to treatment centers increasing the necessity for virtual care options and self management. (Yuen et al. 2010; Soopramanien et al. 2020) Self-management (SM) interventions have potential to mitigate the long-lasting impact of SCI and its related health conditions on patients' quality of life.

The term SM was first used in the literature by Creer and colleagues (1976) in their work on the rehabilitation of children with asthma. It highlighted the important role of patients as active participants in the treatment of their own conditions. Currently, there are several widely accepted definitions of SM, with some focusing on the individual components of SM (e.g., Clark et al. 1991) and others focusing on the group intervention elements (e.g., Alderson et al. 1999). The US Institute of Medicine refers to SM as: "the tasks that individuals must undertake to live with one or more chronic conditions." According to this definition, SM tasks encompass the management of medical, emotional, and social role aspects of the patients' health conditions. Furthermore, as suggested by Nakagawa-Kogan et al. (1988), SM involves the utilization of biological, psychological, as well as social intervention strategies. To better encapsulate functional, long-term benefits to management strategies, we employ Barlow and colleagues' definition of SM (Barlow et al. 2002):

> [An] individual's ability to manage the symptoms, treatment, physical, and psychosocial consequences, and lifestyle changes inherent in living with a chronic condition. Efficacious SM encompasses the ability to monitor one's condition and to affect the cognitive, behavioural and emotional consequences necessary to maintain satisfactory quality of life." (p. 178)

Studies were screened for interventions designed to teach long-term management skills, with constructive outcomes, and outcome measures that were assessed pursuant to long-term follow up periods to better assess adherence to self-management habits. Non-constructive outcome measures assessing knowledge, self-efficacy, and goal setting were removed.

2.1 Mental Health Management

Depressive mood represents a normal deviation in affect to sadness, while depression or a depressive disorder is a deviation that begins to impact daily function. (Elliot and Frank 1996) Prevalence of depression in people following SCI is estimated to be much higher than a healthy population, with one meta-analysis of studies on depression following SCI estimating the prevalence to be approximately 22.2% (Williams and Murray 2015). A meta-analysis of studies on anxiety following SCI found similar results, with an estimated 13% of people having a co-occurring anxiety disorder and 27% experiencing symptoms of anxiety (Le and Dorstyn 2016). Cognitive behavioral therapy (CBT) can be used to treat both depressive and anxiety disorders. It represents a family of treatments where the practitioner addresses the relationship between dissonant cognition, emotions, and behaviours. (Hofmann et al. 2010). While CBT has been successfully administered over virtual platforms, it has been unsuccessful at addressing long-term self-management behavioural modifications in diabetes mellitus. (Sztein et al. 2018), Winkley et al. 2020). Another therapy used for anxiety and depression is mindfulness. The goal of mindfulness practice is to use breathing and grounding techniques to bring awareness to the present moment, surroundings, and body to decrease reactions to emotional stressors (Hofmann and Gomez et al. 2010). Table 1 presents several studies with interventions exploring strategies to promote or supplement mental health self-management following SCI.

Table 1. Mental Health Management

Author Year Country Research Design Score Total Sample Size	Methods	Outcome
Burke et al. (2019) Ireland RCT PEDro=6 Level 1b $N_{Initial}$=69 N_{Final}=68	**Population:** *Intervention Group* (internet delivered cognitive behavioural pain management program (CBT-PMP); n=35): Mean age=50±12.3yr; Gender: males=25, females=10; Mean time post injury=16±11.8yr; Level of injury: cervical=10, thoracic-13, lumbar=7,	1. No significant difference between intervention and control groups for WHOQOL-BREF and ISCI-QOLBDS (p>.05). 2. No significant increase from baseline in HADS, PSQI for sleep or CPAQ for pain acceptance (p>.05 for all).

	unknown=8; Severity of injury: AIS A=1, AIS B=0, AIS C=2, AIS D=3, unknown=29. *Control group* (usual care; n=34): Mean age=52±13.8yr; Gender: males=27, females=7; Mean time post injury=16±12.6yr; Level of injury: cervical=7, thoracic=17, lumbar=7, unknown=3; Severity of injury: AIS A=3, AIS B=2, AIS C=1, AIS D=2, unknown=26. **Intervention:** Participants were randomized to receive internet delivered cognitive behavioral therapy pain management program (CBT-PMP) SPIRE (1 module and assignment/wk for 6wk) or the control group (continued to manage pain as per usual). Outcomes measures were assessed at baseline, post-intervention 6wk, and 3mo post-program completion. **Outcome Measures:** World Health Organization Quality of Life Bref (WHOQOL-BREF), International spinal cord injury quality of life basic data set, International Spinal Cord Injury Pain Basic Data Set (ISCIPBDS, v1), Douleur Neuropathique en 4 Questions (DN4) interview, Chronic Pain Acceptance Questionnaire (CPAQ-8), Brief Pain Inventory (BPI) Interference subscale, Hospital Anxiety and Depression Scale (HADS), Pittsburgh Sleep Quality Index (PSQI)	3. Significant differences between groups in overall pain (p=0.016), worst pain (p=0.004), BPI interference subscale (p=0.031).
Hearn & Finlay (2018) United Kingdom RCT PEDro=5 Level 2 $N_{Initial}$=67 N_{Final}=52	**Population:** *Intervention Group* (online mindfulness intervention; n=36): Mean age= 43.8±8.7yr; Gender: males=17, females=19; Time post injury (range)=3-11yr; Level of injury: cervical=12, thoracic-22, lumbar=2, unknown=8; Severity of injury: AIS A=3, AIS B=13, AIS C=9, AIS D=11. *Control group* (internet-delivered psychoeducation; n=31): Mean age=45.2±12.2yr; Gender: males=14, females=17; Time post injury (range)=3-6yr; Level of injury: cervical=13, thoracic=15, lumbar=3, unknown=3; Severity of injury: AIS A=6, AIS B=4, AIS C=10, AIS D=11. **Intervention:** Participants were randomly allocated to an 8wk online mindfulness intervention or to internet-delivered psychoeducation. Online mindfulness participants received two	1. At T2, significant improvements in favour of mindfulness training were found for depression (p=.002), anxiety (p=.009), pain unpleasantness (p=.009), and pain catastrophizing (p=.020). 2. Significant differences at T2 were also noted for total FFMQ score (p=.000), and the subscales of mindfulness facets of acting with awareness (p=.001), describing (p=.028), non-judging (p=.047), and non-reactivity to inner experience (p=.004). 3. At T2, there were no significant group differences for any aspect of QoL, pain intensity,

	10-min audio-guided meditations each day to listen and complete 6d/wk for 8wks. Psychoeducation participants received a weekly for 8wks including educational content on SCI and chronic pain in lay terminology to read at their convenience. Outcomes were assessed before (T1), at completion of, (T2), and 3 months following the intervention (T3). **Outcome Measures:** Hospital Anxiety and Depression Scale (HADS), Quality of Life (WHOQoL-BREF), Five Facet Mindfulness Questionnaire (FFMQ), Numerical rating scale (NRS), Pain Catastrophizing Scale, Retention rates.	and mindfulness facets of observing and nonjudging. 4. At T3, there were significant group differences for depression (p=.001), anxiety (p=.023), and pain catastrophizing (p=.001) in favour of the mindfulness program, and no differences in other outcomes between the groups.
Migliorini et al. (2016) Australia RCT PEDro=5 Level=2 $N_{Initial}$=59 N_{Final}=48	**Population:** *Intervention Group* (Electronic personal administration of cognitive therapy (ePACT); n=34): Mean age=47.5±12.2yr; Gender: males=25, females=9; Mean time post injury= 11.4±11.9yr; Level of injury: paraplegia=13, tetraplegia=19, unknown=2; Severity of injury: complete=6, incomplete=26, unknown=2. *Control group* (Waitlist; n=25): Mean age=52.8±12.9yr; Gender: males=17, females=8; Mean time post injury=19.8±14yr; Level of injury: paraplegia=20, tetraplegia=4, unknown=1; Severity of injury: complete=9, incomplete=15, unknown=1. **Intervention:** Participants were randomized either to ePACT intervention or waitlist control. ePACT was a 10-module skills and psycho-educational program largely based on cognitive behaviour therapy principles, positive psychology, and mindfulness meditation aspects. Individuals were required to undertake one module per week and complete between module activities. All measures were taken at enrolment into the RCT pre-randomization, at 10 & 12wk post intervention (or time equivalent for waitlist control participants), and for a small subset at 6mo post intervention within the study implementation time frame. **Outcome Measures:** Depression, Anxiety and Stress Scale short version	1. At baseline, there were no significant differences between groups in depression (p=.85), anxiety (p=.11), stress (p=.10), helplessness (p=.57) or overall satisfaction with Life (p=.19), gender (p=.86) or age (P=.12); however, there were significant differences according to time since injury (p=.02) and the level of injury distribution. 2. At post-intervention, life satisfaction increased in intervention group (p=.02) and decreased in controls (p=.13), and the between group difference was significant (p=.01). 3. At post-intervention, depression decreased in both groups, and there was no significant difference between groups (p=.24). 4. At post-intervention, anxiety and stress significantly decreased in just intervention group (p=.001, p=.008 respectively), however, there were no significant between group differences (p=.06, p=.14 respectively). 5. At post-intervention, there was no within-group (p<.41) or between-group (p=.24) differences in helplessness. From post-intervention to follow-up, the improvements in

	(DASS21), Personal Well-being Index Adult, Spinal Cord Lesion Emotional Well-being Questionnaire version 1 Australia (SCL EWL v1 Australia).	depression (p=.01), anxiety (p=.01), and stress (p=.04) maintained in the intervention group, but life satisfaction improvement was not maintained (p=.17).
Heutink et al. (2012) Netherlands RCT PEDro=6 Level 1b $N_{Initial}$=61 N_{Final}=54	**Population:** Mean age=58.8±11.4yr; Mean time post injury= 5.4±1.4-23.7yr. *Intervention group* (Cognitive behavioral therapy program (CBT); n=31); Gender: males=21, females=10; Level of injury: tetraplegia=11, paraplegia=20; Severity of injury: complete=16, incomplete=15. *Control group* (Waitlist: n=30); Gender: males=18, females=12; Level of injury: tetraplegia=8, paraplegia=22; Severity of injury: complete=6, incomplete=24. **Intervention:** Participants were randomized either to an intervention group which included educational, behavioural, and cognitive training, or a waitlist control group. The CBT therapy program consisted of 10 3-hr sessions over 10wk, and the outcomes were assessed at baseline (T1), post intervention at 3mo (T2), and at 6mo follow-up (T3). **Outcome Measures:** Chronic Pain Grade Questionnaire (CPG), Hospital Anxiety and Depression Scale (HADS), Utrecht Activities List (UAL), Life Satisfaction Questionnaire (Li-Sat-9).	1. CPG scores indicated significant improvements in pain intensity (p=009) and pain-related disability (p<.001) just in the intervention group over time from baseline to post intervention; however, there was no significant differences between the groups (p>.05). 2. HADS-anxiety scores showed improvement in anxiety in the intervention group at all time points, and it was significantly greater in the intervention group than the control group at post intervention (p=.007), but not different at follow-up (p=.032). 3. The intervention group showed a significant increase in UAL scores over time from baseline to follow-up (p=.004). the intervention groups had also greater improvement in participation compared to the control group at post intervention (p=.005). 4. There was no significant improvement in depression and life satisfaction over time (p>.05).
Duchnick et al. (2009) United States RCT PEDro=5 Level 2 $N_{Initial}$=41 N_{Final}=33	**Population:** *Intervention group* (Coping effectiveness training, n=21): Mean age=50.8±16.9yr; Gender: males=95%, females=5%; Mean time post injury=46.7±42.5d; Level of injury: paraplegia=60%, tetraplegia=40%; Severity of injury: AIS A=30%, AIS B=30%, AIS C=35% AIS D/NA=35%. *Control group* (Supportive group therapy (SGT), n=20): Mean age=54.6±9.8yr; Gender: males=100%; Mean time post injury=59.6±50.5d; Level of injury: paraplegia=30%, tetraplegia=70%; Severity of injury: AIS A=20%, AIS B=20%, AIS C=20% AIS D/NA=40%.	1. There was no difference in acceptance of disability 3mo after hospital discharge, (p>.05). 2. There were no significant differences between groups at any time point for primary or secondary outcomes. 3. Anxiety improved over time in both groups from baseline to discharge and baseline to follow-up. 4. Depression improved over time in both groups from baseline to discharge, and from discharge

	Intervention: Participants were randomized either to intervention (CET) or control (SGT) groups. CET consisted of weekly 60-min weekly psycho-educational group intervention sessions for 6wks, focused into six topic areas: stress and appraisal, problem solving, communication skills, behavioral strategies, cognitive strategies, and social support/assertiveness. Controls received 60-min weekly sessions of minimally structured, emotion-focused supportive group therapy. Outcome measures were assessed pre and post discharge with 3mo follow-up. **Outcome Measures:** State Anxiety Inventory (SAI), Center for Epidemiologic Studies Depression Scale (CESD), Adaptation to Disability Scale-Revised (ADS-R).	to follow-up, but got worse from discharge to follow-up.
Philips et al. (2001) USA RCT PEDro=3 Level 2 $N_{Initial}$ =111 N_{Final} =47	**Population:** *Intervention group 1* (video intervention; n=36): Mean age= 35±10.8yr; Gender: males=75%, females=25%; Mean time post injury=not reported; Level of injury: not reported; Severity of injury: not reported. *Intervention group 2* (telephone intervention; n=36): Mean age= 37±13.1yr; Gender: males=72%, females=28%; Mean time post injury=not reported; Level of injury: not reported; Severity of injury: not reported. *Control group* (standard care; n=39): Mean age= 33±11.2yr; Gender: males=82%, females=18%; Mean time post injury=not reported; Level of injury: not reported; Severity of injury: not reported. **Intervention:** Participants were new onset SCI adults. Those in the video and telephone groups took part in individual educational rehabilitation sessions with a study nurse (30-40min, 1x/wk, 5wks, then 1x/2wk for 1mo, post discharge). The content was similar, except that the video group saw real time images of the study nurse. Both interventions covered skin care, nutrition, bowel and bladder routines, psychosocial issues and discussion of any equipment needs. The standard care group were provided with a health center help line if and when they need	1. Health-related quality of life (QWB scale scores; n=111) did not differ significantly between the three groups at the end of the intervention period (p>.10). 2. At one year post discharge, QWB scores among those completing one year of enrollment (n=47) were significantly higher for both intervention groups compared to standard care (p<.10). 3. Depressive symptoms declined for all three groups, with those in the video group continuing to exhibit more symptoms at one-year post discharge than those in the telephone-only or standard care groups (p<.10).

	assistance prior to the regular two-month post discharge visit. Demographic data were gathered from patients' charts, and assessments took place at wk5 during the intervention, at w'9 at the end of the intervention, and then on a monthly basis for at least one year post discharge. **Outcome Measures:** Center for Epidemiologic Studies Depression Scale (CES-D), Quality of Well-Being Scale (QWB).	
NorrbrinkBudh et al., (2006) Sweden PCT Level 2 $N_{Initial}$=38 N_{Final}=38	**Population:** *Intervention Group* (pain management program; n=27): Mean age=53.2±12.6yr; Gender: males=9, females=18; Mean time post injury=9.9±12.8yr; Level of injury: cervical=15, thoracic-6, lumbar=6, unknown=8; Severity of injury: AIS A=4, AIS C=3, AIS D=19, AIS E=1. *Control group* (No treatment; n=11): Mean age=49.9±12.3yr; Gender: males=5, females=6; Mean time post injury=15.8±9.3yr; Level of injury: cervical=4, thoracic=7; Severity of injury: AIS A=6, AIS D=5. **Intervention:** Participants were SCI adults with neuropathic pain. Participants were assigned either into pain management intervention group or control group. A comprehensive multidisciplinary pain management program was developed, including 1.5hr education, 1.5hr of CBT, 1hr of relaxation/stretching, and 1hr of body awareness (5hr/d, 2d/wk, 10wks, total of 20 sessions). Outcomes were assessed at baseline, post intervention (10wks), and at 3,6 and 12 mo follow-ups. **Outcome Measures:** Borg CR10 Scale (pain intensity and pain unpleasantness), Quality of Sleep, Nottingham Health Profile (NHP), Life Satisfaction Questionnaire (LiSat-9), Hospital Anxiety and Depression (HAD); Sense of Coherence (SOC), Use of the healthcare system rate.	1. Rank invariant analysis showed systematic decrease, not significant, in anxiety (p=.12) and depression (p=.54), and a tendency toward better quality sleep (p=.54) in the treatment group from baseline to 12mo follow-up. 2. Pain intensities and unpleasantness, health related QoL, and life satisfaction showed no statistical evidence for systematic changes over time. 3. Emotional reaction subscale of NHP showed significant improvement from baseline to 12mo (p=.01). 4. Depression had significantly better improvement in treatment group compared to controls over time. 5. Sense of coherence significantly decreased over time in the controls compared to the treatment group. 6. The changes in pain intensity, pain unpleasantness, life satisfaction, and health related QoL were similar for both groups. 7. At 12mo, using analgesics decreased in treatment group and remained unchanged in controls. 8. Rate of visits to healthcare personnel decreased in both groups, and it was significant for visits to physicians in both

		treatment (p=.03) and control (p=.02) groups over time, with no between-group differences.
Craig et al. (1998) Australia PCT Level 2 $N_{Initial}$=69 N_{Final}=58	**Population:** *Intervention group* (CBT; n=28); Mean age=31 ±11.8yr; Gender: males=23, females=5; Level of injury: paraplegia=46%, tetraplegia=54%; Severity of injury: incomplete=21%, complete=79%. *Control group:* (usual care; n=41); Mean age= 31 ±14yr; Gender: males=34, females=7; Level of injury: paraplegia=51%, tetraplegia=49%; Severity of injury: incomplete=32%, complete=68%. **Intervention:** Participants in the intervention group underwent a cognitive behavioural therapy (CBT) program over in small groups (1.5hr/wk for 10wk), which aimed to provide participants with cognitive and behavioural skills to cope with the psychological and social difficulties encountered upon entering the community. Participants in the control group received usual care. Outcome measures were assessed pre and post intervention (10-12wk later), as well as 1 and 2yr follow up. **Outcome Measures:** Locus of Control of Behaviour Scale (LCB), Beck Depression Inventory (BDI)	1. No significant overall differences were found between groups overall for locus of control as a result of treatment (p>.05). 2. No significant differences occurred across time for LCB (p>.05). 3. There was no significant interactions between group and time (p>.05). 4. However, among participants who displayed external perceptions of control pre-intervention (with a score of 33 or higher on LCB), those who received CBT were significantly more likely to feel in control of themselves 2 years post injury compared to similar persons in the control group (p<.05). 5. For all persons in the intervention and control groups merged, significant associations were found between depressive mood (after 2 years) and locus of control measured (p<.05 immediately post intervention, and after 1 and 2 years (p<.05). 6. For the control group, locus of control was significantly but mildly associated to depressive mood for all measurement occasions (p<.05). 7. For the treatment group, locus of control was not significantly associated with depressive mood at any time (p>.05).
MacGillvray et al. (2020) Canada Pre-Post Level 4 $N_{Initial}$=20 N_{Final}=14	**Population:** *Intervention Group* Median age, range= 39yr, 22-81yr; Gender: males=17, females=3; Mean time post injury=not reported; Level of injury: paraplegia=5, tetraplegia=15; Severity of injury: AIS A=8, AIS B=5, AIS C=6, AIS D=1. **Intervention:** A mobile app was developed to facilitate self-management following SCI. The app	1. Levels of anxiety (HADS) at did not change significantly at community discharge or at 3mo post discharge (p>.05).

	consisted of 18 tools focusing on goal setting, tracking various health aspects, and identifying confidence regarding components of self-management. Following the training sessions, which ranged in duration based on the needs of the participant, the trainer followed up with participants 1x/wk during inpatient rehabilitation and 1-2x/mo after community discharge. Follow-up sessions were used to check-in and identify any feedback, challenges, or questions that participants had. Outcome measures were assessed at baseline, community discharge, and 3mo post-discharge. **Outcome Measures:** Hospital Anxiety and Depression Scale (HADS), a custom Likert scale to evaluate confidence in managing various domains of health.	
Mehta et al. (2020) Canada Pre-Post Level 4 $N_{Initial}$=20 N_{Final}=18	**Population:** *Intervention Group* (N=20) Mean age=54.7±16.2yr; Gender: males=11, females=9; Mean time post injury=12.1±15.9yr; Level of injury: paraplegia=8, tetraplegia=12; Severity of injury: incomplete=14, complete=6. **Intervention:** A group of participants was given internet-based cognitive behavioural therapy (ICBT), based on chronic conditions course for SCI and case studies or vignettes. The Chronic Conditions Course consisted of five lessons delivered over 8wk. Participants were provided with guides through secure email or telephone, based on their preference, to answer any questions regarding the material and to review homework assignments. Outcomes were measured at baseline, at post treatment, and at 3mo follow-up. **Outcome Measures:** Feasibility, treatment satisfaction questionnaire (TSQ), patient health questionnaire (PHQ-9), generalized anxiety disorder-7 (GAD-7), Spinal Cord Injury Quality of Life (SCI-QOL), International Spinal Cord Injury Basic Pain Data Set (ISCIBPD).	1. Depression (p <.001) and anxiety (p=.002) scores decreased significantly after ICBT therapy, and the improvement maintained at follow-up. 2. Significant improvements were found on SCIQoL subscales of grief (p<.001), self-esteem (p=.04), resilience (p <.002), and positive affect (p<.001) from baseline to post-intervention and maintained at follow-up. 3. No significant improvement was seen in “Ability to participate,” from pre-treatment to posttreatment; however, significant improvements were revealed at pre-treatment to follow-up and post-treatment to follow-up (p<.01).

Verwer et al. (2016) Netherlands Pre-Post Level 4 $N_{Initial}$=14 N_{Final}=7	**Population:** *Intervention Group* Mean age=44.7yr (Min=21yr, Max=63yr); Gender: males=11, females=3; Level of injury=paraplegia=10, tetraplegia=4; Severity of injury: complete=6, incomplete=8 **Intervention:** Participants completed at least 2 modules of Psyfit, an online self-help program (has 6 modules with practical exercise and self-test) designed to enhance well-being in persons with depressed mood. Outcomes measures were assessed at baseline, immediately after the intervention and at 3-month follow up. **Outcome Measures:** Mental Health Inventory-5 (MHI), Center for Epidemiological Studies Depression (CES-D) scale, Warwick-Edinburgh Mental Well-Being Scale (WEMWBS).	1. Scores on mental health (MHI-5) (p=.03), depression (CES-D) (p=.02), and well-being WEMWBS (p=.03) decreased significantly between post intervention and 3-month follow up; no significant change was seen between baseline and 3-month follow up (p>.05). 2. The participants who completed two modules showed a significant improvement of the MHI scores between baseline and post intervention (p<.05).
Migliorini et al. (2011) Australia Pre-Post Level 4 $N_{Initial}$=8 N_{Final}=3	**Population:** Mean age=53yr; Gender: males=2, females=1; Mean time post injury=not reported; Level of injury: lumbar=3; Severity of injury: complete=1, incomplete=2. **Intervention:** Participants underwent electronic Personal Administration of Cognitive Training (ePACT), a manualized psychological treatment based on cognitive behaviour and positive psychological principles to address the cognitive and behavioural aspects of depression and anxiety. ePACT consists of 10 modules and 4 information pages. Outcomes were measuring pre- and post-intervention in all three participants. **Outcome Measures:** Depression Anxiety and Stress scale-short version (DASS-21); Personal Wellbeing index (PWI); Spinal Cord Lesion Emotional Wellbeing Questionnaire (SCL EWQ v1 Australia); Structural Clinical Interview for DSM Disorders (SCID-N/P)	Case 1: 1. The participant's baseline DASS-21 Depression scores placed his case into the clinical category of extremely severe for depression, and the clinical category of mild for anxiety and mild for stress. After the intervention, the participant's DASS-21 values were reduced to the non-clinical range. Case 2: 2. After the intervention, the participant's DASS-21 anxiety and stress scores reduced to the nonclinical range. There was a small improvement in his GAF score. In contrast, the participant's overall satisfaction with life and satisfaction with his personal relationships decreased. Case 3: 3. The participant's DASS-21 scores for depression dropped into the non-clinical range. Her scores for Helplessness and Intrusion also dropped, indicating she felt in more control and her SCI was making a smaller impact in her life.

Discussion

Seven studies (three RCTs) investigated the effects of cognitive behavioral therapy programs alone or in combination on mental health following SCI. Programs were delivered remotely and synchronously (Burke et al. 2019; NorrbrinkBudh et al. 2006; Mehta et al. 2020) remotely and asynchronously (Migliorini et al. 2016, 2011), and in person (Heutink et al. 2012; Craig et al. 1998). While the use of mindfulness, cognitive behavioral therapy, and education in conjunction improved depressive symptoms in a study of 3 participants (Migliorini et al. 2016), expansion of the ePACT program to a 48 participant RCT showed no efficacy in improving symptoms of anxiety or depression. Except for another level 4 study (Mehta et al. 2020), no presented intervention utilizing cognitive behavioral therapy yielded improvements in mental health following the end of the intervention period.

Four studies investigated other psychological educations. Hearn and Finlay et al. (2018) demonstrated that a remote mindfulness intervention improves symptoms of anxiety, depression and pain when compared to a psychoeducation control. Similarly, Duchnick et al. (2009) found that individual psychoeducation sessions are ineffective at improving symptoms of anxiety and depression. Only one study examined the effects of an exercise module on mood and found no long-term improvements in overall wellbeing or symptoms of depression (Verwer et al. 2016). A novel smartphone application designed to promote self-management following SCI, while providing some medical management benefits does not improve symptoms of anxiety or depression (MacGillvray et al. 2020). While many of the interventions reviewed produced mental health improvements during treatment, the majority of reviewed studies do not support the use of cognitive behavioral therapy-based interventions to support self-management of mental health following SCI.

Conclusion

There is level 1b evidence (Burke et al. 2019) that virtually delivered cognitive behavioral therapy improves pain but not symptoms of anxiety or depression.

There is level 2 evidence (Hearn and Finlay et al. 2018) that virtually delivered mindfulness improves symptoms of anxiety, depression, and pain.

There is level 2 evidence (Migliorini et al. 2016) that a remotely delivered cognitive behavioral, mindfulness and positive psychology module does not improve symptoms of anxiety or depression.

There is level 1b evidence (Heutink et al. 2012) that a combination of educational and cognitive behavioral training does not improve anxiety, depression, or pain after completion of the program.

There is level 2 evidence (Duchnick et al. 2009) that psycho-education sessions do not improve anxiety or depression.

There is level 2 evidence (Philips et al. 2001) that telephone and video-based education sessions with a nurse did not improve symptoms of depression.

There is level 2 evidence (NorrbrinkBudh et al. 2006) that a pain management program including cognitive behavioral therapy improves symptoms of depression and decreases analgesic use but does not improve perception of pain.

There is level 2 evidence (Craig et al. 1998) that cognitive behavioral therapy does not improve symptoms of depression.

There is level 4 evidence (MacGillvray et al. 2020) that a self-directed app designed for self-management following SCI does not improve symptoms of anxiety or depression.

There is level 4 evidence (Mehta et al. 2020) that virtually delivered cognitive behavioral therapy improves self-esteem, symptoms of depression and grief.

There is level 4 evidence (Verwer et al. 2016) that a virtual self-help exercise module did not improve overall mental health or symptoms of depression after completion of the program.

There is level 4 evidence (Migliorini et al. 2011) that a remotely delivered cognitive behavioral, mindfulness and positive psychology module may improve depression.

Key Points

Cognitive behavioral based programs do not improve symptoms of anxiety or depression long-term following SCI.

2.2 Medical Management

There are many health-related changes and complications that can occur post-SCI. Complications can include pressure ulcers and urinary tract infections (UTI) (Kryger et al. 2019). Interventions aimed at educating SCI patients and providing support for self-management practices are necessary. When an individual's health is manageable, this allows for more independence and improvement in quality of life (Kraus & Wolf 2024). It then becomes important to learn the best practices to prevent any secondary complications. The skills that may be gained through an education/training program may include catheterization (Zanollo et al. 2015) and ulcer prevention (Arora et al. 2017). These studies and others that investigate medical self-management are summarized in Table 2.

Table 2. Medical Management

Author Year Country Research Design Score Total Sample Size	Methods	Outcome
Urinary Tract Infections		
Huang et al. (2019) China RCT PEDro=6 Level 1b $N_{Initial}$=80, N_{Final}=80	**Population:** *Intervention Group* (quality control circle (QCC); n=40): Mean age=56.7±4.3yr; Gender: males=25, females=15; Mean time post injury≥2mo; Level of injury: cervical=6, thoracic=9, lumbar=15, sacral=10; Severity of injury: Grade A=17, Grade B=23. *Control group* (routine health education; n=40): Mean age=57.3±4.8yr; Gender: males=24, females=16; Mean time post injury≥2mo; Level of injury: cervical=8, thoracic=7, lumbar=16, sacral=9; Severity of injury: Grade A=20, Grade B=20. **Intervention:** Participants were randomized into the quality control circle (QCC) group or the control group. The training of health education knowledge on intermittent catheterization was strengthened on members of the QCC group to enhance their subjective management awareness and sense of responsibility. Urine routine was detected weekly; patients and their families were regularly guided to conduct intermittent catheterization. The intervention lasted 3mo. The control group received routine health education. Outcome measures were assessed at baseline and 3mo. **Outcome Measures:** Self-developed questionnaire survey assessing awareness of neurogenic bladder, rates of urinary tract infection and hydronephrosis, self-management ability, recovery of bladder function, nursing satisfaction.	1. The awareness rate of neurogenic bladder was 77.5% (31 patients) in the QCC group of patients, and 47.5% (19 patients) in the control group, with statistically significant difference between the two groups ($\chi2$=7.680, P=0.006) 2. The incidence of urinary tract infection ($\chi2$=6.050, p=.014) and hydronephrosis ($\chi2$=4.501, p=.034) were significantly lower in the QCC group compared to the control group. 3. After 3mo of intervention, the recovery rate of bladder function was significantly higher in the QCC group compared to the control group (p<.001). 4. Participants in the QCC intervention group scored significantly higher than the control group on self-management ability (p=.019). 5. The nursing satisfaction was significantly higher in the QCC group compared to the control group (p=.019).
Kryger et al. (2019) United States RCT PEDro=7 Level 1b $N_{Initial}$=38 N_{Final}=33	**Population:** *Intervention Group* (Interactive Mobile Health and Rehabilitation (iMHere), n=19): Mean age=37.9±13.4yr; Gender: males=13, females=6; Mean time post injury=9.9±8yr; Level of injury: tetraplegia=8, paraplegia=11; Severity of injury: complete=9, incomplete=10. *Control group* (Standard care, n=19): Mean age=44.1±15.3yr; Gender: males=12, females=7; Mean time post injury=13.5±11yr;	1. The intervention group had a statistically significant reduction in UTIs over time (p=.03). 2. There was no statistically significant trend between or within groups in other primary outcome or psychosocial outcomes; however, there was a

	Level of injury: tetraplegia=9, paraplegia=10; Severity of injury: complete12, incomplete=7. **Intervention:** Participants were randomized into the Interactive Mobile Health and Rehabilitation (iMHere) group or control group. iMHere included several modules to provide education and reminders for self-management activities. Intervention participants received 30 min of training to use the app and asked to use the app and respond to the reminders, while they could communicate with a physical therapist via the app, over a 9mo period. The control group received the standard of care in an outpatient physiatry SCI clinic and no technologic intervention. Participants were assessed at baseline (9mo before the start of trial through chart review) and every 3mo for a total of 9mo. **Outcome Measures:** Numbers of UTIs, pressure injuries, emergency department visits for UTI, pressure injuries, or other reasons, and hospitalizations for UTI, pressure injuries or other reasons; Canadian Occupational Performance Measure (COPM), Adolescent Self-Management and Independence Scale, Beck Depression Inventory-II (BDI-II), Patient Assessment of Chronic Illness Care, World Health Organization Quality of Life Brief Instrument, Craig Handicap Assessment and Reporting Technique Short Form	nonsignificant trend toward a reduction in mood symptoms in the intervention group compared with the control group meeting the threshold for clinical significance.
Cardenas et al. (2004) United States of America RCT PEDro=4 Level 2 $N_{Initial}$=56 N_{Final}=42	**Population:** *Intervention group* (Educational program; n=29): Mean age=40.65±13.51yr; Gender: males=22, females=7; Mean time post injury=13.22±11.83yr; Level of injury: cervical=17, thoracic=11, lumbar and sacral=1; Severity of injury: AIS A=20, AIS B=7, AIS C=1, AIS D=1. *Control group* (No intervention; n=27): Mean age=41.48±10.95yr; Gender: males=20, females=7; Mean time post injury=9.74±7.19yr; Level of injury: cervical=17, thoracic=9, lumbar and sacral=1; Severity of injury: AIS A=15, AIS B=8, AIS C=2, AIS D=2. **Intervention:** Participants were randomized into the Educational program and the control group. The educational program	1. The educational group performed better than the control and had fewer number of significant UCCs post-intervention (p=.009). 2. There was no significant difference on symptom reports (p=.097), antibiotic treatment episodes (0.232) and number of UTIs. 3. Educational group had a significant increase in the perception of the severity of UTIs (p=.042) than the control group.

	group received a single educational session (2-2.5hr) with written material on UTIs, a self-administered test, a review by nurse and physician, and a follow up telephone call (15-20min). The control group received no intervention. Outcome measures were assessed at baseline and 5-6mo after randomization. **Outcome Measures:** Urinary colony counts (UCCs), number of symptoms and UTIs, episodes of antibiotic treatment for UTIs, Health Beliefs Questionnaire, Multidimensional Health Locus of Control (MHLC), Self-efficacy questionnaire.	
Hagglund et al. (2005) Columbia PCT Level 2 $N_{Initial}$=60 N_{Final}=60	**Population:** Mean age=39±12.85yr; Gender: males=74%, females=26%. *Intervention Group* (UTI educational workshop; n=37): Mean time post injury=not reported; Level of injury: not reported; Severity of injury: not reported. *Control group* (no intervention; n=23): Mean time post injury=not reported; Level of injury: not reported; Severity of injury: not reported. **Intervention:** Individuals with SCI who had the experience of using personal assistance services (PAS) were included in this study. Participants in the intervention group participated in a 6-hour, in-person, PAS training workshop. The workshop covered information and prevention of commonly occurring secondary conditions in SCI, including pressure sores, UTIs, spasms, and autonomic dysreflexia, general nutrition, and weight loss strategies. Bladder management topics included types of catheters, proper, insertion technique, sterilization and handling of reusable catheters, and signs of infection. An 8min video on UTI prevention, management, and treatment was viewed and discussed. They completed phone interviews before and 6mo after attending the 6hr workshop. Controls also completed baseline phone interviews and follow-up interviews 6mo later. **Outcome Measures:** UTIs Occurrence.	1. Intervention group had significant reductions in UTI occurrence over time from baseline to 6mo (p=.03). 2. There were significant differences between groups in the occurrence of UTIs at 6mo (p<.02). Over half (56%) of the consumers in the control group who did not report a UTI at baseline reported having one at 6mo, whereas 14% of the consumers in the intervention group not reporting a UTI at baseline reported having one at 6mo.
Zanollo et al. (2015) Italy Cohort Level 2	**Population:** *Intervention Group* (Intermittent catheterization (IC) education program; n=84): Mean age ≥18yr; Gender: males=72%, females=28%; Mean time post injury=not reported; Level of injury: not reported; Severity of injury: not reported.	1. The IC Education Program significantly increased the percentage of individuals still using IC during the first year after discharge from the rehabilitation center

$N_{Initial}$=400, N_{Final}=400	*Control group* (No intervention; n=316): Mean age≥18yr; Gender: males=68%, females=32%; Mean time post injury=not reported; Level of injury: not reported; Severity of injury: not reported. **Intervention:** Two different cohorts of adults with SCI were identified. The control group retrospective cohort) comprised individuals with SCI discharged from one of the participating rehabilitation centers using intermittent catheterization (IC) up to 1 year before the Education Program was initiated. A questionnaire was sent by post to this group before the IC Education Program started. The second group (prospective cohort) comprised individuals who had participated in and been discharged using the IC Education Program; they received the questionnaire up to 1 year after program initiation. **Outcome Measures:** SF-Qualiveen questionnaire, Bladder management skills.	compared to the controls (p<·05). 2. The number of continent individuals was increased by the IC Educational Program, however, the between group difference was not significant (p>.05). 3. The program significantly improved the reported satisfaction with training in maintaining normal flow of urine (p=.0004), healthy bladder management (p=.0105), step-by-step catheterization (p=.003), and overcoming barriers (p=.0006).
Evardone et al. (2018) United States Case Series Level 4 $N_{Initial}$=106 N_{Final}=106	**Population:** *Intervention Group* Mean age=52.28±18.73; Gender: males=97.2%, females=2.8%; Mean time post injury=Chronic (>3mo); Level of injury: tetraplegia=54.7%, paraplegia=45.3%; Severity of injury: incomplete=66%, complete=34%. **Intervention:** Retrospective review of medical records. Participants received an education course (on topics such as bladder and bowel management, deep vein thrombosis, sexuality, preventing further injury, health etc). Data from discharge and/ or 90 days following discharge were analyzed. Instructors used a variety of tools to promote learning and retention of information, including use of handouts, anatomical models, videos, and discussion among participants. **Outcome Measures:** Satisfaction with Life Survey (SWLS), Craig Handicap and Assessment Reporting Technique-Short Form (CHART-SF), Short Form Health Survey (SF-8), number of Pressure ulcers and Urinary Tract Infections (UTI) developed.	1. No significant relationship between class attendance and SWLS, CHART-SF and SF-8 was observed (p>.05). 2. Skin care class attendance was a significant predictor of fewer pressure ulcers during rehabilitation (p<.05). 3. The number of completed classes significantly predicted a higher number of UTI during rehabilitation (p<.05).

Wilde et al. (2016) USA Pre-Post Level 4 $N_{Initial}$=29 N_{Final}=23	**Population:** Mean age=43.52 ±13.10yr; Gender: males=15, females=14; Mean time post injury=16 ±16yr; Level of injury: cervical=7, thoracic-17, lumbar=2, mixed level=2, unknown=1; Severity of injury: complete=13, incomplete=13. **Intervention:** Participants received a Web-based clean intermittent catheter (CIC) self-management intervention. The intervention included web-based information, mostly related to types and features of catheters and supplies, an online educational booklet, an interactive urinary diary for self-monitoring fluid intake and urinary output, 3 nurse phone call consultations, and peer-led discussion forums. Outcomes were assessed at baseline and 3-month online surveys. **Outcome Measures:** Feasibility Questionnaire, Intermittent Self-Catheter Questionnaire Psychological Well-Being Scale, Self-management Questionnaire, Frequencies of UTIs, Pain, and Leakage.	1. The only statistically significant improvement was the IC self-management (p=.032). There were improvements, but not significant, in IC self-efficacy scores and IC Quality-of-Life Psychological Well-being Scale. 2. There were no significant changes in the frequency of urinary tract infection and pain. 3. Urinary incontinence between catheterizations was 89% at baseline and reduced to 74% at 3mo. 4. At baseline, catheterization pain was reported by 5 persons, and at 3mo, pain was reported by 3 participants. 5. At baseline, 42% reported having experienced a UTI within the previous 3 months. At 3 months, 30% reported UTIs.
Pressure Ulcers and Skin Integrity		
Arora et al. (2017) Australia RCT PEDro=8 Level 1b $N_{Initial}$=120 N_{Final}=115	**Population:** *Intervention Group* (telephone-based management of pressure ulcer; n=60): Mean age=35±11yr; Gender: males=52, females=8; Median time post injury (IQR)=3.7yr, 1.4-9.6; Level of injury: cervical=12, thoracic=38, lumbar and sacral=2, unknown=8; Severity of injury: AIS A=52, AIS B=3, AIS C=2, AIS D=0, unknown=3. *Control group* (usual care; n=60): Mean age=36±12yr; Gender: males=54, females=6; Median time post injury (IQR)=3.7yr, 1.3-8.5; Level of injury: cervical=17, thoracic=37, lumbar and sacral=0, unknown=6; Severity of injury: AIS A=47, AIS B=2, AIS C=8, AIS D=1, unknown=2. **Intervention:** Participants were randomized into the intervention group and the control group. Participants in the intervention group received weekly advice by telephone for 12 weeks about the management of	1. No statistically significant between group differences for size of the pressure ulcer (p=.08). 2. Statistically significant between group differences for PUSH score (p=.02), Braden score (p<.001), Participation items of WHODAS (p=.003), Utility score of EQ-5D-5L (p=.01), Health rating of EQ-5D-VAS (p=.001), Participants' confidence to manage pressure ulcer (p<.001) and Participants' satisfaction (p<.001). 3. No statistically significant between group differences for depth of pressure ulcer (p=0.17), undermining

	their pressure ulcers from trained health-care professionals (nurse and a physiotherapist). The control group received usual care. Outcome measures were assessed pre and post intervention (12 wk). **Outcome Measures:** Size of the pressure ulcer at 12 weeks, Pressure Ulcer Scale for Healing (PUSH) score, Depth of pressure ulcer, Undermining distance of pressure ulcer, Braden Scale, Hospital Anxiety and Depression Scale (HADS), Participation items of the World Health Organization Disability Assessment Schedule (WHODAS), Utility score of the Euro Quality of Life 5-dimensional 5-level (EQ-5D-5L), Self-rated health of the Euro Quality of Life 5-dimensional Visual Analog Scale (EQ-5D-VAS), Participants' impression of pressure ulcer status, participants' confidence to manage pressure ulcer, participants' satisfaction, Self-report time for pressure ulcer resolution.	distance of pressure ulcer (p=.14), depression items of the HADS (p=.77), participant impression of pressure ulcer status (p=.08) and clinician impression of pressure ulcer (p=.18).
Kim & Cho (2017) South Korea RCT PEDro=4 Level 2 $N_{Initial}$=70 N_{Final}=47	**Population:** *Intervention group* (n=24): Mean age=42±11.1yr, Gender: males=17, females=7; Mean time post injury= 49.83±75.568mo; Level of injury: cervical=4, thoracic=15, lumbar=5; Severity of injury: AIS A=12, AIS B=4, AIS C=6; AIS D=2. *Control group* (n=23): Mean age=36.74±9.72yr; Gender: males=20, females=3; Mean time post injury=65.83±73.23mo; Level of injury: cervical=3, thoracic=14, lumbar=6; Severity of injury: AIS A=15, AIS B=3, AIS C=2, AIS D=3. **Intervention:** Participants were randomized into the intervention group or the control group. The intervention group was given an 8wk self-efficacy enhancement program for pressure ulcer prevention. The self-efficacy enhancement program consisted of small-group face-to-face intervention (education and skills training), education with computer animation, phone counseling, face-to-face counseling, and self-management records. The control group only received a pressure ulcer prevention information booklet. Outcome measures were assessed at baseline and after the 8wk intervention. **Outcome Measures:** Self-care knowledge tool for pressure ulcers (Korean version), a	1. There was no statistically significant difference in the baseline self-care behaviors (p=.434) between the experimental and the control group at baseline. 2. After the 8wk intervention, the experimental showed significantly greater and self-care behaviors (p< 0.001) compared to the control group. 3. No participant in the experimental group experienced a pressure ulcer during the 8wk program, while one participant in the control group developed a pressure ulcer on the heel. However, this difference was not statistically significant (p=.489).

	Korean version of the self-efficacy tool modified from the self-efficacy subscale of the Skin Care Belief Scale, a self-care behaviour assessment tool for pressure developed for the study, pressure ulcer occurrence.	
Guihan et al. (2014) USA RCT PEDro=6 Level=1b $N_{Initial}$=144 N_{Final}=78	**Population:** *Intervention Group* (SM+MI; n=71): Mean age=59.4±10.1yr; Gender: males=69, females=2; Mean time post injury=23.8±15.8yr; Level of injury: cervical=30, thoracic-40, lumbar=1; Severity of injury: AIS A=53, AIS B=7, AIS C=7, AIS D=4 *Control group (ED)*, n=72): Mean age=59.0±12.8yr; Gender: males=70, females=2; Mean time post injury=24.0±15.8yr; Level of injury: cervical=30, thoracic=36, lumbar=6; Severity of injury: AIS A=48, AIS B=8, AIS C=10, AIS D=6. **Intervention:** Participants were randomized into the intervention (SM+MI) group or active control group. The intervention group received group based self-management skill intervention (seven 45-60min phone calls) and motivational interviewing (MI)-based individual telephone counseling calls (8 calls over 24wk). The self-management group intervention content tailored for the study with modules on (1) guideline-based skin care education; (2) training in problem-solving and self-monitoring skills; (3) community resource utilization; (4) relaxation, stress and mood management skills; (5) improving provider relationships; and (6) development of action plans. The active control group received telephone-based individual educational counseling plus group education (ED). The education control intervention was equivalent to the SM+MI intervention in terms of number and timing of sessions and who delivered the intervention. The education control intervention emphasized teaching and advice giving while barring the presumed active ingredients of skills training and MI. Education control arm members received copies of SCI educational guides. Outcome measures were assessed at baseline, 3mo, and 6mo. **Outcome Measures:** Skin Care Behavior Checklist, Skin status (documented with	1. Intention-to-treat analyses found nonsignificant increases in skin behaviors in the SM+MI versus education control intervention arms at 3 and 6 months (p=0.2 and p=0.4, respectively). 2. The difference in behaviors used between SM+MI and education control intervention participants was 4.6% (95% confidence interval [CI], 11.3 to 2.7) (3mo) and 3.0% (95% CI, 8.7 to 3.9) (6mo). High rates of skin worsening were observed (n=74, 51.7%), usually within 3 months post discharge and most frequently within the month post 19intervention. 3. Skin worsening, skin-related visits, and readmissions did not differ by study arm at 3 and 6 months (p>.05).

	digital photographs and planimetry to calculate wound surface area), VA health care utilization (inpatient and outpatient visits), Communication With Providers and Self-Efficacy scales, Pressure Ulcer (PrU) Knowledge Test.	
Houlihan et al. (2013) USA RCT PEDro=6 Level 1b $N_{Initial}$=142 N_{Final}=133 (SCI=106)	**Population:** *Intervention group* (CareCall, n=71)*:* Mean age=48.6±12.5yr; Gender: males=50, females=21; Mean time post injury=11.34±11.1yr; Level of injury: cervical=23, thoracic=25, lumbar=2; Severity of injury: incomplete=29, complete=19. *Control group (usual care, n=71)*: Mean age=47.8±14.1yr; Gender: males=37, females=34; Mean time post injury=12±9.8yr; Level of injury: cervical=28, thoracic=21, lumbar=4; Severity of injury: incomplete=29, complete=23. **Intervention:** Participants were randomized into the CareCall intervention group and usual care control. CareCall participants were weekly contacted by an automated, interactive voice response system scripts organized into modules, integrating content relevant to: skin care, depression and wellness, and health-care utilization. (1x/wk for 6mo). The control group was provided a CareCall resource book developed by clinical experts, containing information and local resources, and received usual care. Outcome measures were assessed at baseline, 2-month, 4-month and 6-month. **Outcome Measures**: Pressure Ulcer Scale for Healing (PUSH)-V3, Patient Health Questionnaire (PHQ-9), Cornell Services Index, Craig Hospital Inventory of Environmental Factors-Short Form- V3, usage rate of intervention by participants.	1. No intervention effect was found on pressure ulcer occurrence, however, considering gender, ulcer rate was significantly lower for women after educational program. 2. For those participants with depressive symptoms at baseline, a significant improvement in the intervention group was found at post intervention in severity of depression ($p<.05$). 3. There was no significant group difference in healthcare utilization at any time points (p=.0423).
Rintala et al. (2008) United States RCT PEDro=5 Level 2 $N_{Initial}$=41 N_{Final}=38	**Population:** *Intervention Group* (Enhanced education and structured follow-up; n=20 (SCI=18): Mean age=54.82±10.85yr; Gender: males=20, females=0; Mean time post injury=19.58± 11.45yr; Level of injury: cervical=7, thoracic=10, lumbar=1; Severity of injury: AIS A=13, AIS B=5, AIS C=1. *Control Group 1* (Structured follow-up; n=11): Mean age=50.642±8.83yr; Gender: males=11, females=0; Mean time post injury=15.37± 4.38yr; Level of injury: cervical=2, thoracic=9; Severity of injury: AIS A=9, AIS B=2.	1. Considering the time from discharge to ulcer recurrence or reaching 24-mo follow-up (which came first), intervention group was ulcer free significantly longer than control 1 (p=.008), and control 2 (p=.009), with large effect sizes. It was not different between the control groups.

	Control Group 2 (unstructured follow-up; n=10): Mean age= 53.86±13.63yr; Gender: males=10, females=0; Mean time post injury=14.82± 10.29yr; Level of injury: cervical=7, thoracic=3; Severity of injury: AIS A=6, AIS B=3, AIS D=1. **Intervention:** SCI veterans who underwent the surgical repair of a stage III or IV pressure ulcer participated in the study and randomized into 3 groups and all received standard educational care. Intervention group received enhanced education and monthly structured follow-up on skin status for up to 2yr after discharge, control group 1 received just the monthly contacts for up to 2yr after discharge, and control group 2 receive minimal contact by mail every 3mo for up to 2yr after discharge. Enhanced education consisted of four 1hr structured individualized pressure ulcer prevention and management education sessions during the final 2wk of the hospitalization. Outcomes were assessed at baseline and follow-up. Follow-up time point was the time of a pressure ulcer recurrence, death, or after 24mo, whichever came first. **Outcome Measures:** Pressure Ulcer Recurrence Rate, Time to Ulcer Recurrence.	2. Intervention group also had the smallest rate of ulcer recurrence during the 24mo follow-up, compared to the control groups (p=.007).
Phillips et al. (1999) USA PCT Level 2 $N_{Initial}$=37, N_{Final}=35	**Population:** *Intervention group 1* (video intervention; n=12): Mean age= 33.4±13.8yr; Gender: males=75%, females=25%; Mean time post injury=not reported; Level of injury: not reported; Severity of injury: not reported. *Intervention group 2* (telephone intervention; n=13): Mean age= 29.6±6.4yr; Gender: males=69%, females=31%; Mean time post injury=not reported; Level of injury: not reported; Severity of injury: not reported. *Control group* (standard care; n=10): Mean age= 38.1Â±15.2yr; Gender: males=80%, females=20%; Mean time post injury=not reported; Level of injury: not reported; Severity of injury: not reported. **Intervention:** The video group participated in weekly video sessions for the first 6-8 weeks following discharge and checked by a nurse for skin ulcer condition. The nurse also helped resolve problems related to wheelchairs, mattresses, and mobility.	1. Those in the video group had the highest number of identified and/or reported pressure ulcers, and the number was middle in standard care group and the lowest in telephone intervention group, with nor between-group significant differences (p>.05). 2. There was no difference in annual ER visits and hospitalization rate within or between any groups (p>.05).

	Participants then received weekly telephone counseling sessions for the next 4-6 weeks (10-12 total sessions). The telephone group participated in weekly telephone-only counseling for 10wk after discharge, guided about skin check-ups, and assisted in problem-solving related to bowel, diet, or any matter of concern. The standard care group was given instructions on using a health center help line. This help line provides information and counseling free of charge to patients who call the center on their own initiative. All three groups were surveyed every 2-3 months. **Outcome Measures:** Annual reported pressure ulcers, Annual ER visits, Annual hospitalization rate, Annual physician visits, employment rate.	
Scovil et al. (2019) Canada Pre-Post Level 4 $N_{Initial}$=2371 N_{Final}=2371	**Population:** *Intervention Group* (SCI knowledge mobilization network (SCI-KMN); n=2371): Mean age=53.1±18.3yr; Gender: males=69%, females=31%; Mean time post injury=not reported; Level of injury: paraplegia=54%, tetraplegia=46%; Severity of injury: complete=17%, incomplete=83%. **Intervention:** The SCI Knowledge Mobilization Network (SCI KMN) selected and implemented 2 pressure injury (PI) prevention best practices at 6 Canadian SCI rehabilitation centers: (1) completing a comprehensive PI risk assessment comprised of a structured risk assessment instrument followed by an individualized, interprofessional risk factor determination and prevention plan; and (2) providing structured and individualized PI prevention patient education. Active Implementation Frameworks provided a systematic approach to best practice implementation. Outcomes were measured at initial stage and full implementation stage. **Outcome Measures:** Pressure injury incidence and prevalence, Completion rate for risk assessment instrument (Spinal Cord Injury Pressure Ulcer Scale, Burden).	1. The change in PI incidence pre- to post-implementation was not statistically significant for Pis of any stage (p>.05) or Pis stage 2 or greater (p>.05).
Evardone et al. (2018) United States Case Series Level 4	**Population:** *Intervention Group* Mean age=52.28±18.73; Gender: males=97.2%, females=2.8%; Mean time post injury=Chronic (>3mo); Level of injury: tetraplegia=54.7%, paraplegia=45.3%;	1. No significant relationship between class attendance and SWLS, CHART-SF and SF-8 was observed (p>.05).

$N_{Initial}$=106 N_{Final}=106	Severity of injury: incomplete=66%, complete=34%. **Intervention:** Retrospective review of medical records. Participants received an education course (on topics such as bladder and bowel management, deep vein thrombosis, sexuality, preventing further injury, health etc). Data from discharge and/ or 90 days following discharge were analyzed. Instructors used a variety of tools to promote learning and retention of information, including use of handouts, anatomical models, videos, and discussion among participants. **Outcome Measures:** Satisfaction with Life Survey (SWLS), Craig Handicap and Assessment Reporting Technique-Short Form (CHART-SF), Short Form Health Survey (SF-8), number of Pressure ulcers and Urinary Tract Infections (UTI) developed.	2. Skin care class attendance was a significant predictor of fewer pressure ulcers during rehabilitation (p<.05). 3. The number of completed classes significantly predicted a higher number of UTI during rehabilitation (p<.05).
Hospital Readmission and Overall Secondary Complications		
Gassaway et al. (2017) United States RCT PEDro=6 Level 1b $N_{Initial}$=194 N_{Final}=167	**Population:** *Intervention group* (Intensive peer mentoring, n=77): Mean age=35.38±15.83yr; Gender: males=81%, females=19%; Level of injury: tetraplegia= 36, paraplegia=41; Severity of injury=not reported. *Control group* (Traditional peer support, n=81): Mean age=39.38±15.28yr; Gender: males=73%, females=27%; Level of injury: tetraplegia=41, paraplegia=40, Severity of injury=not reported. **Intervention:** Participants were randomized either into the intensive peer mentoring or the traditional peer support group. Participants in the peer mentoring group had weekly meetings with a peer mentor during the inpatient stay and 90 days post discharge. Participants in the control group received traditional peer support. Outcome measures were assessed at 3-, 30-, 90- and 180-days post discharge. **Outcome Measures:** Adapted General Self-Efficacy Scale (GSES), project-developed community integration self-efficacy scale, and patient-reported unplanned rehospitalizations.	1. Combined results for the GSES (adapted) and the project-developed community integration items showed significantly higher self-efficacy for the intervention group (p=0.006). 2. There were statistically significant differences between groups for cumulative days re-hospitalized at all time points (p<0.018). 3. A medium effect size (0.48) was observed for intervention on self-efficacy scores and for change in self-efficacy (0.47) at 180 days post discharge. 4. A small effect size of intervention was found on hospital readmissions, (0.21 for percent of patients hospitalized and 0.22 for the number of days hospitalized) at 180 days post discharge.

Mackelprang et al. (2016) USA RCT PEDro=4 Level 2 $N_{Initial}$=168 N_{Final}=164	**Population:** *Intervention group* (telephone counseling and usual care; n=85): Mean age=Not Reported; Gender: males=70, females=15; Mean time post injury=Not Reported; Level of injury: cervical=31, non cervical=54; Severity of injury: AIS A-C=55, AIS D=30. *Control group* (usual care; n=83): Mean age=Not Reported; Gender: males=63, females=20; Mean time post injury=Not Reported; Level of injury: cervical=25, non cervical=58; Severity of injury: AIS A-C: 48; AIS D=34. **Intervention:** Participants were randomized into telephone counselling with usual care (TC+care), or usual care alone. TC+care participated in phone calls from peers to provide education, problem-solving, referral resources, and support. These calls (30-45min/call) took place at days 1 and 2, weeks 1, 2, 4 and 6, and months 2, 3, 4, 6, and 8.Control group received indicated referrals and treatment, with no phone calls from peers. Outcomes were measured at baseline and 3, 6, 9, and 12 months. **Outcome Measures:** Cornell Services Index; Patient Health Questionnaire-9 (PHQ-9); EuroQol thermometer; single item from the Medical Outcomes Study 36-Item Short-Form Health Survey; Craig Handicap Assessment; Reporting Technique Short Form	1. There were no significant differences between groups in the composite measure of health care utilization and medical complications, nor in psychosocial measures. 2. The control group reported fewer emergency department visits than the intervention group, but not significantly so.
Rowland et al. (2006) United States RCT PEDro=4 Level 2 $N_{Initial}$=71 N_{Final}=67	**Population:** Mean age: 35.42 yrs; Gender: males = 49, females = 18; Time post injury = not reported; Level of injury: paraplegia = 26, quadriplegia = 41; Severity of injury: complete = 20, incomplete = 21. **Intervention:** Participants were randomized to either an experimental condition in which they received computerized feedback and one-on-one consultations based on responses to an online knowledge and behavioral questionnaire, or to a control condition in which they received no feedback until the study's completion. One yr after the initial assessment, the online questionnaire was re-administered to all participants as a post-test. Researchers telephoned participants 3x between the pre- and post-test assessments to administer phone	1. There were no significant differences between groups for secondary condition development. 2. At 1yr, knowledge of pressure ulcer, UTIs, and weight gain were higher in experimental group than the controls.

	surveys probing secondary condition development. **Outcome Measures:** Knowledge Assessment, Secondary Condition Occurrence (Pressure Sores, UTIs, Pain, Weight Gain, Depression).	
Zemper et al. (2003) United States RCT PEDro=4 Level 2 $N_{Initial}$=43 N_{Final}=43	**Population:** *Intervention Group* (Well on Wheels (WOW) program; n=23): Mean age=44 (23-74)yr; Gender: males=14, females=9; Mean time post injury=13 (2-34)yr; Level of injury: paraplegia=10, tetraplegia=7, ambulatory=3; Severity of injury: complete=17, incomplete=3. *Control group* (no intervention; n=20): Mean age=55 (22-80)yr; Gender: males=16, females=4; Mean time post injury=16 (1-49)yr; Level of injury: paraplegia=8, tetraplegia=10, ambulatory=5; Severity of injury: complete=11, incomplete=4. **Intervention:** Participants were randomly assigned to intervention or control groups. The intervention group attended wellness workshops (4hr, 6x over 3mo), covering physical activity, nutrition, lifestyle management, and prevention of secondary conditions. Outcomes were assessed at baseline, 2wk and 4mo after completion of the program. **Outcome Measures:** Self-Rated Abilities for Health Practices Scale (SAHP), Physical Activities with Disability (PADS) Questionnaire, Health Promoting Lifestyle Profile-II (HPLP), Secondary Condition Frequency and Severity, BMI, Cholesterol, Physical Fitness.	1. There was no significant between group differences in any of the outcome measures (p>.05). 2. There was no significant withing group changes in the control group (p>.05). 3. Within group changes in the intervention group from baseline to the 4mo follow-up showed significant improvements in the SAHP scale (p<.05), the HPLP-II total score and health responsibility subscale (p<.001), the HPLP-II stress management subscale (p=.001), the perceived stress (p<.05), the HPLP-II physical activity subscale (p=.001). 4. The PADS total activity scale and subscales showed no significant change for either the intervention group or the control group over time (p>.05). 5. Number and severity of secondary conditions at follow-up were significantly lower than baseline (p<.001) in the intervention group. 6. Physical endurance or aerobic capacity showed a positive trend but not significant in intervention group over time (p>.05). 7. BMI and total cholesterol values increased slightly for both groups but showed no significant differences between or within the groups (p>.05).

Jones et al. (2021) USA Cohort Level 2 $N_{Initial}$=1117 N_{Final}=799	**Population:** Mean age=38.2 ±16.8yr; Gender: males=77%, females=23%; Mean time post injury: not reported, Level of injury: not reported, Severity of injury: not reported. **Intervention:** Participants took part in one-to-one peer mentoring and peer-led self-management classes. The mentor met with the participant (in person or by phone) weekly during the inpatient stay and up to 90d post-discharge. The peer-led education program consisted of four 1-h classes focused on self-management of conditions associated with SCI bowel, bladder, and skin management, and special concerns (e.g. respiratory, cardiovascular). In addition, peer mentor demonstrated self-management activities (e.g. wheelchair skills) or to join patients on community outings, upon request of the therapy team. Patients were also encouraged to join the SCI Peers Facebook page with monitored forums on various topics related to self-management and life after SCI. Outcome measures were assessed baseline, 30d, 90d, and 180d post discharge. **Outcome Measures:** Unplanned hospital readmissions, General Self-Efficacy scale (GSE), Patient Health Questionnaire (PHQ-8), Satisfaction with Life Scale (SWLS)	1. After implementing the peer interventions, a significant decrease in both level (p=.002) and slope (p=.048) of number of patients readmitted and level only of unplanned hospital days 30-days post-discharge (p<.001) were observed. 2. A statistically significant relationship was noted between one-to-one peer mentoring and days re-hospitalized (p=.01); the relationship between peer mentoring and number of patients with readmissions almost achieved significance (p=.050). 3. There was no significant relationship between peer-led classes attended and either measure of readmissions (p=.500 for number of patients and .822 for number of days). 4. Using a subset of participants with data collected at the 90- and 180-day evaluation periods (n=799), OLS regressions indicated a significant relationship between self-efficacy (GSE) and hospital readmissions at all three evaluation time points (P< .001). No significant associations were found with PHQ-8, SWLS, or peer exposure. 5. Significant differences in days hospitalized (p=.047) are noted between the low exposure group (<7 peer contacts) and high exposure group (7 peer contacts). At 30 days post discharge. At 180 days post discharge, there are significant differences in cumulative days re-

		hospitalized (p=.023) and in GSE (p< .001). No differences are noted in PHQ-8 or SWLS. 6. Patients with paraplegia exposed to > 7 peer contacts demonstrated greater improvement in GSE 180 days post-discharge (p=.034). Patients with quadriplegia who received > 7 peer contacts also experienced greater improvement in GSE (p=.005), and fewer days readmitted within 30 days of discharge (p=.050).
Craig et al. (1999) Australia Cohort Level 2 $N_{Initial}$=69 N_{Final}=58	**Population:** *Intervention Group* (group cognitive behaviour therapy (CBT); n=28): Mean age=31±11.8yr; Gender: males=23, females=5; Mean time post injury≥2yr; Level of injury: paraplegia=46%, quadriplegia=54%; Severity of injury: complete=71%, incomplete=21%. *Control Group* (traditional rehabilitation; n=41): Mean age=not reported; Gender: not reported; Mean time post injury≥1yr; Level of injury: paraplegia=51%, quadriplegia=49%; Severity of injury: complete=68%, incomplete=32%. **Intervention:** The study involved the long-term assessment of participants who previously participated in a PCT and received either CBT or Traditional Rehabilitation, with the aim of reporting the effectiveness of early CBT after 2 years of follow-up. The participants received 1.5-2-hr weekly group sessions over 10wks. The outcomes were reported just at the 2yr follow-up. **Outcome Measures:** Re-admission Rate, Drug Usage, Social Discrimination, Adjustment to Live with SCI.	1. Treatment group had fewer re-admissions than the controls (p<.05). 2. The controls were found to have a significantly higher frequency of self-reported drug usage compared with the treatment group (p<.05). 3. There were no differences between the groups in feeling of social discrimination. 4. The participants in treatment group had higher levels of adjustment to live with SCI (p<.01).
Ljungberg et al. (2011) United States Pre-Post Level 4 $N_{Initial}$=37 N_{Final}=24	**Population:** Mentor (n=37): Mean age=35.38yr; Gender: males=28, females=9; Mean time post injury=1yr; Level of injury: paraplegia=23, tetraplegia=14; Severity of injury: not reported. **Intervention:** Mentees participated in a 1yr spinal cord injury peer-mentoring program. Peer mentors met with their assigned	1. Between mo 0 (programme entry) and mo 6, 67% of the subjects increased their GSEF score, but the result was not statistically significant. However, there were significant differences in the level of GSEF between mentees with

	participants regularly during inpatient care and on discharge (1x/wk for the first 3mo, 1x/2wk for the next 3mo unless more interaction was needed, 1x/mo for the last 6mo). During the mentor-mentee contact, the mentor monitored the health status of mentees, provided information, demonstrated prevention strategies and initiated referrals to healthcare professionals when needed. Outcome measures were assessed at baseline, 6mo, and post intervention. The Generalized Perceived Self-Efficacy Scale (GSEF) was assessed at baseline and 6mo; the medical complications tracking form (MCTF) was completed by peer mentors at each contact with their mentees; the interview on program satisfaction was conducted at 6mo. **Outcome Measures:** Generalized Perceived Self-Efficacy Scale (GSEF), medical complications tracking form (MCTF) assessing incidences of skin breakdown, urinary tract infections, respiratory complications, depression/anxiety, neuropathic pain, rehospitalisation, and physician/therapy visits, in-depth interview assessing program satisfaction.	lower education (9-12th grade) and higher education (>12th grade) (p=.013). Results for other subgroups were not statistically significant. 2. Rates of secondary medical complications and doctor visits captured on the medical tracking complication form decreased significantly between 0-6 mo and 7-12 mo: urinary tract infection (UTI) (p=.001), pain (p=.001), depression (p =.004), pressure ulcers (p =.046), hospitalisations (p=.002) and ER visits (p =.004). 3. There were no significant differences in the incidence of respiratory complications, or anxiety between the first and second half of the intervention.

Discussion

Three studies investigated the impact of intermittent catheterization education following SCI and found conflicting results. Huang et al. (2019) reported decreased UTI incidence and recovery time following UTI, while Zanollo et al. (2015) and Wilde et al. (2016) both found few practical improvements following intervention, with no decrease in continence. Other interventions explored included education programs and workshops (Cardenas et al. 2004; Hagglund et al. 2005; Evardone et al. 2018) as well as an RCT investigating self-management smart phone application (Kryger et al. 2016). The education programs yielded conflicting results regarding UTI incidence, while the smart phone application shows promise as a tool to provide education and bladder management following SCI.

Eight studies investigated the impact of self management education and counselling interventions on skin management to prevent pressure ulcers following SCI, with the majority showing no effect on pressure ulcer severity or incidence. Exceptions include an RCT of virtual educational modules which showed no effect on the overall intervention group, but significantly reduced pressure ulcer incidence in women (Houlihan et al. 2013). Rintala et al. (2008) found that an initial skin management education program followed by monthly follow-up by a health care provider yielded decreased pressure ulcer recurrence, with Evardone et al. (2018) similarly finding that an education program decreases pressure ulcer incidence. While the type and quality

of education would vary between intervention, notably Evardone et al. (2018) used a broad range of materials to convey concepts, and Houlihan et al. (2013) and Rintala et al. (2008) included regular contact by health care professionals in their models, which may have improved their outcomes. Further research should explore these combined models of patient education.

Seven studies investigated the effects of peer mentoring and counselling on the rates of secondary complications or hospital readmission. While studies investigating counselling showed conflicting results, peer mentoring decreased hospital readmission in an RCT, cohort and pre-post study (Gassaway et al. 2017; Jones et al. 2021; Ljungberg et al. 2011).

Conclusion

There is level 1b evidence (Huang et al. 2019) that an intermittent catheterization education group decreases UTI incidence and decreases the recovery time following UTI.

There is level 1b evidence (Kryger et al. 2016) that a mobile self-management app decreases UTI incidence.

There is level 2 evidence (Cardenas et al. 2004) that an education program does not decrease UTI incidence, number of symptom reports or antibiotic treatments given.

There is level 2 evidence (Hagglund et al. 2005) that a personal assistive device training workshop decreases UTI incidence.

There is level 2 evidence (Zanollo et al. 2015) that an intermittent catheterization education program does not improve continence.

There is level 4 evidence (Evardone et al. 2018) that attending an education program was associated with lower UTI incidence.

There is level 4 evidence (Wilde et al. 2016) that a virtual based intermittent catheter education program did not improve UTI incidence, pain or continence.

There is level 1b evidence (Arora et al. 2017) a virtually administered advice program does not improve pressure sore size or depth but may improve healing.

There is level 2 evidence (Kim and Cho et al. 2017) that an education and counselling program does not improve pressure ulcer incidence.

There is level 1b evidence (Guihan et al. 2014) that a virtually administered counselling program does not improve pressure ulcer incidence or characteristics or the number of doctor's visits for skin management.

There is level 1b evidence (Houlihan et al. 2013) that a virtual module decreases pressure ulcer incidence in women only and does not impact the number of doctor's visits for skin management.

There is level 2 evidence (Rintala et al. 2008) that monthly follow up regarding skin status with skin management education increases pressure ulcer recurrence time and decreases pressure ulcer recurrence.

There is level 2 evidence (Phillips et al. 1999) that virtual modules, counselling, or a home visit had no difference in pressure ulcer incidence.

There is level 4 evidence (Wolfe et al. 2019) that a pressure injury risk assessment and action plan did not improve injury incidence.

There is level 4 evidence (Evardone et al. 2018) that attending an education program was associated with lower pressure ulcer incidence.

There is level 1b evidence (Gassaway et al. 2017) that peer mentoring decreases hospital readmission.

There is level 2 evidence (Mackelprang et al. 2016) that virtual counselling does not decrease the incidence doctor's visits or secondary complications.

There is level 2 evidence (Rowland et al. 2016) that personalized counselling based on questionnaire results does not decrease the incidence of secondary complications.

There is level 2 evidence (Zemper et al. 2003) that a wellness workshop may decrease incidence of secondary complications.

There is level 2 evidence (Jones et al. 2021) that peer mentoring decreases hospital readmission.

There is level 2 evidence (Craig et al. 1999) that cognitive behavioral therapy decreases hospital readmission.

There is level 4 evidence (Ljungberg et al. 2011) that peer mentoring decreases incidence of secondary complications and hospital readmissions.

Key Points

There is conflicting evidence regarding the efficacy of education programs at preventing UTI.

Mobile self-management phone applications may decrease UTI incidence. Further research is required.

Pressure ulcer management and education programs do not decrease pressure ulcer incidence or severity.

There is moderate evidence that peer mentoring decreases incidence of hospital readmission.

There is moderate evidence that virtual counselling does not decrease the incidence of secondary complications.

2.3 Pain Management

According to the International Spinal Cord Pain Classification, pain following spinal cord injury can be subdivided into four categories. These include nociceptive pain, which includes musculoskeletal and visceral pain, neuropathic pain, which includes spinal cord and peripheral nerve pain, other pain which incorporates chronic pain syndromes and irritable bowel, and finally unknown pain. (Bryce et al. 2012) A meta-analysis of studies with participants with chronic pain following SCI estimates the overall prevalence of chronic pain to be approximately 68%, with 58% experience neuropathic pain and 45% experiencing nociceptive pain. (Hunt et al. 2021) Self-management strategies involving CBT, exercise and education programs have been found effective in chronic back pain and cancer pain populations. (Du et al. 2017; Zhang et al. 2023). Studies investigating pain management strategies following SCI are presented in Table 3.

Table 3. Pain Management

Author Year Country Research Design Score Total Sample Size	Methods	Outcome
Cardenas et al. (2020) United States RCT PEDro=6 Level 1b $N_{Initial}$=32 N_{Final}=25	**Population:** *Intervention Group* (home exercise program (HEP); n=17): Mean age=44.1±10.8yr; Gender: males=13, females=4; Mean time post injury=17.8±12.9yr; Level of injury: paraplegia=13, tetraplegia=4; Severity of injury: complete=11, incomplete=2, unknown=4. *Control Group* (education only; n=15): Mean age=45.7±14.5yr; Gender: males=13, females=2; Mean time post injury=21.3±14.7yr; Level of injury: paraplegia=8, tetraplegia=6, unknown=1; Severity of injury: complete=10, incomplete=1, unknown=4. **Intervention:** The home exercise program included stretching and strengthening exercises and, after one-to-one instruction by a physical therapist regarding the proper performance of exercises, subjects were instructed to perform them 3d/wk using therapy bands and hand weights. The Control group received printed materials on the shoulder and viewed a 1h video of shoulder anatomy, mechanisms of injury, and general information for dealing with shoulder pain, but did not contain	1. Significant baseline differences were found between the two groups for the DASH, the shoulder-specific DASH, and the MPI-Interference subscale, which were all higher (worse) in the HEP group compared to the control group (p<.05). 2. The HEP group had a significantly greater improvement in non-dominant PESS scores immediately post-intervention, (p=.026) and significantly greater perceived improvements in shoulder condition at the 4-week post-intervention follow-up (PGIC scale, p=.015). 3. Concerning adverse events, two participants reported mild to moderate increases in shoulder pain that was present during the first one to two weeks, but both reported resolution of this symptom thereafter. One participant also reported a moderate exacerbation of epicondylitis

	recommendations for specific shoulder exercises. Outcome measures were assessed pre and post intervention as well as at 4wk follow-up. **Outcome Measures:** Physical Examination of the Shoulder Scale (PESS), Ultrasound Shoulder Pathology Rating Scale (USPRS), Quantitative Ultrasound (QUS), Numerical Rating Scale for Pain (NRS), Disabilities of the Arm, Shoulder, and Hand (DASH), Interference Subscale of Multidimensional Pain Inventory, Wheelchair User's Shoulder Pain Index (WUSPI), Patient Global Impression of Change (PGIC).	when weight was increased after the first four weeks.
Burke et al. (2019) Ireland RCT PEDro=6 Level 1b $N_{Initial}$=69 N_{Final}=68	**Population:** *Intervention Group* (internet delivered cognitive behavioural pain management program (CBT-PMP); n=35): Mean age=50±12.3yr; Gender: males=25, females=10; Mean time post injury=16±11.8yr; Level of injury: cervical=10, thoracic-13, lumbar=7, unknown=8; Severity of injury: AIS A=1, AIS B=0, AIS C=2, AIS D=3, unknown=29. *Control group* (usual care; n=34): Mean age=52±13.8yr; Gender: males=27, females=7; Mean time post injury=16±12.6yr; Level of injury: cervical=7, thoracic=17, lumbar=7, unknown=3; Severity of injury: AIS A=3, AIS B=2, AIS C=1, AIS D=2, unknown=26. **Intervention:** Participants were randomized to receive internet delivered cognitive behavioral therapy pain management program (CBT-PMP) SPIRE (1 module and assignment/wk for 6wk) or the control group (continued to manage pain as per usual). Outcomes measures were assessed at baseline, post-intervention 6wk, and 3mo post-program completion. **Outcome Measures:** World Health Organization Quality of Life Bref (WHOQOL-BREF), International spinal cord injury quality of life basic data set, International Spinal Cord Injury Pain Basic Data Set (ISCIPBDS, v1), Douleur Neuropathique en 4 Questions (DN4) interview, Chronic Pain Acceptance Questionnaire (CPAQ-8), Brief Pain	1. No significant difference between intervention and control groups for WHOQOL-BREF and ISCI-QOLBDS (p>.05). 2. No significant group X time interaction for the HADS questionnaire, PSQI for sleep or CPAQ for pain acceptance (p>.05 for all). 3. Significant differences between groups in overall pain (p=0.016), worst pain (p=0.004), BPI interference subscale (p=0.031).

	Inventory (BPI) Interference subscale, Hospital Anxiety and Depression Scale (HADS), Pittsburgh Sleep Quality Index (PSQI)	
Hearn & Finlay (2018) United Kingdom RCT PEDro=5 Level 2 $N_{Initial}$=67 N_{Final}=52	**Population:** *Intervention Group* (online mindfulness intervention; n=36): Mean age= 43.8±8.7yr; Gender: males=17, females=19; Time post injury (range)=3-11yr; Level of injury: cervical=12, thoracic-22, lumbar=2, unknown=8; Severity of injury: AIS A=3, AIS B=13, AIS C=9, AIS D=11. *Control group* (internet-delivered psychoeducation; n=31): Mean age=45.2±12.2yr; Gender: males=14, females=17; Time post injury (range)=3-6yr; Level of injury: cervical=13, thoracic=15, lumbar=3, unknown=3; Severity of injury: AIS A=6, AIS B=4, AIS C=10, AIS D=11. **Intervention:** Participants were randomly allocated to an 8wk online mindfulness intervention or to internet-delivered psychoeducation. Online mindfulness participants received two 10-min audio-guided meditations each day to listen and complete 6d/wk for 8wks. Psychoeducation participants received a weekly for 8wks including educational content on SCI and chronic pain in lay terminology to read at their convenience. Outcomes were assessed before (T1), at completion of, (T2), and 3 months following the intervention (T3). **Outcome Measures:** Hospital Anxiety and Depression Scale (HADS), Quality of Life (WHOQoL-BREF), Five Facet Mindfulness Questionnaire (FFMQ), Numerical rating scale (NRS), Pain Catastrophizing Scale, Retention rates.	1. At T2, significant improvements in favour of mindfulness training were found for depression (p=.002), anxiety (p=.009), pain unpleasantness (p=.009), and pain catastrophizing (p=.020). 2. Significant differences at T2 were also noted for total FFMQ score (p=.000), and the subscales of mindfulness facets of acting with awareness (p=.001), describing (p=.028), non-judging (p=.047), and non-reactivity to inner experience (p=.004). 3. At T2, there were no significant group differences for any aspect of QoL, pain intensity, and mindfulness facets of observing and nonjudging. At T3, there were significant group differences for depression (p=.001), anxiety (p=.023), and pain catastrophizing (p=.001) in favour of the mindfulness program, and no differences in other outcomes between the groups.
Rice et al. (2014) USA RCT PEDro=5 Level=2 $N_{Initial}$=93 N_{Final}=37	**Population:** *Intervention group* (CPG recommendations; n=12); Mean Age=33.2±14.3yr; Gender: males=9, females=3; Mean time post injury=not reported; Level of injury: paraplegia=12, tetraplegia=0; Severity of injury: AIS A=6, AIS B=1, AIS C=3, AIS D=1, Unknown=15. *Control group* (standard care; n=25); Mean age=40.8±16.4yr; Gender: males=19, females=6; Mean time post injury=not reported; Level of Injury:	1. No significant interaction, between-subject differences, or within-subject differences were found between study groups in terms of MWC set-up or wheelchair selection. 2. The intervention group propelled with a significantly (p=.02) lower push frequency than the SCG on tile. The intervention group had lower

	Tetraplegia=12, Paraplegia=3; Severity of injury: AIS A=14, AIS B=3, AIS C=5, AIS D=1, Unknown=2. **Intervention:** Participants were randomized to receive standard care (SCG), or an education protocol following the CPG recommendations. Participants in the intervention group received instructions from a physical therapist and an34ccupantional therapist who followed a strict education protocol on upper-limb preservation. Outcome measures were assessed at discharge, at 6mo, and at 1yr post discharge. **Outcome Measures:** Numeric Rating Scale (NRS) for pain, Wheelchair Users Shoulder Pain Index (WUSPI).	push frequency than the SCG. (p=0.01) On the ramp, the intervention group showed a significantly greater push length (p=.03). 3. No significant differences were found between NRS or WUSPI scores for pain. 4. A simple main effect trend (p=.07) found that the intervention group had an increase in the CHART physical subsection scores between 6mo visit and 1yr visit.
NorrbrinkBudh et al. (2006) Sweden PCT Level 2 $N_{Initial}$=38 N_{Final}=38	**Population:** *Intervention Group* (pain management program; n=27): Mean age=53.2±12.6yr; Gender: males=9, females=18; Mean time post injury=9.9±12.8yr; Level of injury: cervical=15, thoracic-6, lumbar=6, unknown=8; Severity of injury: AIS A=4, AIS C=3, AIS D=19, AIS E=1. *Control group* (No treatment; n=11): Mean age=49.9±12.3yr; Gender: males=5, females=6; Mean time post injury=15.8±9.3yr; Level of injury: cervical=4, thoracic=7; Severity of injury: AIS A=6, AIS D=5. **Intervention:** Participants were SCI adults with neuropathic pain. Participants were assigned either into pain management intervention group or control group. A comprehensive multidisciplinary pain management program was developed, including 1.5hr education, 1.5hr of CBT, 1hr of relaxation/stretching, and 1hr of body awareness (5hr/d, 2d/wk, 10wks, total of 20 sessions). Outcomes were assessed at baseline, post intervention (10wks), and at 3,6 and 12 mo follow-ups. **Outcome Measures:** Borg CR10 Scale (pain intensity and pain unpleasantness), Quality of Sleep, Nottingham Health Profile (NHP), Life Satisfaction Questionnaire (LiSat-9), Hospital Anxiety and Depression (HAD);	1. There was a non-significant decrease in anxiety (p=.12) and depression (p=.54), and a tendency toward better quality sleep (p=.54) in the treatment group from baseline to 12mo follow-up. 2. Pain intensities and unpleasantness, health related QoL, and life satisfaction showed no statistical evidence for systematic changes over time. 3. Emotional reaction subscale of NHP showed significant improvement from baseline to 12mo (p=.01). 4. Depression significant improved in the treatment group compared to the control group over time. 5. Sense of coherence significantly decreased over time in the controls compared to the treatment group. 6. The changes in pain intensity, pain unpleasantness, life satisfaction, and health related QoL were similar for both groups. 7. At 12mo, using analgesics decreased in treatment group

	Sense of Coherence (SOC), Use of the healthcare system rate.	and remained unchanged in controls. 8. Rate of visits to healthcare personnel decreased in both groups, and it was significant for visits to physicians in both treatment (p=.03) and control (p=.02) groups over time, with no between-group differences.
Burns et al. (2013) Canada Pre-Post Level 4 $N_{Initial}$=22 N_{Final}=17	**Population:** Mean age=48±13yr; Gender: males=11, females=6; Mean time post injury=8.9±11yr; Level of injury: paraplegia=9, tetraplegia=8; Severity of injury: complete=3, incomplete=14. **Intervention:** Participants took part in an interdisciplinary pain program consisting of sessions (2.5hr, 1x/2wk for 10wk) with patient education on chronic pain and associated pain mechanisms, cognitive behavioral therapy, self-management strategies, group discussions and activities, and either exercise or guided relaxation at the end of each session. Outcome measures were assessed at baseline, at the end of the 10wk program, and at 3 and 12mo follow-up. **Outcome Measures**: Multidimensional pain inventory SCI (MPI-SCI), Coping inventory of Stressful Situations (CISS), Pain Stage s of Change Questionnaire (PSOCQ), Life Satisfaction questionnaire (LISAT-11).	1. The difference for the global item of the LiSat-11 approached significance (P<.069) during the follow-up period. 2. There were significant changes for the action and maintenance subscales of the PSOCQ after participants completed the program (p=.002 and p=.003 respectively). 3. Rating of pain severity did not change from before or after the intervention or at 12 months after participation. 4. There were significant changes for the Life Control (p=.014) at post intervention and the Life Interference subscale of MPI-SCI at 12mo (p=.010). 5. No significant changes were found for any of the CISS subscales.
Heutink et al. (2013) Netherlands Pre-Post Level 4 $N_{Initial}$=47 N_{Final}=47	**Population:** *Intervention Group* (Cognitive Behavior Therapy (CBT); n=47): Mean Age=58.0±11.8yr; Gender: males=31, females=16; Median time post injury=7.3, 1.4-23.7yr (range); Level of Injury: tetraplegic=16, paraplegic=31; Severity of Injury: complete=28, incomplete=19. **Intervention:** Participants took part in a CBT program consisting of educational, cognitive, and behavioural elements targeted at coping with chronic neuropathic spinal cord injury pain. The program included reading texts and homework assignments on different models of pain (3hr, 10sessions over 10wk). Outcome measures were assessed at baseline, after the 10wk	1. The median (IQR) pain intensity scores and the pain-related disability scores on the CPG were 70 (58.3-76.7) and 50 (23.3-63.3) at baseline, and 70 (56.7-80.0; p=.104) and 40 (16.7-66.7; p=.088) at 3 months follow-up, respectively. 2. Favorable changes in pain coping strategies and pain cognitions between baseline and follow-up were found for 6 out of 13 scales, including higher measures of the pain transformation subscale (p=.038), active coping subtotal score (p=.044), Optimism (p=.015) and lower scores in the worrying subscale (p=.045),

	period, and at follow-up 3wk later (13wk). **Outcome Measures:** Pain Type, Numeric Rating Scale (NRS), Pain Coping Inventory (PCI), Pain Cognition List-2003 (PCL), Chronic Pain Grade (CPG).	catastrophizing subscale (p=.003), and reliance on health care (p=.002). 3. No significant correlations were found between changes in coping strategies and cognitions and changes in pain intensity. 4. A higher baseline score for Reliance on health care was associated with a larger decrease in pain intensity and pain-related disability between baseline and follow-up. 5. Catastrophizing and restrictions were significantly correlated with favorable changes in pain-related disability.

Discussion

Of the seven studies investigating pain following SCI, four included cognitive behavioral interventions with conflicting results. An RCT (Burke et al. 2019) found CBT improved pain acceptance and pain inventory scores but showed no improvement in symptoms of anxiety or depression. However, a PCT (Norrbrinkbudh et al. 2006) found the inverse, with improved symptoms of anxiety and depression and decreased pain intensity. While both studies incorporated the Hospital Anxiety and Depression Score, different outcomes measures were used to assess pain, which may account for some variation between study results. Other studies investigated the use of home-exercise (Cardenas et al. 2020), mindfulness (Hearn and Finlay et al. 2018) and wheel-chair skills training (Rice et al. 2014). Both home-exercise and mindfulness interventions showed promise at decreasing pain, and further research should be conducted in these fields.

Conclusion

There is level 1b evidence (Cardenas et al. 2020) that a home exercise program improves shoulder pain and function.

There is level 1b evidence (Burke et al. 2019) that virtually delivered cognitive behavioral therapy improves pain but not symptoms of anxiety or depression.

There is level 2 evidence (Hearn and Finlay et al. 2018) that virtually delivered mindfulness improves symptoms of anxiety, depression, and pain.

There is level 2 evidence (Rice et al. 2014) that a wheelchair skills education program required a lower push frequency on various terrain but did not improve pain.

There is level 2 evidence (NorrbrinkBudh et al. 2006) that a pain management program including cognitive behavioral therapy improves symptoms of depression and decreases analgesic use but does not improve perception of pain.

There is level 4 evidence Burns et al. 2013) that a pain management program including education and cognitive behavioral therapy does not improve long-term pain.

There is level 4 evidence (Heutink et al. 2013) that a cognitive behavioral therapy program does not improve pain intensity or related disability.

Key Points

There is conflicting evidence regarding the efficacy of cognitive behavioral therapy at improving pain.

Home-based exercise or mindfulness programs may improve pain following SCI. More research is required.

2.4 Sexual Function Management

Sexual disfunction following SCI depends on the severity and level of injury. Complications can range from decreased arousal resulting in erectile disfunction in men or decreased lubrication in women, anorgasmia, ejaculatory disfunction, or pain during intercourse (Krassioukov & Elliot 2017). Changes in sexual function following SCI can cause strain on relationships and cause emotional distress (Barrett et al. 2024) A structured interview of people with SCI following rehabilitation in the United Kingdom exposed a lack of counseling related to sexual education, and a desire for more education (Nevin and Melby 2022). The non-medical management of sexual function is composed of individual, group or peer led education sessions of many modalities (Bryant et al. 2022). Reviewed studies presenting sexual function management following SCI are presented in Table 4.

Table 4. Sexual Function Management

Author Year Country Research Design Score Total Sample Size	Methods	Outcome
Zarei et al. (2020) Iran RCT PEDro=7 Level 1b $N_{Initial}$=70 N_{Final}=70	**Population:** *Intervention Group* (sexual educational mobile app; n=35): Mean age=36.7±39.5yr; Gender: males=35, females=0; Mean time post injury=47.8±50.5mo; Level of injury:	1. The intervention group showed significantly better sexual adjustment and Sexual satisfaction than controls from baseline to 4wk and 8wk (p<.001).

	tetraplegia=35; Severity of injury: AIS A=14, AIS B=12, AIS C=6, AIS D=3. *Control group* (no intervention; n=35): Mean age=5.3±37.7yr; Gender: males=35, females=0; Mean time post injury=5.5±60.8mo; Level of injury: tetraplegia=35; Severity of injury: AIS A=12, AIS B=10, AIS C=8, AIS D=5. **Intervention:** Married men with tetraplegic SCI were randomized either into intervention group to access a sexo-marital education mobile application at any time for 8wk, or the control group with no access to the app during this period. Outcomes were assessed at baseline, 4wk and 8wk post intervention. **Outcome Measures:** Sexual adjustment questionnaire (SAQ), Larson's sexual-satisfaction scale, Spinner's marital adjustment scale, ENRICH marital satisfaction scale.	2. There was no statistically significant difference for increase in marital adjustment between groups at 4wk ($p<.16$) and 8wk ($p<.25$). 3. Significant between-group differences were found in all domains of marital satisfaction in favour of the intervention group at 4wk and 8wk, including marital satisfaction, communication, conflict resolution, idealistic distortion ($p<.001$).
Rezaei-Fard et al. (2019) Iran RCT PEDro=4 Level 2 $N_{Initial}$=52 N_{Final}=44	**Population:** *Intervention Group* (permission limited information specific suggestion intensive therapy (PLISSIT); n=22): Mean age= 41.77±7.86yr; Gender: males=0, females=22; Mean time post injury=8.36±6.23yr; Level of injury: not reported; Severity of injury: AIS A=6, AIS B=11, AIS C=3, AIS D=2. *Control Group* (routine sexual educational package; n=22): Mean age=39.31±8.81yr; Gender: males=0, females=22; Mean time post injury=8.9±6.72yr; Level of injury: not reported; Severity of injury: AIS A=8, AIS B=9, AIS C=4, AIS D=1. **Intervention:** Participants were randomized either to the PLISSIT intervention group or the control group. Intervention participants received 3 weekly group sessions of PLISSIT, and the controls received routine education. PLISSIT included topics on genital system, related neurophysiology and SCI-related pathology, and suggestions to improve sexual relationships. Outcomes were assessed at baseline, 4wk, and 8wk after the completion of intervention. **Outcome Measures:** Female Sexual Function Index (FSFI).	1. Total FSFI scores significantly increased within intervention group at both follow-up time pointes, and the improvement was significantly higher than the controls ($p=.000$). 2. There were improvements in all FSFI subscales within the intervention group over time, and between the groups in favour of intervention, including sexual desire ($p=.000$), arousal ($p=.000$), lubrication ($p=.003$), orgasm ($p=.001$), sexual satisfaction ($p=.000$) and pain ($p=.048$).

Discussion

Our review yielded two RCTs studying sexual education following SCI. Both were Iranian studies, with one conducted through a smart phone application with married male participants (Zarei et al. 2020), and the other being conducted in in-person groups with female participants (Rezaei-Fard et al. 2019). Both studies demonstrated benefits to sexual education on satisfaction. Further studies should be conducted on expanded and diverse populations.

Conclusion

There is level 1b evidence (Zarei et al. 2020) that smart phone application mediated sexual-marital education improves sexual satisfaction in men.

There is level 2 evidence (Rezaei-Fard et al. 2019) that group-based sexual education improves sexual satisfaction, arousal, lubrication, orgasm, and pain in women.

Key Points

There is moderate evidence that sexual education improves sexual satisfaction following SCI.

2.5 Other Management Strategies

Other educational interventions reviewed include weight management, wheelchair skills, and oral health. People with SCI are at risk of living a more sedentary lifestyle, which alters body composition, creates greater risk for cardiovascular disease, and places a greater emphasis on appropriate nutrition. (Sabour et al. 2018) Similarly, impairments to upper limb function prevent regular brushing, leading to increased plaque on the teeth of people with SCI. Decreased options for transit also lead to less frequent dental appointments, indicating a need for hygiene support. (Yuen 2013) Miscellaneous self-management interventions are presented in Table 5.

Table 5. Miscellaneous Management

Author Year Country Research Design Score Total Sample Size	Methods	Outcome
Weight Management		
Sabour et al. (2018) Iran RCT PEDro=5 Level 2	**Population:** *Intervention group* (nutrition Education program n=30): Mean age=not reported; Gender: males=25, females=5; Mean time post injury=not reported; Level of injury:	1. No significant between-group differences were observed in any outcome measures post-intervention (p>.05).

$N_{Initial}$=57 N_{Final}=57	cervical=3, thoracic=24, lumbar=3; Severity of injury: not reported. *Control group* (no intervention; n=27): Mean age=not reported; Gender: males=20, females=7; Mean time post injury=not reported; Level of injury: cervical=6, thoracic=17, lumbar=4; Severity of injury: not reported. **Intervention:** Participants were randomly assigned to the intervention group, that received a nutrition education program (5x over 7mo) or the control group, that received no intervention. Program sessions included face to face consults and viewing educational movies and slides. Outcome measured at baseline and at 7mo. **Outcome Measures:** Weight, Height, Body Mass index (BMI), Waist circumference, serum lipid profile, fasting plasma glucose (FPG), plasma concentration of Triglyceride (TG), plasma concentration of total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C), estimated physical activity level.	
Wheelchair Skills		
Rice et al. (2014) USA RCT PEDro=5 Level=2 $N_{Initial}$=93 N_{Final}=37	**Population:** *Intervention group* (CPG recommendations; n=12); Mean Age=33.2±14.3yr; Gender: males=9, females=3; Mean time post injury=not reported; Level of injury: paraplegia=12, tetraplegia=0; Severity of injury: AIS A=6, AIS B=1, AIS C=3, AIS D=1, Unknown=15. *Control group* (standard care; n=25); Mean age=40.8±16.4yr; Gender: males=19, females=6; Mean time post injury=not reported; Level of Injury: Tetraplegia=12, Paraplegia=3; Severity of injury: AIS A=14, AIS B=3, AIS C=5, AIS D=1, Unknown=2.	1. No significant interaction, between-subject differences, or within-subject differences were found between study groups in terms of MWC set-up or wheelchair selection. 2. The intervention group propelled with a significantly (p=.02) lower push frequency than the SCG on tile. A simple main effect trend (p=.10) found that the intervention group had lower push frequency than the SCG. On the ramp, the intervention group showed a significantly greater push length (p=.03). 3. No significant differences were found between NRS or WUSPI scores for pain. 4. A simple main effect trend (p=.07) found that the intervention group

	Intervention: Participants were randomized to receive standard care (SCG), or an education protocol following the CPG recommendations. Participants in the intervention group received instructions from a physical therapist and an41ccupantional therapist who followed a strict education protocol on upper-limb preservation. Outcome measures were assessed at discharge, at 6mo, and at 1yr post discharge. **Outcome Measures:** Numeric Rating Scale (NRS) for pain, Wheelchair Users Shoulder Pain Index (WUSPI).	had an increase in the CHART physical subsection scores between 6mo visit and 1yr visit.
Divanoglou et al. (2019) Botswana Pre-Post Level 4 $N_{Initial}$=19 N_{Final}=14	**Population:** *Intervention Group* Mean age=31yr; Gender: males=9, females=10; Mean time post injury= 4yr; Level of injury: paraplegia=15, tetraplegia=2, unknown=2; Severity of injury: incomplete=12, complete=5, unknown=2. **Intervention:** Participants took part in a 7-day peer-based community program, which consisted of 10 training sessions (overall for 16h) on wheelchair skills, cardiorespiratory fitness, strengthening and ball sports. as well as 6 workshop-type sessions. The workshop sessions focused on the following topics: anatomy and sequelae of SCI; bowel and bladder function and management; pressure ulcers; fertility, sexuality and relationships; health promotion and lifestyle; and the Convention on the Rights of Persons with Disabilities. training activities of daily living (ADL) were incorporated in the daily schedule as needed. Outcome measures were assessed at baseline, post-intervention (1wk), and at 5mo follow up. **Outcome Measures:** Spinal Cord Independence Measure self-	1. Participants achieved a higher level of overall physical independence on completion of the program compared to baseline (p=.019, d=0.79) as indicated by their total SCIM-SR scores. These improvements were observed primarily in the mobility subscale where participants achieved an average of 14% improvement in mobility in room and toilet during the program (p=.011, d=0.85), which was further increased to 20% at 5mo follow-up (p=.005, d=0.93). 2. In regard to self-efficacy, there were no changes in the total MSES score, or in two out of three constructs of the scale (i.e. general and social constructs). Participants achieved medium size improvements in the personal function construct of the MSES at completion (p=.004, d=0.76) and at 5mo follow-up (p= .04, d=0.63) as compared to baseline. 3. Participants achieved large improvements in their total QEWS score on completion compared to baseline (p=.001; d=0.86). Participants improved their ability to maintain balance on the back wheels (p=003; d=0.87), ascend and descend a gutter (p=.045; d=0.72) and covered longer distances during a 6-minute push test (p=.003; d=0.71).

	report (SCIM-SR), Queensland Evaluation of Wheelchair Skills practical test (QEWS), Wheelchair Skills Test Questionnaire version 4.3 (WST-Q), Moorong Self-efficacy Scale (MSES), Life Satisfaction Questionnaire-11 (LiSat-11), Leisure Time Physical Activity Questionnaire for people with SCI (LTPAQ-SCI), Utrecht Scale for Evaluation of Rehabilitation Participation (USER-Participation)	4. Participants reported improvements in both their ability and confidence to handle their wheelchair, as indicated by their WST-Q scores. Their wheelchair skills capacity was improved by an average of 11% between baseline and completion (p=.014; d=0.82), and by 13.5% between baseline and follow-up (p=.021; d=0.77). They also reported a 14% increase in their wheelchair skills confidence between baseline and completion (p=.092; d=0.61), which reached a 25% improvement at 5mo follow-up (p=.003; d=0.96). 5. There were no significant differences between baseline and 5mo follow-up with regard to the secondary outcomes (i.e. LiSat-11 and USER-Participation Frequency, USER-Participation Restrictions) (p>.05).
Oral Health		
Yuen (2013) USA Pre-Post Level 4 $N_{Initial}$=8 N_{Final}=8	**Population:** Mean age=49±11yr; Gender: males=7, females=1; Mean time post injury=17±12yr; Level of injury: cervical and tetraplegia=8; Severity of injury: AIS A=5, AIS D=3. **Intervention:** Eight adults with tetraplegia participated in the oral home telecare program consisted of individualized oral hygiene training in the use of assistive devices using personal computer-based video conferencing between each participant and an occupational therapist. Training was conducted on an average of five 15-30min sessions over 3mo. Outcomes were assessed at baseline, 6mo and 12mo. **Outcome Measures**: Gingival health assessment using the Lo-Silness gingival index (LSGI), oral home telecare questionnaire (OHTQ).	1. LSGI scores showed improvement in gingival health at 6mo (p=.03) and 12mo (p=.04) follow-up. 2. Oral hygiene behaviors showed an increase in frequency of daily toothbrushing, dental flossing and the use of an oral irrigator at 6mo, and improvement in oral hygiene frequency and duration were maintained at 12mo.

Discussion

Our review yielded interventions related to other aspects of self-management including weight loss (Sabour et al. 2018), wheelchair skills training (Rice et al. 2014; Divanoglou et al. 2019) and oral hygiene (Yuen 2013). Apart from Sabour et al. (2018), these studies had low sample sizes or high attrition rates. Further research on nutrition, physical activity, mobility and wheelchair skills and oral health education are required, with consideration given to outcome measures that capture functional improvements and time points that allow for prolonged follow-up to assess adherence to self-management regimes outside of organized interventions.

Conclusion

There is level 2 evidence (Sabour et al. 2018) that a nutrition program does not improve body composition.

There is level 2 evidence (Rice et al. 2014) that a wheelchair skills education program required a lower push frequency on various terrain but did not improve pain.

There is level 4 evidence (Divanoglou et al. 2019) that a peer-based wheelchair skills program improves wheelchair skills including balance, maneuvering and push distance.

There is level 4 evidence (Yuen 2013) that a virtual oral hygiene training program improves gingival health.

Key Points

Wheelchair skills programs may improve wheelchair skills, further research is required.

Oral hygiene training may improve gingival health, further research is required.

There is minimal evidence regarding the efficacy of nutritional programs on body composition.

3 Summary

This overview of the literature captures the key characteristics of the existing intervention programs for SM post SCI. As identified in the previous sections, SCI SM programs were often delivered by peers and healthcare professionals, such as nurses, psychologists, and occupational therapists. The benefits of peer involvement in SCI SM interventions have been well-documented in the literature. The lived experiences and social support from those with similar conditions can be especially empowering for program participants (Hernandez et al. 2001), and have been shown to enhance self-esteem, improve vocational outcomes, and reduce hospital readmission in individuals with SCI (Gassaway et al. 2017; Shem et al. 2011). The active engagement of clinicians and other healthcare professionals is also a key contributor to the

success of many SCI SM interventions. It should be noted that when delivering SM programs, it is crucial for healthcare professionals to appropriately position their role and find a delicate balance between exercising control and providing patients with autonomy to take control over the management of their own conditions (Mudge et al. 2015).

In terms of location of program delivery, besides traditional settings such as rehabilitation hospitals, rehabilitation centers, and community, a significant percentage of SCI SM intervention programs, especially the more recent ones, were delivered virtually via the Internet. In fact, this trend aligns with the preferences of many patients with SCI. In a qualitative study examining participants' views on SM program delivery conducted with 99 Canadians with traumatic SCI, the Internet was considered as the preferred method of program delivery by 40% of the participants (Munce et al. 2014). Virtual delivery methods may be especially ideal for individuals with SCI who experience significant limitations in mobility and should continue to be utilized in future SCI SM program delivery to improve program accessibility and patient engagement.

Regarding the utilization of established components of SM across interventions, some SM components were embedded in the intervention programs more frequently than others, all components from each of the three taxonomies were utilized by at least one program. The distribution of utilization of the SM components from Barlow and colleagues' (2002) taxonomy and the PRISMS taxonomy (Pearce et al. 2015) reveals that the existing SM interventions for SCI were primarily concerned with providing patients with information about condition and symptom management and psychological training, which were often achieved through the use of information booklets as well as group and/or individual education sessions. These foci are consistent with SM programs' traditional emphasis on facilitating symptom management and behavioral changes through education (Lorig & Holman 2003; Barlow et al. 2002).

There is level 1b evidence (Burke et al. 2019) that virtually delivered cognitive behavioral therapy improves pain but not symptoms of anxiety or depression.

There is level 2 evidence (Hearn and Finlay et al. 2018) that virtually delivered mindfulness improves symptoms of anxiety, depression, and pain.

There is level 2 evidence (Migliorini et al. 2016) that a remotely delivered cognitive behavioral, mindfulness and positive psychology module does not improve symptoms of anxiety or depression.

There is level 1b evidence (Heutink et al. 2012) that a combination of educational and cognitive behavioral training does not improve anxiety, depression, or pain after completion of the program.

There is level 2 evidence (Duchnick et al. 2009) that psycho-education sessions do not improve anxiety or depression.

There is level 2 evidence (Philips et al. 2001) that telephone and video-based education sessions with a nurse did not improve symptoms of depression.

There is level 2 evidence (NorrbrinkBudh et al. 2006) that a pain management program including cognitive behavioral therapy improves symptoms of depression and decreases analgesic use but does not improve perception of pain.

There is level 2 evidence (Craig et al. 1998) that cognitive behavioral therapy does not improve symptoms of depression.

There is level 4 evidence (MacGillvray et al. 2020) that an app designed for self-management following SCI does not improve symptoms of anxiety or depression.

There is level 4 evidence (Mehta et al. 2020) that virtually delivered cognitive behavioral therapy improves self-esteem, symptoms of depression and grief.

There is level 4 evidence (Verwer et al. 2016) that a virtual self-help exercise module did not improve overall mental health or symptoms of depression after completion of the program.

There is level 4 evidence (Migliorini et al. 2011) that a remotely delivered cognitive behavioral, mindfulness and positive psychology module may improve depression.

There is level 1b evidence (Huang et al. 2019) that an intermittent catheterization education group decreases UTI incidence and decreases the recovery time following UTI.

There is level 1b evidence (Kryger et al. 2016) that a mobile self-management app decreases UTI incidence.

There is level 2 evidence (Cardenas et al. 2004) that an education program does not decrease UTI incidence, number of symptom reports or antibiotic treatments given.

There is level 2 evidence (Hagglund et al. 2005) that a personal assistive device training workshop decreases UTI incidence.

There is level 2 evidence (Zanollo et al. 2015) that an intermittent catheterization education program does not improve continence.

There is level 4 evidence (Evardone et al. 2018) that attending an education program was associated with lower UTI incidence.

There is level 4 evidence (Wilde et al. 2016) that a virtual based intermittent catheter education program did not improve UTI incidence, pain or continence.

There is level 1b evidence (Arora et al. 2017) a virtually administered advice program does not improve pressure sore size or depth but may improve healing.

There is level 2 evidence (Kim and Cho et al. 2017) that an education and counselling program does not improve pressure ulcer incidence.

There is level 1b evidence (Guihan et al. 2014) that a virtually administered counselling program does not improve pressure ulcer incidence or characteristics or the number of doctor's visits for skin management.

There is level 1b evidence (Houlihan et al. 2013) that a virtual module decreases pressure ulcer incidence in women only and does not impact the number of doctor's visits for skin management.

There is level 2 evidence (Rintala et al. 2008) that monthly follow up regarding skin status with skin management education increases pressure ulcer recurrence time and decreases pressure ulcer recurrence.

There is level 2 evidence (Phillips et al. 1999) that virtual modules, counselling, or a home visit had no difference in pressure ulcer incidence.

There is level 4 evidence (Wolfe et al. 2019) that a pressure injury risk assessment and action plan did not improve injury incidence.

There is level 4 evidence (Evardone et al. 2018) that attending an education program was associated with lower pressure ulcer incidence.

There is level 1b evidence (Gassaway et al. 2017) that peer mentoring decreases hospital readmission.

There is level 2 evidence (Mackelprang et al. 2016) that virtual counselling does not decrease the incidence doctor's visits or secondary complications.

There is level 2 evidence (Rowland et al. 2016) that personalized counselling based on questionnaire results does not decrease the incidence of secondary complications.

There is level 2 evidence (Zemper et al. 2003) that a wellness workshop may decrease incidence of secondary complications.

There is level 2 evidence (Jones et al. 2021) that peer mentoring decreases hospital readmission.

There is level 2 evidence (Craig et al. 1999) that cognitive behavioral therapy decreases hospital readmission.

There is level 4 evidence (Ljungberg et al. 2011) that peer mentoring decreases incidence of secondary complications and hospital readmissions.

There is level 1b evidence (Cardenas et al. 2020) that a home exercise program improves shoulder pain and function.

There is level 1b evidence (Burke et al. 2019) that virtually delivered cognitive behavioral therapy improves pain but not symptoms of anxiety or depression.

There is level 2 evidence (Hearn & Finlay et al. 2018) that virtually delivered mindfulness improves symptoms of anxiety, depression, and pain.

There is level 2 evidence (Rice et al. 2014) that a wheelchair skills education program required a lower push frequency on various terrain but did not improve pain.

There is level 2 evidence (NorrbrinkBudh et al. 2006) that a pain management program including cognitive behavioral therapy improves symptoms of depression and decreases analgesic use but does not improve perception of pain.

There is level 4 evidence (Burns et al. 2013) that a pain management program including education and cognitive behavioral therapy does not improve long-term pain.

There is level 4 evidence (Heutink et al. 2013) that a cognitive behavioral therapy program does not improve pain intensity or related disability.

There is level 1b evidence (Zarei et al. 2020) that smart phone application mediated sexual-marital education improves sexual satisfaction in men.

There is level 2 evidence (Rezaei-Fard et al. 2019) that group-based sexual education improves sexual satisfaction, arousal, lubrication, orgasm, and pain in women.

There is level 2 evidence (Sabour et al. 2018) that a nutrition program does not improve body composition.

There is level 2 evidence (Rice et al. 2014) that a wheelchair skills education program required a lower push frequency on various terrain but did not improve pain.

There is level 4 evidence (Divanoglou et al. 2019) that a peer-based wheelchair skills program improves wheelchair skills including balance, maneuvering and push distance.

There is level 4 evidence (Yuen 2013) that a virtual oral hygiene training program improves gingival health.

4 Gaps in the Evidence

First, it is worth noting that only a small proportion of studies reviewed in this chapter provided a definition of the term SM in their reporting of the intervention programs. Given the variability in the conceptualization of SM and the complex nature of SCI SM interventions, to assist the future evaluation and uptake of evidence, it is important for researchers to clearly define key terms, such as SM, in their work (Pearce et al. (2015).

Within the body of work on SM, difficulties in accessing needed medical and social services and financial assistance have been identified as a major barrier in the management of various chronic conditions, including SCI (Munce et al. (2014), Mead et al. (2010), Blixen et al. (2016). To address this challenge, SM interventions for SCI need to move beyond information provision on available resources and services and place focus on teaching program participants how to effectively communicate with service providers and to advocate for a more accessible environment. However, as indicated in our findings, this aspect of SM was rarely dealt with in the existing intervention studies on the management of SCI. This is reflected in the under-utilization of the patient-health care provider partnership. This discrepancy between patient needs and current program provision calls for more research on SM interventions integrating self-advocacy and communication skill training in the future.

Finally, the clinical and demographic characteristics vary considerably across patients with SCI, and each individual is likely to respond differently to the same SM intervention program. (Munce et al. (2016) Thus, a one-size-fits-all approach to SM interventions is not likely to result in success. More comparative studies and in-depth qualitative studies are needed to assist researchers and practitioners in better understanding how to tailor intervention programs to meet specific subgroups and individuals' unique needs.

References

Alderson, M., Starr, L., Gow, S., & Moreland, J. (1999). The program for rheumatic independent self-management: a pilot evaluation. *Clinical rheumatology, 18*, 283-292.

Arora, M., Harvey, L. A., Glinsky, J. V., Chhabra, H. S., Hossain, S., Arumugam, N., Bedi, P. K., Lavrencic, L., Hayes, A. J., & Cameron, I. D. (2017, Feb). Telephone-based management of pressure ulcers in people with spinal cord injury in low- and middle-income countries: a randomised controlled trial. *Spinal Cord, 55*(2), 141-147. https://doi.org/10.1038/sc.2016.163

Barlow, J., Wright, C., Sheasby, J., Turner, A., & Hainsworth, J. (2002). Self-management approaches for people with chronic conditions: a review. *Patient education and counseling, 48*(2), 177-187.

Barrett, O. E., Ho, A. K., & Finlay, K. A. (2024). Sexual function and sexual satisfaction following spinal cord injury: an interpretative phenomenological analysis of partner experiences. *Disability and Rehabilitation, 46*(1), 86-95.

Bryant, C., Gustafsson, L., Aplin, T., & Setchell, J. (2022). Supporting sexuality after spinal cord injury: a scoping review of non-medical approaches. *Disability and Rehabilitation, 44*(19), 5669-5682.

Bryce, T. N., Biering-Sørensen, F., Finnerup, N. B., Cardenas, D., Defrin, R., Lundeberg, T., Norrbrink, C., Richards, J., Siddall, P., & Stripling, T. (2012). International spinal cord injury pain classification: part I. Background and description. *Spinal Cord, 50*(6), 413-417.

Burke, D., Lennon, O., Blake, C., Nolan, M., Barry, S., Smith, E., Maye, F., Lynch, J., O'Connor, L., Maume, L., Cheyne, S., S, N. G., & Fullen, B. M. (2019, Aug). An internet-delivered cognitive behavioural therapy pain management programme for spinal cord injury pain: A randomized controlled trial. *Eur J Pain, 23*(7), 1264-1282. https://doi.org/10.1002/ejp.1402

Burns, A. S., Delparte, J. J., Ballantyne, E. C., & Boschen, K. A. (2013, Oct). Evaluation of an interdisciplinary program for chronic pain after spinal cord injury. *Pm r, 5*(10), 832-838. https://doi.org/10.1016/j.pmrj.2013.05.004

Cardenas, D. D., Felix, E. R., Cowan, R., Orell, M. F., & Irwin, R. (2020, Jun). Effects of Home Exercises on Shoulder Pain and Pathology in Chronic Spinal Cord Injury: A Randomized Controlled Trial. *Am J Phys Med Rehabil, 99*(6), 504-513. https://doi.org/10.1097/phm.0000000000001362

Cardenas, D. D., Hoffman, J. M., Kelly, E., & Mayo, M. E. (2004). Impact of a urinary tract infection educational program in persons with spinal cord injury. *J Spinal Cord Med, 27*(1), 47-54. https://doi.org/10.1080/10790268.2004.11753730

Clark, N. M., Becker, M. H., Janz, N. K., Lorig, K., Rakowski, W., & Anderson, L. (1991). Self-management of chronic disease by older adults: a review and questions for research. *Journal of aging and health, 3*(1), 3-27.

Craig, A., Hancock, K., Chang, E., & Dickson, H. (1998, Feb). The effectiveness of group psychological intervention in enhancing perceptions of control following spinal cord injury. *Aust N Z J Psychiatry, 32*(1), 112-118. https://doi.org/10.3109/00048679809062717

Craig, A., Hancock, K., & Dickson, H. (1999, May). Improving the long-term adjustment of spinal cord injured persons. *Spinal Cord, 37*(5), 345-350. https://doi.org/10.1038/sj.sc.3100829

Creer, T. L., Renne, C. M., & Christian, W. P. (1976). Behavioral contributions to rehabilitation and childhood asthma. *Rehabilitation literature*.

Divanoglou, A., Trok, K., Jörgensen, S., Hultling, C., Sekakela, K., & Tasiemski, T. (2019, Oct). Active Rehabilitation for persons with spinal cord injury in Botswana - effects of a community peer-based programme. *Spinal Cord, 57*(10), 897-905. https://doi.org/10.1038/s41393-019-0300-6

Du, S., Hu, L., Dong, J., Xu, G., Chen, X., Jin, S., Zhang, H., & Yin, H. (2017). Self-management program for chronic low back pain: a systematic review and meta-analysis. *Patient education and counseling, 100*(1), 37-49.

Duchnick, J. J., Letsch, E. A., & Curtiss, G. (2009, May). Coping effectiveness training during acute rehabilitation of spinal cord injury/dysfunction: a randomized clinical trial. *Rehabil Psychol, 54*(2), 123-132. https://doi.org/10.1037/a0015571

Elliott, T. R., & Frank, R. G. (1996, Aug). Depression following spinal cord injury. *Arch Phys Med Rehabil, 77*(8), 816-823. https://doi.org/10.1016/s0003-9993(96)90263-4

Evardone, M., Wilson, C. S., Weinel, D., Soble, J. R., & Kang, Y. (2018, Jan). Does attendance in SCI education courses impact health outcomes in acute rehabilitation? *J Spinal Cord Med, 41*(1), 17-27. https://doi.org/10.1080/10790268.2016.1177269

Gassaway, J., Jones, M. L., Sweatman, W. M., Hong, M., Anziano, P., & DeVault, K. (2017, Aug). Effects of Peer Mentoring on Self-Efficacy and Hospital Readmission After Inpatient Rehabilitation of Individuals With Spinal Cord Injury: A Randomized Controlled Trial. *Arch Phys Med Rehabil, 98*(8), 1526-1534.e1522. https://doi.org/10.1016/j.apmr.2017.02.018

Gassaway, J., Jones, M. L., Sweatman, W. M., & Young, T. (2019). Peer-led, transformative learning approaches increase classroom engagement in care self-management classes during inpatient rehabilitation of individuals with spinal cord injury. *The Journal of Spinal Cord Medicine, 42*(3), 338-346.

Guihan, M., Bombardier, C. H., Ehde, D. M., Rapacki, L. M., Rogers, T. J., Bates-Jensen, B., Thomas, F. P., Parachuri, R., & Holmes, S. A. (2014, Jul). Comparing multicomponent interventions to improve skin care behaviors and prevent recurrence in veterans hospitalized for severe pressure ulcers. *Arch Phys Med Rehabil, 95*(7), 1246-1253.e1243. https://doi.org/10.1016/j.apmr.2014.01.012

Hagglund, K., Clark, M., Schopp, L., Sherman, A., & Acuff, M. (2005). Consumer-assistant education to reduce the occurrence of urinary tract infections among persons with spinal cord injury. *Topics in Spinal Cord Injury Rehabilitation, 10*(3), 53-62.

Hearn, J. H., & Finlay, K. A. (2018, Aug). Internet-delivered mindfulness for people with depression and chronic pain following spinal cord injury: a randomized, controlled feasibility trial. *Spinal Cord, 56*(8), 750-761. https://doi.org/10.1038/s41393-018-0090-2

Heutink, M., Post, M. W., Overdulve, C. W., Pfennings, L. E., van de Vis, W., Vrijens, N. L., & Lindeman, E. (2013, Fall). Which pain coping strategies and cognitions are associated with outcomes of a cognitive behavioral intervention for neuropathic pain after spinal cord injury? *Top Spinal Cord Inj Rehabil, 19*(4), 330-340. https://doi.org/10.1310/sci1904-330

Heutink, M., Post, M. W. M., Bongers-Janssen, H. M. H., Dijkstra, C. A., Snoek, G. J., Spijkerman, D. C. M., & Lindeman, E. (2012, Jan). The CONECSI trial: results of a randomized controlled trial of a multidisciplinary cognitive behavioral program for coping with chronic neuropathic pain after spinal cord injury. *Pain, 153*(1), 120-128. https://doi.org/10.1016/j.pain.2011.09.029

Hofmann, S. G., Sawyer, A. T., & Fang, A. (2010, Sep). The empirical status of the "new wave" of cognitive behavioral therapy. *Psychiatr Clin North Am, 33*(3), 701-710. https://doi.org/10.1016/j.psc.2010.04.006

Houlihan, B. V., Jette, A., Friedman, R. H., Paasche-Orlow, M., Ni, P., Wierbicky, J., Williams, K., Ducharme, S., Zazula, J., Cuevas, P., Rosenblum, D., & Williams, S. (2013, Sep). A pilot study of a telehealth intervention for persons with spinal cord dysfunction. *Spinal Cord, 51*(9), 715-720. https://doi.org/10.1038/sc.2013.45

Huang, X., Hu, W., Guo, Y., & Li, W. (2019). Effects of quality control circle on patients with neurogenic urination disorder after spinal cord injury and intermittent catheterization. *Int J Clin Exp Med, 12*(4), 4132-4139.

Hunt, C., Moman, R., Peterson, A., Wilson, R., Covington, S., Mustafa, R., Murad, M. H., & Hooten, W. M. (2021). Prevalence of chronic pain after spinal cord injury: a systematic review and meta-analysis. *Regional Anesthesia & Pain Medicine, 46*(4), 328-336.

Jones, M. L., Gassaway, J., & Sweatman, W. M. (2021, May). Peer mentoring reduces unplanned readmissions and improves self-efficacy following inpatient rehabilitation for individuals with spinal cord injury. *J Spinal Cord Med, 44*(3), 383-391. https://doi.org/10.1080/10790268.2019.1645407

Kim, J. Y., & Cho, E. (2017, Jan). Evaluation of a self-efficacy enhancement program to prevent pressure ulcers in patients with a spinal cord injury. *Jpn J Nurs Sci, 14*(1), 76-86. https://doi.org/10.1111/jjns.12136

Krassioukov, A., & Elliott, S. (2017). Neural control and physiology of sexual function: effect of spinal cord injury. *Topics in Spinal Cord Injury Rehabilitation, 23*(1), 1-10.

Kraus, B., & Wolf, T. J. (2024). Needs Assessment of Self-Management for Individuals With Chronic Spinal Cord Injury/Disease. *OTJR: Occupational Therapy Journal of Research, 44*(1), 57-66.

Kryger, M. A., Crytzer, T. M., Fairman, A., Quinby, E. J., Karavolis, M., Pramana, G., Setiawan, I. M. A., McKernan, G. P., Parmanto, B., & Dicianno, B. E. (2019, Aug 28). The Effect of the Interactive Mobile Health and Rehabilitation System on Health and Psychosocial Outcomes in Spinal Cord Injury: Randomized Controlled Trial. *J Med Internet Res, 21*(8), e14305. https://doi.org/10.2196/14305

Le, J., & Dorstyn, D. (2016, Aug). Anxiety prevalence following spinal cord injury: a meta-analysis. *Spinal Cord, 54*(8), 626. https://doi.org/10.1038/sc.2016.69

Ljungberg, I., Kroll, T., Libin, A., & Gordon, S. (2011, Feb). Using peer mentoring for people with spinal cord injury to enhance self-efficacy beliefs and prevent medical complications. *J Clin Nurs, 20*(3-4), 351-358. https://doi.org/10.1111/j.1365-2702.2010.03432.x

MacGillivray, M. K., Sadeghi, M., Mills, P. B., Adams, J., Sawatzky, B. J., & Mortenson, W. B. (2020, Sep). Implementing a self-management mobile app for spinal cord injury during inpatient rehabilitation and following community discharge: A feasibility study. *J Spinal Cord Med, 43*(5), 676-684. https://doi.org/10.1080/10790268.2019.1614343

Mackelprang, J. L., Hoffman, J. M., Garbaccio, C., & Bombardier, C. H. (2016, Oct). Outcomes and Lessons Learned From a Randomized Controlled Trial to Reduce Health Care Utilization During the First Year After Spinal Cord Injury Rehabilitation: Telephone Counseling Versus Usual Care. *Arch Phys Med Rehabil, 97*(10), 1793-1796.e1791. https://doi.org/10.1016/j.apmr.2016.03.002

McIntyre, A., Marrocco, S. L., McRae, S. A., Sleeth, L., Hitzig, S., Jaglal, S., Linassi, G., Munce, S., & Wolfe, D. L. (2020). A scoping review of self-management interventions following spinal cord injury. *Topics in Spinal Cord Injury Rehabilitation, 26*(1), 36-63.

Mehta, S., Hadjistavropoulos, H., Nugent, M., Karin, E., Titov, N., & Dear, B. F. (2020, May). Guided internet-delivered cognitive-behaviour therapy for persons with spinal cord injury: a feasibility trial. *Spinal Cord, 58*(5), 544-552. https://doi.org/10.1038/s41393-019-0398-6

Migliorini, C., Sinclair, A., Brown, D., Tonge, B., & New, P. (2016, Sep). A randomised control trial of an Internet-based cognitive behaviour treatment for mood disorder in adults with chronic spinal cord injury. *Spinal Cord, 54*(9), 695-701. https://doi.org/10.1038/sc.2015.221

Migliorini, C., Tonge, B., & Sinclair, A. (2011). Developing and piloting ePACT: A flexible psychological treatment for depression in people living with chronic spinal cord injury. *Behaviour Change, 28*(1), 45-54.

Nakagawa-Kogan, H., Garber, A., Jarrett, M., Egan, K. J., & Hendershot, S. (1988). Self-management of hypertension: Predictors of success in diastolic blood pressure reduction. *Research in nursing & health, 11*(2), 105-115.

Nevin, S., & Melby, V. (2022). Talking about post-injury sexual functioning: The views of people with spinal cord injuries—A qualitative interview study. *International journal of nursing practice, 28*(3), e12977.

Norrbrink Budh, C., Kowalski, J., & Lundeberg, T. (2006, May). A comprehensive pain management programme comprising educational, cognitive and behavioural interventions for neuropathic pain following spinal cord injury. *J Rehabil Med, 38*(3), 172-180. https://doi.org/10.1080/16501970500476258

Phillips, V. L., Temkin, A., Vesmarovich, S., Burns, R., & Idleman, L. (1999, Fall). Using telehealth interventions to prevent pressure ulcers in newly injured spinal cord injury patients post-discharge. Results from a pilot study. *Int J Technol Assess Health Care, 15*(4), 749-755.

Phillips, V. L., Vesmarovich, S., Hauber, R., Wiggers, E., & Egner, A. (2001). Telehealth: reaching out to newly injured spinal cord patients. *Public Health Rep, 116 Suppl 1*(Suppl 1), 94-102. https://doi.org/10.1093/phr/116.S1.94

Rezaei-Fard, M., Lotfi, R., Rahimzadeh, M., & Merghati-Khoei, E. (2019). Effectiveness of sexual counseling using PLISSIT model to promote sexual function of women with spinal cord injury: a randomized controlled trial. *Sexuality and Disability, 37*, 511-519.

Rice, L. A., Smith, I., Kelleher, A. R., Greenwald, K., & Boninger, M. L. (2014). Impact of a wheelchair education protocol based on practice guidelines for preservation of upper-limb function: a randomized trial. *Archives of Physical Medicine and Rehabilitation, 95*(1), 10-19.e11. https://doi.org/https://dx.doi.org/10.1016/j.apmr.2013.06.028

Rice, L. A., Smith, I., Kelleher, A. R., Greenwald, K., & Boninger, M. L. (2014, Jan). Impact of a wheelchair education protocol based on practice guidelines for preservation of upper-limb function: a randomized trial. *Arch Phys Med Rehabil, 95*(1), 10-19.e11. https://doi.org/10.1016/j.apmr.2013.06.028

Rintala, D. H., Garber, S. L., Friedman, J. D., & Holmes, S. A. (2008, Aug). Preventing recurrent pressure ulcers in veterans with spinal cord injury: impact of a structured education and follow-up intervention. *Arch Phys Med Rehabil, 89*(8), 1429-1441. https://doi.org/10.1016/j.apmr.2008.01.015

Rowland, J. L., White, G. W., & Wyatt, D. A. (2006). Analysis of an intervention to reduce or prevent secondary conditions for people with spinal cord injuries. *Journal of Clinical Psychology in Medical Settings, 13*, 261-269.

Sabour, H., Javidan, A. N., Soltani, Z., Pakpour, A. H., Yekaninejad, M. S., & Mousavifar, S. A. (2018, Jan). The effect of behavioral intervention and nutrition education program on serum lipid profile, body weight and blood pressure in Iranian individuals with spinal cord injury: A randomized clinical trial. *J Spinal Cord Med, 41*(1), 28-35. https://doi.org/10.1080/10790268.2016.1209890

Scovil, C. Y., Delparte, J. J., Walia, S., Flett, H. M., Guy, S. D., Wallace, M., Burns, A. S., & Wolfe, D. L. (2019, Feb). Implementation of Pressure Injury Prevention Best Practices Across 6 Canadian Rehabilitation Sites: Results From the Spinal Cord Injury Knowledge Mobilization Network. *Arch Phys Med Rehabil, 100*(2), 327-335. https://doi.org/10.1016/j.apmr.2018.07.444

Soopramanien, A., Jamwal, S., & Thomas, P. W. (2020, Jun 30). Digital Health Rehabilitation Can Improve Access to Care in Spinal Cord Injury in the UK: A Proposed Solution. *Int J Telerehabil, 12*(1), 3-16. https://doi.org/10.5195/ijt.2020.6312

Sztein, D. M., Koransky, C. E., Fegan, L., & Himelhoch, S. (2018, Sep). Efficacy of cognitive behavioural therapy delivered over the Internet for depressive symptoms: A systematic review and meta-analysis. *J Telemed Telecare, 24*(8), 527-539. https://doi.org/10.1177/1357633x17717402

Verwer, J. H., van Leeuwen, C. M., Bolier, L., & Post, M. W. (2016, Jun). Feasibility of an online well-being intervention for people with spinal cord injury: a pilot study. *Spinal Cord, 54*(6), 473-477. https://doi.org/10.1038/sc.2015.165

Wilde, M. H., McMahon, J. M., Fairbanks, E., Brasch, J., Parshall, R., Zhang, F., Miner, S., Thayer, D., Schneiderman, D., & Harrington, B. (2016, Sep-Oct). Feasibility of a Web-Based Self-management Intervention for Intermittent Urinary Catheter Users With Spinal Cord Injury. *J Wound Ostomy Continence Nurs, 43*(5), 529-538. https://doi.org/10.1097/won.0000000000000256

Williams, R., & Murray, A. (2015, Jan). Prevalence of depression after spinal cord injury: a meta-analysis. *Arch Phys Med Rehabil, 96*(1), 133-140. https://doi.org/10.1016/j.apmr.2014.08.016

Winkley, K., Upsher, R., Stahl, D., Pollard, D., Kasera, A., Brennan, A., Heller, S., & Ismail, K. (2020, Jun). Psychological interventions to improve self-management of type 1 and type 2 diabetes: a systematic review. *Health Technol Assess, 24*(28), 1-232. https://doi.org/10.3310/hta24280

Yuen, H. K. (2013, Jun). Effect of a home telecare program on oral health among adults with tetraplegia: a pilot study. *Spinal Cord, 51*(6), 477-481. https://doi.org/10.1038/sc.2012.176

Yuen, H. K., Wolf, B. J., Bandyopadhyay, D., Magruder, K. M., Selassie, A. W., & Salinas, C. F. (2010, Jul-Aug). Factors that limit access to dental care for adults with spinal cord injury. *Spec Care Dentist, 30*(4), 151-156. https://doi.org/10.1111/j.1754-4505.2010.00146.x

Zanollo, L. G., Stensrød, G. C., Kerdraon, J., Lund, K. G., Halvorsen, A., Losavio, E., Als, K. S., & Soler, J. M. (2015). Standardized intermittent catheterisation education improves catheterisation compliance in individuals with spinal cord injury. *International Journal of Urological Nursing, 9*(3), 165-172.

Zarei, F., Rashedi, S., Tavousi, M., Haeri-Mehrizi, A. A., & Maasoumi, R. (2020, Nov). A mobile-based educational intervention on sexo-marital life in Iranian men with spinal cord injury: a randomized controlled trial. *Spinal Cord, 58*(11), 1189-1196. https://doi.org/10.1038/s41393-020-0489-4

Zemper, E. D., Tate, D. G., Roller, S., Forchheimer, M., Chiodo, A., Nelson, V. S., & Scelza, W. (2003, Dec). Assessment of a holistic wellness program for persons with spinal cord injury. *Am J Phys Med Rehabil, 82*(12), 957-968; quiz 969-971. https://doi.org/10.1097/01.Phm.0000098504.78524.E2

Zhang, J., Chan, D. N., Liu, X., Cai, Y., Chen, J., & Xie, M. (2023). Effects of self-management interventions for cancer patients with pain: A systematic review of randomised controlled trials. *Journal of Clinical Nursing*.

Abbreviations

AIS	American Spinal Injury Association Impairment Scale
CBT	cognitive behavioral therapy
ePACT	electronic personal administrative cognitive training
HADS	Hospital Anxiety and Depression Score
ISCPC	International Spinal Cord Pain Classification
PCT	prospective controlled trial
RCT	randomized controlled trial
SCI	spinal Cord Injury
SM	self-management
UTI	urinary tract infection