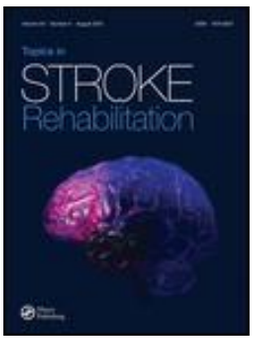

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Scoping Review of Common Secondary Conditions After Stroke and Their Associations with Age and Time Post Stroke

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Background: Health care providers need to be alert to secondary conditions that might develop after stroke so that these conditions can be prevented or treated early to reduce further deterioration of health and quality of life. **Objectives:** To review and describe the prevalence of secondary conditions after stroke and to summarize associations between secondary conditions and age and time post stroke. **Methods:** A scoping review of studies pertaining to secondary conditions after stroke published between 1986 and 2011 was conducted. **Results:** Seventy-six articles provided information regarding 6 secondary conditions: depression, pain, falls, fatigue, bowel/bladder problems, and sleep difficulties. Prevalence varied widely across studies for each condition. The limited repeated-measures evidence suggests that secondary conditions tend to occur in the first weeks or months post stroke and may remain relatively stable over time. Other evidence from regression analyses suggests either no significant associations between time post stroke or age or mixed results. Secondary conditions appear to be most commonly associated with severity of impairments. **Conclusions:** Health care providers need to be alert to the development of secondary conditions after stroke in individuals as they age as well as in the poststroke time span. Obtaining a clear understanding of the prevalence of secondary conditions and associations with age and time post stroke is difficult because of variations in research methodologies. Future research is needed to define secondary condition prevalence and risk factors more clearly and to identify interventions that could reduce the prevalence and impact of these conditions on quality of life. **Key words:** *aging, depression, falls, pain, secondary conditions, stroke*

Stroke can cause many sudden changes, including motor and sensory impairments, communication difficulties, and cognitive impairments. In addition to these and other primary consequences of stroke, secondary conditions occurring months or even years after a stroke can lead to further deterioration in health and quality of life. Secondary conditions are health conditions that occur after, but are associated with, a primary condition such as a stroke.[1] Awareness of the most common secondary conditions after stroke is important because it helps clinicians know what to be alert to and to select appropriate assessments. These efforts may help to decrease the severity and negative impact of secondary conditions.

A scoping review of the literature is useful for obtaining an overview of secondary conditions after stroke. A scoping review provides a "map" of the current literature in an area that can summarize key issues and, perhaps more importantly, identify areas in which additional research is needed.[2] Scoping reviews may focus on a more general topic and encompass a broader range of study designs than the more pinpointed systematic reviews. Scoping reviews are not focused on extracting as much information about study design and level of evidence as systematic reviews. Instead, scoping reviews survey the current research landscape and, in so doing, can provide an overview of a body of literature to determine whether a full systematic review is warranted.

This article is one of a series of scoping literature reviews designed to investigate secondary conditions and their associations with aging with a disability.[3,4] Specifically, these reviews explore questions related to prevalence of secondary conditions and associations with

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both chronological age and duration of the primary condition. This scoping review addresses 2 main questions: (1) What is the prevalence of secondary conditions after stroke that are commonly reported in the literature? (2) Are these secondary conditions associated with age or time post stroke in a manner that would assist clinicians in anticipating and intervening to minimize these complications of aging with disability?

Methods

Search criteria

The search was conducted for peer-reviewed studies of adults with stroke in PubMed, CINAHL, and PsycINFO published in English between 1986 and 2011. MeSH terms were used for the search, and the list of more than 70 search terms is available from the authors. This initial search identified 8,507 articles. The following criteria were used to narrow the search:

1. The primary or secondary purpose of the article addressed prevalence, incidence, frequency, duration, or course of a secondary condition that persisted more than 1 year post stroke.
2. The focus of the article was secondary conditions rather than stroke prevention or risk factors.
3. The sample size was greater than 5, and results for stroke were reported separately in any study that addressed stroke and other conditions.
4. Reviews, dissertations, abstracts, conference proceedings, commentaries, and duplicates were excluded.
5. The conditions of diabetes, lung disease, and hypertension were excluded because clear differentiations were not always made between these conditions as comorbidities that may have existed before stroke and secondary conditions with onset after stroke. Although these conditions should be recognized for the significant role they can play in the health of someone with stroke,[5] they did not meet our criteria for secondary conditions.
6. Conditions such as motor and sensory impairments, cognitive changes, communication impairments, or other impairments associated with stroke onset were not included in this review because we considered these to be primary symptoms or consequences of stroke, not secondary conditions.

Data extraction and outcome measures

Two reviewers extracted data from the full-text articles including research design; demographics; outcome measures; control variables; and outcomes related to frequency, severity, or course of secondary conditions. Data were compiled in a Microsoft ACCESS database. An independent reviewer confirmed the accuracy of extracted data. Conditions for which only one article met the inclusion criteria were omitted to focus on conditions most commonly represented in the literature.

Results

Seventy-six articles met the inclusion criteria, and these articles covered the 6 secondary conditions of depression, pain, falls, fatigue, bowel and bladder problems, and sleep problems. The key findings from these articles are summarized in **Table 1**.

Depression

More articles identified by this search (43) explored depression than any other secondary condition. For the purpose of obtaining a summary of depression prevalence, articles were grouped into 4 categories depending on the prevalence reported: 25% or less, 26% to 50%, 51% to 75%, and 76% or greater. In 36 studies, overall prevalence of poststroke depression was reported and could be sorted into these categories. (Some studies were included in more than one prevalence category because measurements were obtained at multiple time points.) In the largest number of studies (19), prevalence levels were reported that fell in the range of 26% to 50%. This was followed by 14 studies in which prevalence of 25% or less

Table 1. Summary of secondary conditions, as well as their prevalence and associations with other variables post stroke

Secondary condition	No. of articles	Publication years	Stroke sample size, range	Time post onset	Prevalence	Associations
Depression	43	1989–2011	20-3,689	<1 year to 26 years	Depression prevalence across severity levels: 6%-76%.	Time post onset: No association.[8-16] Depression at 6 months predicted later depression.[18] More severe depression in first year after stroke.[17] Age: No association.[8-10,12,14-16,18-23] Associated with younger age.[17,24-27] Associated with older age.[28,29] Side of lesion: No association.[6,7, 10,12,13,17-20,28,29,35,58-60] Associated with left-sided lesion[25] and right-sided lesion.[11,23,26] Stroke severity: Increased depression with more severe stroke.[7,16,26,28,30] No association.[20] Gender: More common in women.[6,7,11,14,24,25,29,58] More common in men.[28] No association.[12,13,16,17] Comparison adults without stroke: Rates higher in stroke.[20,21,23,29,31,32] Rates not significantly different.[31,55,58]
Pain	11	1992–2011	43–631	<1 year to 26 years	Musculoskeletal (shoulder, limb, back) pain: 6%-32%.[34-37] 42% of patients with pain had shoulder pain.[38] Central pain: 1%-12%.[35,36,39-41] 35% of patients with pain had central pain.[38] Headache/migraine pain: 3%-18%.[22,34] 23% of patients with pain had headache.[38] Pain, type not specified: 25%-61%.[33,35,37,39,40,42]	Time post onset: Associated with shorter time post stroke.[35] Age: No association.[35] Associated with younger age.[40] Type of stroke/side of lesion: No association.[35] Shoulder pain more common in hemorrhagic stroke.[36] Gender: No association.[35,40] Stroke severity: No association.[37] Comparison with adults without stroke: More pain in subjects with stroke.[42,33] Migraine rates not different.[22]
Falls	9	2000–2011	26-631	<1 year to 26 years	Overall rates of falls: 19%-70%. Participants reporting more than fall: 15%-57%.	Time post onset: No association.[47,48] Descriptive trends of both increasing[37] and decreasing decreasing[46] falls after 6 months. Age: No association.[47,48] More falls in older individuals.[49] Side of lesion: No association.[47,48] Associated with right-sided lesions.[49] Extent of physical impairment: More falls associated with more severe physical impairments[45,47,48] Gender: No association.[47-49] Comparison to adults without stroke: Falls more common in subjects with stroke.[42,43]
Fatigue	7	2001–2011	53-3,667	<1 year to 13 years	Prevalence, 33%-59%.	Time post onset: No association.[55] Decline in fatigue first 3 months, then no significant change.[52] Age: No association.[50,52] More fatigue associated with older age at stroke.[51] More fatigue associated with younger age.[53] Site of lesion: No association.[50-52] Associated with basilar artery infarct.[22] Associated with infratentorial infarct.[53] Gender: More prevalent in women.[52] Other factors with significant associations: Severity of impairments.[22,50-55] Depression.[22,50,53,55] Social factors.[51,54] Comparison with adults without stroke: More fatigue with stroke.[22,55] Worse general and physical fatigue but not mental fatigue.[52]

(Continued)

Table 1. (*Continued*)

Secondary condition	No. of articles	Publication years	Stroke sample size, range	Time post onset	Prevalence	Associations
Bowel/ Bladder	3	2005–2011	213-631	<1 year to 43 years	Some type of bowel/bladder dysfunction reported in up to 31.5% of patients.[36] Urinary incontinence: 17%-28%. [36,42,56] More mild condition of urinary leakage in 26%.[56] Urinary tract infection in 10.7%.[36] Fecal incontinence in 11.9%.[36]	Time post onset: No association with urinary incontinence.[56] Other factors: Number of strokes and type of stroke not associated with urinary incontinence. Significant predictors of urinary incontinence were moderate-severe paresis, depression, and impaired cognition.[56] Comparison with adults without stroke: Rates of incontinence higher in stroke subjects.[42,56]
Problems sleeping	3	1996–2011	20–631	<1 year to 15 years	Difficulty falling asleep: 8%-48%. [42,33,57] Waking up early: 6%[42] Waking up during the night: 19%- 65%.[42,33,57] Not feeling rested in the morning or daytime sleepiness: 33%-52%. [33,42,57]	Time post onset: Longer time since stroke associated with more daytime sleepiness[57] Age: No association.[57] Other factors: Pain associated with sleep difficulties.[33,57] Comparison adults without stroke: More sleep difficulties in stroke subjects, particularly falling asleep.[33,42]

was reported. In 4 studies, prevalence in the range of 51% to 75% was reported. Several studies explored the prevalence of minor (mild) versus major (severe) depression. Minor depression was more common than major depression, with up to 80% of the participants who had depression being rated as having minor depression.[6,7]

Ayerbe et al[8] described poststroke depression as "dynamic," with new cases being identified and others resolving over time and with different predictors at different time points. This is reflected in the mixed findings across studies. Most studies that examined associations statistically found no association between depression and time post stroke.[8-16] As exceptions to this, Nidhinandana et al[17] found that depression was most severe in the first year after stroke, and Schepers et al[18] found that the presence of depression at 6 months post stroke was significantly associated with later depression. In most studies, investigators found no association between poststroke depression and age.[8-10,12,14-16,18-23] However, when associations were found, they were conflicting, with some studies finding that depression was associated with younger age[17, 24-27] and other studies finding associations with older age.[28,29]

Another way to observe trends in poststroke depression over time is to focus on studies with repeated-measures designs. Of the studies included in this review of depression, 17 involved repeated measures. The course of poststroke depression was not clear in many of these because of study purpose or design. In some studies, the repeated measures were only conducted with individuals who were diagnosed with depression at stroke onset, precluding the identification of new-onset depression cases later after stroke. Others in this set of repeated-measures studies provided the data for each time point as cross-sectional data, meaning that overall prevalence rates were provided, but details as to the numbers of participants with either resolved or new onset of depression were not provided at each time point.

A handful of studies provided a more detailed window into prevalence patterns across time. Morris et al[19] reported that 26% of patients who had minor depression at 2 months post stroke still had depressive symptoms at 15 months post stroke and 62% of patients with major depression

at 2 months post stroke still had depression at 15 months post stroke. Schepers et al[18] found that a depression prevalence of 16% at 3 years post stroke was significantly lower than prevalence rates at 6 months (23.7%) and 1 year (25.2%) post stroke. In that same study, a large proportion of participants (65.6%) had no depression at any time point up to 3 years post stroke and 12.2% had depression at all 3 time points. Of the patients who presented with earlier onset depression at 6 months post stroke, 41.9% had recovered from depression when the study ended at 3 years post stroke. In contrast, of those patients who did not have early depression at the first time point, only 3% had experienced new depression by the end of the study. Brodaty et al[20] found overall depression prevalence of 12.1% at 3 months post stroke and 20.7% at 15 months post stroke. Of the patients who were depressed at 3 months after stroke, 57.9% were still depressed at 15 months. Of those patients who were not depressed at 3 months, 15.5% experienced new depression by 15 months. Ayerbe et al[8] conducted a longer term follow-up study with assessments at baseline, 1 year, 3 years, and 5 years post stroke. They found that 48% of the participants were not depressed at any time point; 6% were depressed at every time point; and 13% demonstrated a fluctuating course of depression, recovery, and then recurrent depression. Again, there were indicators that most depression has an early onset in that 56% of the patients who had depression at any time during the study were diagnosed with depression by 3 months after stroke. Between 15% and 20% of patients at each time point represented new-onset cases at that time. Berg et al[28] found that 54% of the patients they followed were depressed at some point during the 18-month study. Of the patients who were already depressed at the first time point 2 months after stroke, 46% remained depressed at follow-up time points 12 and 18 months after stroke. Later onset of depression was less common, with 12% of patients showing new onset of depression at 12 or 18 months post stroke. Finally, Paolucci et al[6] suggested a trend in that onset of depression was most common in the first few weeks after stroke as opposed to months later. Taken together, results of these studies suggest that onset of depression appears to be more common earlier after stroke and that depression is likely to persist the first few years after stroke. Later onset of depression is still observed but is not as common.

Across studies that tested associations statistically, depression appeared to be associated with more severe strokes[7,16,26,28,30] and tended to be more common in women.[7,10,20,21,25,27,28,31] Depression was more prevalent in stroke populations than in nondisabled control populations.[20,21,23,29,31,32]

Pain

Twelve studies reported on the overall prevalence of pain. Half of these studies reported pain prevalence in the range of 26% to 50%, and 5 studies reported lower pain prevalence of 25% or less. One study had the highest reported prevalence of pain at 61%.[33] Several studies examined the prevalence of different types of pain. The prevalence range for musculoskeletal pain was 6% to 42%,[34-38] with shoulder pain most commonly reported. Central pain prevalence ranged from 1% to 35%,[35,36,38-41] and prevalence of migraine/headache pain ranged from 3% to 23%.[22,34,38] The evidence suggests that migraine prevalence may not differ significantly from that in nonstroke populations,[22] but other types of pain were more prevalent in stroke populations than in normative samples.[33,42]

There was limited evidence regarding the association, or lack thereof, between pain and the temporal variables of interest in this study: age or time since stroke. Kong et al[35] found that higher levels of pain were associated with shorter time since onset. In that same study, no significant association was found between poststroke pain and age. In contrast, Klit et al[40] found pain to be associated with younger age.

Only 2 studies used repeated measures to explore patterns of pain. Jönsson et al[39] reported that the prevalence of moderate-severe pain decreased from 32% at 4 months to 21% at 16 months. Moderate-severe pain was experienced by 15.2% of participants at both time points. The prevalence of mild pain also decreased from 7.7% to 4.0%. Of the patients with moderate-severe pain at the first time point, 53.1% experienced a reduction to mild or no pain by the second time point. Of the patients with moderate-severe pain

at 16 months post stroke, 27.4% had no or mild pain at 4 months post stroke. Langhorne et al[37] found similar prevalence rates of pain (collapsed across different types of pain) at 4 different time points up to 30 months post stroke. Pain was reported by 43% of participants at study onset, 56% at 6 months after stroke, 46% at 18 months after stroke, and 49% at 30 months after stroke. Although they did not conduct a longitudinal study, Widar et al[38] asked participants to report when their poststroke pain started, with 27.9% reporting onset within the first week after stroke, 23.3% in the first month after stroke, 44.2% in the range of 2 to 6 months after stroke, and 4.7% after that.

Falls

Falls were significantly more prevalent in people with stroke than in nondisabled control groups without stroke.[42,43] Eight studies included reports on the overall prevalence of falls. Of these, 5 studies reported fall prevalence in the 26% to 50% range and 2 studies reported fall prevalence of 25% or less. The highest fall prevalence rate was 70%.[44] It is unclear why the prevalence of falls was higher in this latter study, which was conducted in Japan. The authors did note a higher-than-anticipated prevalence of osteoporosis, although this might account for the higher rate of fractures from falls, not necessarily the higher prevalence of falls.

In addition to these data on overall prevalence of falls, the research highlights 2 additional points of interest. First is the prevalence of multiple falls. Understanding the prevalence and risk factors for multiple falls can be important because of the high risk of injury from falls. Five studies reported on the prevalence of multiple falls. Again, the study by Watanabe[44] had the highest prevalence of multiple falls at 57% of research participants. The other 4 studies had prevalence rates for multiple falls of 24% or less. Second, there is the issue of fear of falling. Although awareness of the risk of falling may help patients to be more careful in their environments, fear of falling may also detract from quality of life by becoming a source of anxiety, particularly if the fear of falling is disproportionate to the actual occurrence of falls. Akosile et al[45] found that 81% of participants in their study reported fear of falling, whereas only 19% had actually fallen. Based on measures of fall risk examined in that study, the correlation between fall risk and fear of falling was moderate at 0.61 ($P < .05$), but the correlation between fear of falling and actual fall incidence was low at -0.27 ($P = .18$).[45]

Two studies examined longitudinal trends in falls post stroke. Langhorne et al[37] followed participants at discharge and then at 3 additional time intervals up to 30 months post stroke. At 6 months post stroke, 36% of participants had reported a fall, with that number increasing to 49% at 18 months and 45% at 30 months. Wagner et al[46] conducted monthly interviews with patients for up to 30 months post stroke, although because of rolling enrollment, the sample sizes were much larger for the earlier months as opposed to the latter months. The highest prevalence of falls was in the first month post stroke, with 18% of participants reporting a fall. The prevalence of falls in each of the first 5 months after stroke ranged from 10% to 18%. For the subsequent months, falls were rarely reported by more than 10% of participants.

Statistical associations between fall prevalence and the variables of time post stroke and age were inconclusive. Reports indicated either no significant association between falls and time post stroke[47,48] or mixed reports of both increasing[37] and decreasing[46] rates of falls after 6 months post stroke. Two studies found no association between poststroke falls and age,[47,48] whereas one found falls to be more prevalent in older adults.[49] Falls were more prevalent in adults with more severe physical impairments after stroke.[45,47,48]

Fatigue

Seven studies about fatigue were included in this review. Of these, 5 studies reported fatigue in the 26% to 50% prevalence range, and 3 reported fatigue in the 51% to 75% prevalence range. (These numbers add up to more than 7, because one study was recorded in both fatigue prevalence ranges for data collected at 2 different time points.) Mild or occasional fatigue appears to be more prevalent than severe or constant fatigue.[50,51]

Two studies conducted repeated measures of fatigue. Christensen et al[52] found fatigue prevalence to be highest at 10 days post stroke, with a prevalence of 59%. Fatigue prevalence then declined to 44% at 3 months, 38% at 1 year, and 40% at 2 years. Fatigue was fairly stable in this sample in that 75% of participants stayed in the same fatigue category (ie, presence or absence of fatigue) between 3 months and 2 years post stroke. Only 9% of participants had new onset of fatigue after 3 months post stroke. Snaphaan, van der Werf, and de Leeuw[53] also reported that fatigue was relatively stable between 2 months and 18 months post stroke. In that study, 57% of participants had no fatigue at either time point, whereas 26% had fatigue at both time points. Nine percent of participants reported fatigue at 2 months post stroke that resolved by 18 months, and only 8% of participants had new onset of fatigue between 2 months and 18 months post stroke. Although their study did not have a repeated-measures design, Choi-Kwon et al[50] asked participants to report when they felt onset of fatigue post stroke. The vast majority of participants with fatigue (76.8%) reported that fatigue started within the first week after stroke. Less than 10% of participants reported new onset of fatigue at each of the subsequent time points up to 1 year post stroke.

Other researchers using different research designs did not find significant associations between fatigue and time post stroke.[52,53] There were mixed results with regard to an association between age and fatigue: Two studies found no significant relationship,[50,52] but Glader, Stegmayr, and Asplund[51] found fatigue to be significantly associated with older age at stroke and Snaphaan, van der Werf, and de Leeuw[53] found fatigue to be associated with younger age. Higher levels of fatigue were associated with more severe impairments after stroke[22,50-55] and with depression.[22,50,53,55] In general, fatigue was more prevalent in individuals with stroke compared with nondisabled control subjects.[22,55] Although when distinguishing among different types of fatigue, Christensen et al[52] found that general fatigue and physical fatigue were worse in individuals with stroke than in nondisabled control subject, but mental fatigue was not significantly different.

Bowel/bladder dysfunction

Bowel and bladder dysfunction of some type was observed in just under one-third of participants (31.5%).[36] Across the 3 studies included in this review, the prevalence of urinary incontinence ranged from 17% to 28%,[36,42,56] whereas the more mild condition of urinary leakage had a prevalence of 26%.[56] One study indicated prevalence of fecal incontinence as 12%.[36] Time since onset of stroke was not a significant predictor of urinary incontinence, and age was not tested as a predictor variable in the studies reviewed. Rates of urinary incontinence were higher in individuals with stroke compared with those in control groups.[42,56] No repeated-measures data were presented in the studies reviewed.

Sleep difficulties

Studies of sleep difficulties generally divided sleep into 3 broad categories: problems falling asleep, problems staying asleep, and daytime sleepiness. Across the 3 studies included in this review, prevalence of sleep difficulties in these categories was as follows: difficulty falling asleep in 8% to 48%, difficulty staying asleep in 19% to 65%, and not feeling rested in the morning/daytime sleepiness in 33% to 52%. Sleep difficulties were not associated with age, but increased daytime sleepiness was associated with longer time post stroke.[57] Pain was associated with sleep difficulties.[33,57] Sleep difficulties, particularly problems with falling asleep, were more prevalent in people with stroke than in control groups.[42,33] No repeated-measures data were available in the reviewed studies of sleep difficulties.

Discussion

This review summarizes findings regarding the prevalence of 6 secondary conditions associated with stroke that are commonly discussed in the literature. The prevalence of each condition varies widely depending on the particular study, and this likely reflects different research methodologies across studies. However, if the upper bounds of the prevalence ranges are considered, depression, pain, falls, fatigue, and sleep difficulties are

experienced by at least half of people with stroke. Although not quite as prevalent, bowel and bladder problems are experienced by up to one-third of people post stroke. These prevalence rates highlight that these secondary conditions are common and have the potential to dramatically reduce health and quality of life post stroke.

One of the key purposes of this project was to summarize the findings regarding associations between secondary conditions post stroke and both chronological age and time post stroke. Significant associations would help to alert providers as to when secondary conditions might be more likely to occur and to facilitate identification or possible prevention of these complications. Significant associations might also highlight the particular needs of individuals aging with disabilities that could be addressed in health care and community programs. The results of regression analyses suggest that exceptions do exist, but there is not strong evidence of associations between these secondary conditions and either chronological age or time post stroke. Most studies exploring these questions found no significant associations; in the few studies in which associations were found, results were often conflicting. However, although tests for statistically significant trends were not always performed, studies conducting repeated measures of secondary conditions do seem to suggest that secondary conditions tend to develop relatively early post stroke (in the first few months). Although later onset of secondary conditions was observed in all studies, this was not nearly as common as onset of conditions within the first weeks or months. One limitation of repeated-measures designs is the poor feasibility of long-term follow-up of participants. Only one repeated-measures study reviewed in this article followed participants beyond 3 years post stroke, limiting the ability to observe the possibility of secondary conditions starting later after stroke. The regression analyses mentioned previously that did statistically test for associations between secondary conditions and time post stroke tended to include participants with longer poststroke durations.

There may be several reasons for inconclusive findings regarding associations with age or time after onset. First, because stroke tends to occur in older individuals, there is a restricted range of age and time after onset in individuals with stroke. A restriction of range of variables can attenuate the strength of associations found. One way to address this would be to focus on studies that enroll individuals who have stroke at a young age and monitor them for longer periods as they age. In this review, for example, several studies specifically enrolled participants with stroke onset at a young age.[16,22,23,34,57,58] The problem with relying on this approach for understanding the relationships between secondary conditions and either age or time post stroke is that the onset of disability at a younger age and then aging with that disability may be different than aging as a relatively healthy adult and experiencing onset of disability at a later age. These are issues that require additional exploration.

A second possible reason for the lack of consistent associations between the variables explored in this study might be different methodologies across studies, which will be explored in more detail later in this discussion. A third possible explanation is that for most conditions there was very little information available regarding associations with age or time since stroke; we may simply not have enough data to interpret. More consistent findings might emerge as researchers examine these questions in future studies. Finally, significant associations between the prevalence or severity of secondary conditions and either age or time since stroke may not exist in the population. Although the small number of repeated-measures studies suggests that secondary conditions tend to occur relatively early post stroke, secondary conditions do not appear to occur in any particular window of time. If this latter possibility is correct, the clinical implications are important and indicate that health care providers need to remain vigilant for possible development of secondary conditions at any age or time post stroke. Stroke severity emerged more often as a variable associated with secondary conditions and may be a better predictor to monitor.

Although the overall purpose of this scoping review was to get a "birds-eye" view of commonly reported secondary conditions after stroke, additional information to be gained from this type of review includes the feasibility and benefits of pursuing a more structured and rigorous

systematic review of this body of literature to address these research questions. A systematic review would provide a more detailed analysis of the studies, including aspects of research design and quality, thus providing context for interpreting the findings of the studies. However, systematic reviews are also very resource intensive. A systematic review might bring more clarity to the secondary condition prevalence data, but a high-quality systematic review would typically focus on a single secondary condition rather than the wide range of conditions included in this review. There are also several challenges perceived in this body of literature that might limit additional benefits to be gained from a systematic review. One challenge might be in defining what constitutes a secondary condition. For example, this review excluded comorbidities that may have existed before the stroke, such as diabetes and hypertension, although these are likely significant factors contributing to overall health. This review also excluded conditions that are critical to health, function, and quality of life post stroke but that are considered to be primary consequences of stroke instead of secondary conditions. These include motor and sensory changes, cognitive changes, and changes in communication abilities. Other reviewers who define secondary conditions differently may arrive at different conclusions. Another factor to consider is the inclusion criteria for studies in a review. For example, the decisions made to restrict this project to articles in a particular time frame, to exclude articles such as reviews and conference proceedings, and to limit the articles to those that addressed secondary conditions that persisted beyond 1 year post stroke may have resulted in the exclusion of articles that other reviews would include.

However, the primary challenge in reconciling this body of literature may be the diversity of research methods across studies. A host of variables including participant inclusion criteria (age, time post stroke, severity of impairment), data collection methods (interviews, different questionnaire instruments, clinical examinations), and data reporting methods (reporting overall prevalence vs reporting different levels of severity and different statistical analyses) make comparisons across studies very difficult. Developing more consistent methodologies across such a broad community of researchers pursuing different research questions in different research settings is challenging, but new tools that could improve consistency across studies are increasingly becoming available. One example is a new generation of patient self-report measurement tools generated through the National Institutes of Health (NIH) roadmap initiative, Patient-Reported Outcomes Measurement Information System (NIH PROMIS; nihpromis.org). PROMIS instruments are available on a wide range of patient-reported topics relevant to this review, including depression, fatigue, pain, and sleep disturbance. These can be accessed free of charge through the PROMIS Assessment Center (www.assessmentcenter.net), which is an online test administration Web site. PROMIS has greatly facilitated the quality and uniformity of measurement in patient-reported outcomes. PROMIS instruments are calibrated to a common underlying scale, the logit scale, and methods are provided for "cross-walking" or translating scores from one instrument to another. Other resources available particularly for measuring self-report experiences include the Neuro-QOL instruments (www.neuroqol.org) and the NIH Toolbox (www.nihtoolbox.org). Efforts on the part of researchers to use measurement resources such as these may lead to more reliable data that can be compared more easily across studies.

In conclusion, this scoping review has described research findings regarding the prevalence and correlates of common secondary conditions after stroke. The results indicate that these conditions are experienced by a sizable segment of the stroke population. Given the relatively high prevalence rates, gaining an understanding of the course, nature, and contributing factors of secondary conditions might help health care providers better circumvent or at least minimize the impact of secondary conditions. Future research is needed to more clearly describe these parameters. In the meantime, it appears that stroke severity may be a stronger predictor of secondary conditions after stroke than either chronological age or time post stroke. Secondary conditions seem to appear more commonly in the weeks and months after stroke. Later onset, although not as common, is still prevalent enough to warrant ongoing vigilance.

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