

**ORIGINAL RESEARCH**

# Lifetime Prevalence of Chronic Health Conditions Among Persons With Spinal Cord Injury



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**Abstract**

**Objective:** To assess lifetime prevalence of 7 chronic health conditions (CHCs) among a cohort of adults with chronic traumatic spinal cord injury (SCI).

**Design:** Cross-sectional.

**Setting:** Rehabilitation hospital.

**Participants:** Adults with SCI who were  $\geq 18$  years of age, were  $\geq 1$  year postinjury, and had residual neurologic effects impeding full recovery (n = 1678).

**Interventions:** Not applicable.

**Main Outcome Measures:** CHCs were measured using questions from the Behavioral Risk Factor Surveillance System for diabetes (not including gestational), heart attack (also called a myocardial infarction), angina or coronary artery disease, stroke, hypertension (not including during pregnancy), high blood cholesterol, or cancer.

**Results:** Of participants, 49.5% reported having at least 1 CHC, with 23.2% reporting  $\geq 2$  CHCs. The most frequently reported CHC was high cholesterol (29.3%) followed by hypertension (28.7%) and diabetes (11.8%). Although the prevalence of CHCs significantly increased with increasing age, only hypertension and cancer were significantly associated with years postinjury. Four CHCs (diabetes, coronary artery disease, hypertension, high cholesterol) were significantly related to mobility status as measured by injury level and ambulatory status. However, after controlling for age, years postinjury, sex, and race, mobility status became nonsignificant in relation to coronary artery disease, but it remained significantly associated with diabetes, hypertension, and high cholesterol.

**Conclusions:** Clinicians should be aware of the risk of CHCs in persons with SCI and should screen for these conditions and regular maintenance activities related to SCI.

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Spinal cord injury (SCI) results in a loss of motor and/or sensory function, leading to disability. Approximately 273,000 people live with SCI in the United States, and 12,000 new cases of SCI occur annually.<sup>1</sup> Although SCI primarily occurs in young men, the age at injury has steadily increased in recent years, and more people than ever are reaching aging milestones.<sup>2</sup> Chronic health conditions

(CHCs), such as cardiovascular disease (CVD), cancer, and respiratory disease, are an important public health issue in the general population because they are the top 3 leading causes of death,<sup>3</sup> and CVD is also a leading cause of death among persons with SCI.<sup>4</sup> Rimmer et al<sup>5</sup> differentiate secondary health conditions (eg, pressure ulcers) from CHCs (eg, diabetes). Although the SCI Model Systems National Database has been used to address many questions of outcomes after SCI, it does not include data on CHCs, creating a void in the literature.

Persons with SCI are at significantly increased risk for CHCs. In recent years, clinicians and researchers have noted many persons with SCI show evidence of what is often termed premature

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aging, earlier onset of health conditions normally associated with aging (eg, diabetes, CVD).<sup>6</sup> Additionally, when age matched with able-bodied controls, there is a more rapid acceleration of certain disease states after SCI (eg, coronary artery calcification).<sup>7</sup> In a scoping review, Jensen et al<sup>8</sup> identified 5 studies looking at the prevalence of coronary artery disease, CVD, or hypertension, none of which assessed duration effects of SCI on prevalence. There is a need for a large-scale study of persons with SCI to appropriately assess the relation of CHCs with severity of injury and time postinjury.

A major inciting factor for increased risk is the consequence of inactivity resulting from SCI-associated paralysis and extent of disability depending on SCI level and completeness, including ability to ambulate.<sup>7</sup> Scelza et al<sup>9</sup> found that although most people are interested in exercise, less than half are actively exercising. Barriers to exercise are physical (inaccessible exercise facilities, lack of financial resources) and psychological (concern exercise would be too difficult). Metabolic changes resulting from sedentary lifestyle or obesity may be amplified in the SCI population, placing the population at increased risk for the common secondary medical consequences of dyslipidemia, hypertension, insulin resistance, adverse soft tissue body composition, changes of increased adiposity and reduced skeletal muscle, and disuse osteoporosis. These CHCs have a substantial impact on patient morbidity and mortality.<sup>7</sup>

Recently, there has been a focus on CHCs in the general population, especially multiple chronic conditions (MCC).<sup>10</sup> Those with MCC are more likely to take medications and see >1 clinician, which can result in inconsistent care.<sup>11</sup> The National Quality Forum defines MCC as “having two or more concurrent chronic conditions that collectively have an adverse effect on health status, function, or quality of life and that require complex healthcare management, decision-making, or coordination.”<sup>11(p7-8)</sup> This definition would include SCI; therefore, this patient population already has an exacerbating factor to consider in the study of CHCs: their disability. CHCs may first appear prior to SCI onset, and their course may be dramatically affected by disability secondary to neurologic impairment. An assessment of national data showed that those with mobility limitations had a higher number of conditions than those without any limitations,<sup>12</sup> and the number of conditions is related to increased health care utilization even after accounting for disability.<sup>13</sup> CHCs typically are progressive and may ultimately threaten health, participation, quality of life, and longevity.<sup>14,15</sup>

Despite the alarming nature of this information, Jensen<sup>8</sup> identified a gap in the literature surrounding the associations between age at injury and years postinjury and the prevalence and course of secondary health conditions, including CHCs, and made a call for new studies to more accurately evaluate these issues. Of the 20 health conditions included in the literature review by Jensen,<sup>8</sup> all but 1, bladder cancer, were found to be more frequent or severe in the SCI sample than in the normative group.<sup>16</sup> Furthermore, in no case was a health condition found to be less prevalent in the SCI sample.<sup>8</sup> However, for most of the health conditions,

there were not studies simultaneously assessing both age and duration of disability in relation to the outcome. Often, findings regarding the frequency of CHCs are from studies where MCC are not examined together in the same sample, making direct comparisons of individual CHCs impossible.<sup>8</sup>

The purpose of this study is to assess lifetime prevalence of 7 CHCs among a cohort of adults with chronic SCI. Our objectives are to assess the relation of lifetime prevalence of each CHC and their relation with (1) injury level and ambulatory status and (2) age and years postinjury.

## Methods

### Participants

After institutional review board approval, we identified participants through a large specialty rehabilitation hospital in South-eastern United States. Both inpatients and outpatients who met the eligibility criteria for this study at the time of enrollment were approached to participate. Eligibility criteria included the following:  $\geq 18$  years of age,  $\geq 1$  year postinjury, and traumatic SCI with residual neurologic impairment impeding full recovery. This is part of a larger study focused on health status after SCI and was conducted between 2010 and 2013.<sup>17</sup> Of the 2573 eligible participants, 1689 completed the study questionnaire. Among these, 11 were missing responses for >2 of the CHC questions and were removed from the sample; therefore, 1678 participants were included in the analysis.

### Procedures

Data were collected through mail-in surveys distributed between 2010 and 2013. Prospective participants were sent an introductory letter describing the study and alerting them of materials that were sent 4 to 6 weeks later. Second mailings and phone calls were made to nonresponders. Participants were offered \$50 in remuneration. All study procedures were approved by an institutional review board. The overall response rate was 65.6% (1689 of 2573 potential participants), with mortality responsible for a substantial proportion of nonresponse.

### Measures

Chronic conditions were measured using standardized questions from the Behavioral Risk Factor Surveillance System (BRFSS). These items were chosen to enable comparability with state and national prevalence estimates. Each question was preceded by “Has a doctor, nurse, or other health professional ever told you that you had...” Participants were asked if they had ever been told they had diabetes (not including gestational), a heart attack (also called a myocardial infarction), angina or coronary artery disease, a stroke, hypertension (not including during pregnancy), high blood cholesterol, or cancer. Participants reporting having had cancer were asked to specify the type of cancer.

Participants were asked to report their injury level and walking ability. Ambulatory ability (Are you able to walk at all?) was used in conjunction with injury level to form 4 categories representing a proxy variable for level of mobility. Injury severity was categorized using a 4-way schema: C1-4, nonambulatory (high tetraplegia); C5-8, nonambulatory (low tetraplegia); noncervical, nonambulatory (paraplegia); and all ambulatory.<sup>18,19</sup> This scheme has been used frequently in studies of mortality and SCI, with ambulatory status serving as a proxy measure for the

#### List of abbreviations:

<b>BRFSS</b>	<b>Behavioral Risk Factor Surveillance System</b>
<b>CHC</b>	<b>chronic health condition</b>
<b>CVD</b>	<b>cardiovascular disease</b>
<b>MCC</b>	<b>multiple chronic conditions</b>
<b>SCI</b>	<b>spinal cord injury</b>

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