Use of Stroke-Related Income Supplements and Predictors of Use in a Working-Aged Finnish Ischemic Stroke Cohort

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Background: Compared with the direct costs, the indirect costs of stroke may be larger contributors to the socioeconomic burden of stroke, and the need to better understand the indirect costs of stroke is well established. We investigated the indirect costs of stroke according to a novel outcome, the use of stroke-related income supplements, in a Finnish cohort of working-aged patients. *Methods:* Consecutive patients (n = 230) who experienced a first-ever ischemic stroke were recruited. Demographic, clinical, and cognitive function data (which were measured using clinical neuropsychological assessments) were collected at baseline and at 6-month and 2-year follow-ups. Data on the use of income supplements within the first 3 years of the stroke were retrieved from national insurance registry files and used to construct survival models. *Results:* Stroke patients used a mean of 11 months of stroke-related income supplements; this use was associated with atrial fibrillation, cognitive impairment, prestroke income supplement use, higher National Institutes of Health Stroke Scale scores, lower Barthel Index scores, and increased lesion sizes. In multivariate survival models, atrial fibrillation and cognitive impairment were the factors most strongly associated with the use of stroke-related income supplements. *Conclusions:* Using stroke-related income supplement data to quantify poststroke productivity losses allowed a working-aged cohort to be investigated without inclusion restrictions based on occupational status or other factors; the use of these data as an outcome emphasized the well-known detrimental effects of atrial fibrillation and cognitive impairment on stroke outcome. The results support stroke-related income supplement use as a complementary outcome for understanding stroke-related productivity losses. **Key Words:** Ischemic stroke—productivity losses—indirect costs—atrial fibrillation—neuropsychology—cognitive impairment.

The global socioeconomic burden of stroke is huge[1] and also rising[2] due to an aging population and an increasing prevalence of major risk factors. Both direct and indirect costs contribute to this high burden. The direct costs of stroke, such as inpatient stays, outpatient visits, rehabilitation, and medications, are better understood than are

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Received October 9, 2014; revision received February 25, 2015; accepted March 8, 2015.

This study was funded by The Finnish Social Insurance Institution's (KELA's) Research Department and the Finnish Cultural Foundation's Lapland Regional Fund.

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1052-3057/$ - see front matter

http://dx.doi.org/10.1016/j.jstrokecerebrovasdis.2015.03.049

the indirect costs. In contrast, the indirect costs, including various productivity losses, are more difficult to quantify. The loss of work, caused by the poststroke inability of stroke survivors to return to their former employment, is perhaps the most obvious productivity loss. The total cost of lost work is difficult to quantify explicitly; this quantification becomes even more difficult if factors that are unpaid but also contribute to society are considered. Working-aged stroke patients who are unemployed but help with the day-care arrangements of small grandchildren, obtain groceries for elderly parents or coach a local junior football team arguably are contributing to society despite the lack of pay. Thus, losing the ability to participate in these activities after stroke could be considered a productivity loss. The measurement of all types of stroke-related productivity losses, work-related or otherwise, is valuable in understanding the socioeconomic burden of stroke. Indeed, the indirect costs are estimated to be more significant than are the direct costs, indicating an urgent need to understand these costs.[2] Joo et al.[3] concluded a recent review of indirect costs associated with stroke by stating that "indirect costs account for a significant portion of the economic burden of stroke and there is a pressing need to develop proper approaches to analyze these costs and to make better use of relevant data sources for such studies or establish new ones." In this study, we introduce a novel approach to measure productivity-related variation, the use of stroke-related income supplements, to trace stroke-related productivity changes in both employed patients and patients outside of the workforce.

Although the inability to return to work causes significant productivity losses, income redistribution programs also contribute to productivity losses. In many countries, unemployed individuals and others outside of the workforce receive one or more forms of income supplements, such as disability, sick leave, or unemployment benefits. Stroke-related income supplements further raise the negative economic impact of stroke by adding to the societal cost beyond the productivity losses caused solely by the inability to work. However, unlike the inability to work, stroke-related income supplements are not restricted to the employed subpopulation of patients. Thus, tracking income supplements allows productivity to be studied in consecutive patient cohorts without restricting participation based on employment status, as is the case in return-to-work studies.[4] In addition, as illness-based income supplements are always based on disability, they can capture productivity-related variation. Therefore, income supplement data can provide a complementary and less well-understood perspective on stroke-related productivity losses.

In this study, we explored productivity changes among a consecutive cohort of working-aged patients who experienced a first-ever ischemic stroke by measuring the use of stroke-related income supplements. Productivity changes were estimated by the duration of use of stroke-related income supplements, and we also analyzed the predictors of supplement use. Based on studies of occupational outcomes after stroke,[4-6] we hypothesized that the predictors of income supplement use would be multifactorial and would emphasize the importance of the cognitive outcome of stroke.

Materials and Methods

Study Design, Setting, and Participants

From April 2007 to September 2009, we recruited ischemic stroke patients to a prospective cohort study from Helsinki University Central Hospital in Helsinki, Finland and Lapland Central Hospital in Rovaniemi, Finland. All patients were treated in accordance with the current institutional standards.

The participants were enrolled from a consecutive sample of all eligible patients who were admitted to the clinics. The inclusion criteria were a first-ever diagnosis of supratentorial ischemic stroke and an age between 18 and 65 years. Patients with a history of neurologic or psychiatric disorders based on medical records or clinical interviews were excluded. To provide normative data for evaluating the cognitive performance of the patients, we recruited a demographic control group from the patients' spouses, siblings, relatives, and friends. The controls were assessed twice, with a 3-month interval between the assessments. The Ethics Committee of Helsinki University Central Hospital approved the study and the consent procedure, and all participants provided signed informed consent for clinical and registry data acquisition.

Demographic Information and Clinical Measures

The sexes and ages (years) of the study participants were compiled from the participants' medical records. The educational status (years of education) was obtained from clinical interviews. A total of 6 principal vascular risk factors (ie, atrial fibrillation, diabetes, hypercholesterolemia, hypertension, smoking, and overweight [mass {kg}]/[height {m}]^2 >25) were binary coded using information gathered at the time of the baseline neuropsychological assessment from the subjects' medical records or from clinical interviews, and the number of vascular risk factors present was summed (0-6) for each subject. A stroke neurologist defined the pathophysiological cause of the stroke (according to the Trial of ORG 10172 in Acute Stroke Treatment classification scheme[7]) for each stroke patient, evaluated the lesion size (largest diameter >4.0 cm, 1.5-4.0 cm, <1.5 cm, or not visible) and determined whether silent infarcts (binary encoding) or leukoaraiosis (binary encoding) were present on the brain images (computed tomography or magnetic resonance imaging) routinely obtained in the course of