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AMERICAN CONGRESS OF REHABILITATION MEDICINE

Archives of Physical Medicine and Rehabilitation

journal homepage: www.archives-pmr.org

Archives of Physical Medicine and Rehabilitation 2015;96:133-40

REVIEW ARTICLE (META-ANALYSES)

Prevalence of Depression After Spinal Cord Injury: A Meta-Analysis

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Abstract

Objectives: To use meta-analysis to synthesize point prevalence estimates of depressive disorder diagnoses for persons who have sustained a spinal cord injury (SCI).

Data Sources: We searched PsycINFO, PubMed, the Cumulative Index to Nursing and Allied Health Literature (CINAHL), and Dissertation Abstracts International (DAI) for studies examining depression after SCI through 2013. We also conducted a manual search of the reference sections of included studies.

Study Selection: Included studies contained persons with SCI; used a diagnostic measure of depression (ie, an unstructured, semi-structured, or structured clinical interview, and/or a clinician diagnosis); and provided a diagnosis of major or minor depressive episodes for the subjects in the study. Diagnostic criteria were based on the *Diagnostic and Statistical Manual of Mental Disorders*, *Fourth Edition,* or the *Diagnostic and Statistical Manual of Mental Disorders-Third Edition* (including Research Diagnostic Criteria) criteria.

Data Extraction: The 2 authors of this study screened the titles and abstracts of 1053 unique studies for inclusion in this meta-analysis. Nineteen studies, containing 35,676 subjects and 21 effect size estimates, were included.

Data Synthesis: The mean prevalence estimate of depression diagnosis after SCI was 22.2%, with a lower-bound estimate of 18.7% and an upper bound estimate of 26.3%. Random effects and mixed effects models were used in this work. A small number of study moderators were explored, including sample sex composition, *Diagnostic and Statistical Manual of Mental Disorders* version used, data collection method (primary vs secondary), sample traumatic etiology composition, sample injury level and completeness composition, and sample diagnostic composition. Data collection method, *Diagnostic and Statistical Manual of Mental Disorders* version, and diagnostic composition significantly predicted variation in observed effect size estimates, with primary data collection studies having lower estimates compared with secondary data analysis studies, studies using *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition,* diagnostic criteria having higher estimates compared with studies using *Diagnostic and Statistical Manual of Mental Disorders, Third Edition,* criteria, and samples comprising individuals diagnosed only with major depression having lower prevalence estimates.

Conclusions: The existing data on depression after SCI indicate that the prevalence of depression after SCI is substantially greater than that in the general medical population. These results underscore the importance of continued research on measuring depression in persons with SCI and on treatments for depression after SCI.

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Depression inhibits the physical rehabilitation process[1] and exacerbates physical health problems associated with spinal cord injury (SCI).[2] Typical physical complications expected after SCI include impaired respiratory function and an elevated risk for pneumonia and atelectasis, neurogenic bowel dysfunction, gallstones, neurogenic bladder, urinary tract infections, sexual dysfunction, pressure ulcers, thrombophlebitis, spasticity, heterotopic ossification, osteoporosis, and chronic pain.[3] Depressive disorders compound the debilitating effects of these physical complications.

SCI may occur acutely (eg, from a traumatic event such as a fall or car accident) or chronically (eg, from illness such as spinal tumors, transverse myelitis, or Guillan-Barré syndrome). The distinction between the 2 etiologies is important. Traumatic SCI is an unanticipated negative life-course event, and it is expected to have a more profound psychological effect, at least

Disclosures: none.

0003-9993/14/$36 - see front matter © 2015 by the American Congress of Rehabilitation Medicine
http://dx.doi.org/10.1016/j.apmr.2014.08.016

immediately, for the person. Chronic syndromes are important to consider for life-course development and psychopathology; however, physiological transformation for many chronic conditions tends to occur more slowly. Perhaps for this reason, most research on psychological aspects of SCI focuses on traumatic SCI.

Estimates of depression prevalence rates vary dramatically from study to study. The general understanding is that rates of depressive disorders after SCI are higher than the prevalence estimates of the general medical population, but most studies about depression after SCI inevitably state a very wide range of possible population values. For example, in their review of the literature, Bombardier et al[4] found that major depression prevalence estimates appeared to range from 9.8% to 38%.

Most of what we know about the prevalence of depressive disorders after SCI is also based on self-report measures. These self-report measures have infrequently been validated against diagnostic criteria. In one such example, Bombardier et al[5] compared a range of cutoff scores on the Patient Health Questionnaire-9 (PHQ-9) to a diagnosis of major depression using the Structured Clinical Interview for *Diagnostic and Statistical Manual of Mental Disorders*, *Fourth Edition* (*DSM-IV*).[6] The PHQ-9 is one of the most popular depression measures used, and the authors found that a total cutoff score of $\geq$11 provided optimal sensitivity and specificity, both $>$.80. In that sample, about 24.6% of the individuals screened positive for "probable major depression."

With such wide variance in depression prevalence estimates among persons with SCI, researchers and practitioners should be concerned about potential sources of variation, which may not be solely due to sampling variability. One such source of variation could be the sample's demographic characteristics such as sex, age, and race. Another source could be the diagnostic standard that the prevalence estimate was based on, as well as the measure used to produce the depression scores originally. Variability in the medical characteristics of these samples, such as time since injury and level and completeness of injury, may further explain the wide variation in depression prevalence estimates.

To date, there have been no systematic efforts to quantitatively synthesize the existing research on depression prevalence in persons with SCI that also explores potential sources of variability in those prevalence estimates. Kalpakjian et al[7] mention that combining various classes of depression measures, such as severity, screening, and diagnostic, may provide an inaccurate and potentially more confusing result. Systematically searching for and quantitatively synthesizing depression prevalence estimates from studies that formally diagnosed depression after SCI may provide an optimally useful and efficient estimate. Such an estimate could clarify the specific risk of depression among individuals with SCI and help practitioners allocate their time and screening efforts effectively.

List of abbreviations:

CI	**confidence interval**
DSM	***Diagnostic and Statistical Manual of Mental Disorders***
DSM-III	***Diagnostic and Statistical Manual of Mental Disorders, Third Edition***
DSM-III-R	***Diagnostic and Statistical Manual of Mental Disorders, Revised Third Edition***
DSM-IV	***Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition***
MDD	**major depressive disorder**
PHQ-9	**Patient Health Questionnaire-9**
RDC	**Research Diagnostic Criteria**
SCI	**spinal cord injury**

The purpose of this study was to estimate the prevalence of depression diagnoses after SCI. The focus was on studies that used diagnostic measures to identify depressive disorders. A systematic literature review was conducted and random effects and mixed effects models were fit to the data. Exploratory moderator analyses were used to evaluate potential sources of effect size heterogeneity, including sample's sex composition, *Diagnostic and Statistical Manual of Mental Disorders* (*DSM*) version used for diagnosis, data collection method (primary data collection vs secondary data collection), sample composition of traumatic injuries, and sample composition of injury level and completeness. The following section describes the details of the search, coding, and analysis in accordance with the Preferred Reporting Items for Systematic Review and Meta-Analyses.

Methods

Literature search and information retrieval

A systematic search of the literature was undertaken. PsycINFO, PubMed, the Cumulative Index to Nursing and Allied Health Literature (CINAHL), and Dissertation Abstracts International (DAI) were searched. Using Boolean operators, we used the wildcard term *depress** in combination with each of the following to isolate the population of studies investigating depression after SCI: *spinal cord injury*, *spinal cord injuries*, *spinal injury*, *spinal injuries*, *spine injury*, and *spine injuries.* The search included all relevant records through 2013. We also manually searched the reference section of each article meeting or preliminarily meeting our inclusion criteria after the screening process.

Titles and abstracts were screened. Studies were retained if their titles or abstracts indicated that depression was measured. If abstracts indicated depression severity rather than diagnosis, the study was excluded. If it was unclear whether a measure was used for diagnostic purposes, it was retained for full-text screening. Studies were included in the analysis if they included a diagnostic measure of depression (ie, an unstructured, semi-structured, or structured clinical interview and/or a clinician diagnosis); if they provided a diagnosis of major or minor depressive episodes for the subjects in the study; if the sample consisted of persons with SCI (traumatic or a mix of traumatic and nontraumatic); and if the diagnostic criteria used in the study were based on, or were exactly, the *DSM-IV* or the *Diagnostic and Statistical Manual of Mental Disorders, Third Edition* (*DSM-III*) (including Research Diagnostic Criteria [RDC]) diagnostic criteria. The 2 authors of this article searched for and screened the studies in this review.

Study coding

Characteristics of the studies and their samples were coded for this analysis. Study-level characteristics used in this analysis included year of publication, study location, study setting, data collection method, and publication source. Sample characteristics included sex composition, racial composition, sample age, injury level composition, injury completeness composition, traumatic injury composition, and time since injury. We also coded sample size, diagnostic measure used, and diagnostic criteria used.